INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA

NOTICE 739 OF 2021

HEREBY ISSUES A NOTICE REGARDING THE FINDINGS OF ITS INQUIRY (GOVERNMENT GAZETTE NO. 45247 OF 30 SEPTEMBER 2021), THE AUTHORITY'S POSITION AND THE DRAFT IMPLEMENTATION OF THE RADIO FREQUENCY MIGRATION PLAN AND THE INTERNATIONAL MOBILE TELECOMMUNICATIONS ROADMAP IN TERMS OF SECTION 34(16) OF THE ELECTRONIC COMMUNICATIONS ACT (ECA)

1. The Independent Communications Authority of South Africa ("the Authority'), in terms of section 4, read with sections 31(4), 34(7)(c)(iii), 34(8) and 34(16) of the Electronic Communications Act (Act No. 36 of 2005), hereby gives notice **regarding the findings of its inquiry (government gazette no. 45247 of 30 September 2021), the authority's position** and invites comments on the draft **Implementation of the Radio Frequency Migration Plan and of the International Mobile Telecommunications (IMT) Roadmap**
2. Interested persons are hereby invited to submit written representations on a **signed PDF version**, including an electronic version of the representation in **Microsoft Word**, of their views on the draft implementation of the Radio Frequency Migration Plan and of the International Mobile Telecommunications (IMT) Roadmap
3. Submissions must be made no later than 16h00 on **Friday 11 February 2022.**
4. Written representations or enquiries may be directed to:

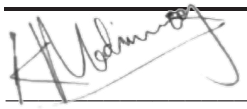
1

The Independent Communications Authority of South Africa,
Dr Ivy Matsepe-Casaburri building,
350 Witch-Hazel Avenue, Eco Point Office Park
Eco Park, Centurion
South Africa
Private Bag X10,
Highveld Park 0169
Centurion, Pretoria

Attention:

Mr Manyaapelo Richard Makgotlho
E-mail: rmakgotlho@icasa.org.za
cc: jdikgale@icasa.org.za

5. All written non-confidential representations submitted to the Authority pursuant to this notice shall be made available for inspection by interested persons from 16 February 2022 on the Authority`s website and Library. Copies of such representations and documents can be obtainable on payment of a fee.
6. The notice regarding the inquiry, briefing note and representations will be uploaded on the Authority website using this link: https://www.icasa.org.za/legislation-and-regulations/radio-frequency-spectrum-plans/draft-radio-frequency-spectrum-plans.
7. Where persons making representations require that their representation or part thereof be treated as confidential, then an application in terms of section 4D of the ICASA Act, 2000 (Act No. 13 of 2000) must be lodged with the Authority. Such an application must be submitted simultaneously with the representation on the inquiry. In addition, all confidential material must be pasted onto a separate annexure which is clearly marked as "Confidential". If, however, the request for confidentiality is not granted, the person making the request will be allowed to withdraw the representation or document in question.
8. The guidelines for confidentiality requests are contained in Government Gazette Number 41839 (Notice 849 of 2018).



DR KEABETSWE MODIMOENG
CHAIRPERSON
DATE: 15/12/2021

Implementation of the Radio Frequency Migration Plan and the International Mobile Telecommunications (IMT) Roadmap for public consultation

December 2021

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1. Purpose

The overall purpose of this document is to set out for public consultation the Authority's draft Implementation Plan of the Radio Frequency Migration Plan and the International Mobile Telecommunications (IMT) Roadmap. The document identifies the various options for the deployment of the priority bands analysed below, as identified after consultation with stakeholders, and to state the Authority's proposed intentions in each case. The focus is on a two (2) to three (3) year time frame for all the bands consulted on in this document.

The conditions for the use of the frequency bands for IMT will be specified in the appropriate Radio Frequency Spectrum Assignment Plans (RFSAPs), either to be developed and or amended. The assignment of high-demand frequencies will be made through an Invitation to Apply (ITA), in line with regulations 6 and 7 of the Radio Frequency Spectrum Regulations 2015. This process will detail the actual mechanism of assignment (including market-based, competitive processes).

The Authority's primary objectives are to ensure universal availability of broadband services, as well as a vibrant and competitive electronic communications sector that promotes investment, meets the needs of consumers, and promotes economic growth and development.

2. Introduction

Section 34(16) of the Electronic Communications Act, 2005 (Act No. 36 of 2005) (the ECA) mandates the Authority to develop Frequency Migration Plans for frequencies identified during the development of the National Radio Frequency Plan for migration and the implementation thereof.

The Authority, in this Draft Implementation Plan, sets out draft implementation plans for the Radio Frequency Migration Plan 2013[1] and 2019[2], as well as the International Mobile Telecommunication Roadmap 2014[3] and 2019[4], and the consequential respective Radio Frequency Spectrum Assignment Plans ("RFSAP")[5], in accordance with the latest version or updated National Radio Frequency Plan, read with sections 30 and 34(16) of the ECA.

On 30 September 2021, the Authority published a notice[6] on the inquiry for the implementation of the Radio Frequency Migration Plan and of the International Mobile Telecommunications (IMT) Roadmap ("the Inquiry") for consultation in terms of section 4B of the Independent Communications Authority of South Africa Act, 2000 (Act No. 13 of 2000) (the ICASA Act), -.

The purpose of the Inquiry was to determine the current use and usage of the frequency bands as mandated by the Radio Frequency Migration Regulations 2013 in order to develop an implementation plan regarding the Radio Frequency Migration Plans, IMT Roadmap and the frequencies identified for migration during the development of the National Radio Frequency Plan of 2018, as well as the implementation plan thereof, through the development and amendment of new and existing the Radio Frequency Assignment Plans to achieve global harmonisation of Standards and Systems.

[1] Government Gazette Number 36334 (Notice 352 and 353 of 2013).
[2] Government Gazette Number 42337 (Notice 166 of 2019).
[3] Government Gazette Number 38213 (Notice 1009 of 2014).
[4] Government Gazette Number 42361 (Notice 197 of 2019).
[5] Government Gazette Number 38640 (Notices 270 to 278 of 2015).
[6] Government Gazette Number 45247 (Notice 580 of 2021).

3. Findings in respect of the Inquiry (Government Gazette No. 45247 of 30 September 2021)

The Inquiry identified 56frequency bands of interest, viz:

- 28 Category 1 "radio frequency bands that might be considered for migration and radio frequency spectrum assignment plans"
- 28 Category 2 IMT and "other radiocommunications bands for closer study".

The following questions were posed in respect of each of the 56 bands:

1. Rate the importance of this band to your business.
2. Does your firm use this band? (Yes/No)
3. If yes to Q2, what does your firm use this band for?
4. Does your firm have plans to use this band in the future?
5. If your firm uses this band or plans to use it, what is the value (in annual revenues) of the use of this and for your application?
6. If yes to Q2, what would be the impact if you had to vacate this band?
7. Additional comments and if yes to Q2, how many sites in total have you deployed for this band and how many sites per province?

In addition, stakeholders were asked to identify and justify "*any other IMT or other Radiocommunications frequency bands which have not been covered above that you feel need to be considered?"*

3.1. Stakeholder Responses Received

The following stakeholder submissions were received by the deadline of 16h00 on Friday 03 December 2021:

- Cell C Limited;
- eMedia Investments (Pty) Ltd;
- Liquid Intelligent Technologies
- Mthinte Communications (Pty) Ltd;
- MultiChoice;
- NAB:
- One Telecom;
- Rain Group Holdings (Pty) Limited;
- SABC;
- SENTECH;
- Telkom;
- Vodacom;
- WAPA.

Requests for confidentiality were received from 5 stakeholders, which were acceded to, either in part or in totality.

3.2. Stakeholder Written Response Summary

The list of bands that stakeholders provided detailed written responses to the inquiry for the implementation of the Radio Frequency Migration Plan and IMT Roadmap[7] are as follows:

IMT frequency bands in the inquiry for the implementation of the Radio Frequency Migration Plan and IMT Roadmap

No	Band	Respondents	Confidentiality Requested
1.	450 – 455 & 455 – 456 & 456 – 459 & 459 – 460 & 460 - 470 MHz	Telkom; Vodacom;	Telkom; Vodacom
2.	617-652 paired with 663-698 MHz	eMedia Investments (Pty) Ltd; SABC; SENTECH; MultiChoice; Telkom;	SABC; Telkom
3.	694 - 790 MHz	eMedia Investments (Pty) Ltd; SABC; SENTECH; MultiChoice; Rain Group Holdings (Pty) Limited; Telkom;	SABC; Rain Group Holdings (Pty) Limited; Telkom;
4.	733 – 758 MHz (700MHz Guard frequency bands)	eMedia Investments (Pty) Ltd; SABC; SENTECH; MultiChoice; Telkom; Vodacom;	SABC; Telkom; Vodacom
5.	790 - 862 MHz	eMedia Investments (Pty) Ltd; SABC; SENTECH; MultiChoice; Telkom;	SABC; Telkom
6.	862 - 890 MHz (including 862-876 MHz)	Cell C Limited; Telkom;	Cell C; Telkom;

[7] Government Gazette Number 45247 (Notice 580 of 2021)

7.	890 - 942 MHz	Cell C Limited; Telkom;	Cell C; Telkom;
8.	942 - 960 MHz	Cell C Limited; Telkom;	Cell C; Telkom;
9.	1350 - 1375 MHz paired with 1492-1518 MHz	Telkom;	Telkom;
10.	1375 – 1400 MHz paired with 1427 – 1452 MHz	Telkom;	Telkom;
11.	1452 - 1492 MHz	Telkom; Vodacom;	Telkom; Vodacom;
12.	1492-1518 MHz	Telkom; Vodacom;	Telkom; Vodacom;
13.	1880 - 1900 MHz (1880-1920 MHz + 1885-1980 MHz)	Telkom;	Telkom;
14.	1980-2010/ 2170-2200 MHz + 2010-2025 MHz	Telkom;	Telkom;
15.	2010-2025 MHz Planned for IMT		
16.	2025 – 2110 paired with 2200 - 2285 MHz	SENTECH; Telkom;	Telkom;
17.	2300 - 2400 MHz	Telkom;	Telkom;
18.	2500 - 2690 MHz	Rain Group Holdings (Pty) Limited; Telkom;	Rain Group Holdings (Pty) Limited; Telkom;
19.	3300 - 3400 MHz	MultiChoice; Telkom;	Telkom;
20.	3400 - 3600 MHz	MultiChoice; Telkom;	Telkom;
21.	3600 - 3800 MHz	eMedia Investments (Pty) Ltd; SENTECH; Mthinte Communications (Pty) Ltd; MultiChoice; One Telecom; Rain Group Holdings (Pty) Limited; Telkom; Vodacom:	Rain Group Holdings (Pty) Limited; Telkom; Vodacom;
22.	3800 - 4200 MHz	eMedia Investments (Pty) Ltd; SENTECH;	Telkom; Vodacom

		MultiChoice; Telkom; Vodacom;	
23.	4 800-4 990 MHz	Telkom;	Telkom;
24.	24.25 - 27.5 GHz	Telkom; Vodacom; WAPA;	Telkom; Vodacom;
25.	37 - 43.5 GHz (including 38-39.5 GHz for HAPS)	Cell C Limited; Telkom;	Cell C; Telkom;
26.	45.5-47 GHz	Telkom;	Telkom;
27.	47.2 - 48.2 GHz (identified for IMT in Region 2 and another 69 countries from Regions 1 and 3)	Telkom;	Telkom;
28.	66 - 71 GHz	Telkom;	Telkom;

Other Radiocommunications Services bands in the inquiry for the implementation of the Radio Frequency Migration Plan and IMT roadmap

No	Band	Respondents	Confidentiality Requested
29.	75.2 - 87.5 MHz		
30.	138 - 144 MHz		
31.	150.05 - 153 MHz		
32.	156.4875 - 156.5625 MHz	Telkom;	Telkom;
33.	156.875 - 174 MHz	Telkom;	Telkom;
34.	174 - 223 MHz	eMedia Investments (Pty) Ltd; SABC; SENTECH; MultiChoice; NAB:	SABC;
35.	214 - 230 MHz T-DAB	eMedia Investments (Pty) Ltd; SENTECH; MultiChoice; NAB;	

36.	223 - 230 & 230 - 238 MHz	eMedia Investments (Pty) Ltd; SENTECH; NAB;	
37.	238 - 267 MHz	eMedia Investments (Pty) Ltd; SABC; SENTECH; NAB;	SABC;
38.	335.4 - 380 MHz	Telkom;	Telkom;
39.	380 - 387 & 387 - 390 & 390 - 399.9 MHz		
40.	410 - 420 & 420 - 430 MHz		
41.	440 - 450 MHz	SABC;	SABC;
42.	470-493 MHz	eMedia Investments (Pty) Ltd; SABC; SENTECH; WAPA;	SABC;
43.	825 to 830 MHz and 870 to 875 MHz	eMedia Investments (Pty) Ltd; SABC; SENTECH; Liquid Intelligent Technologies	SABC;
44.	1518 - 1525 MHz		
45.	1525 - 1530 & 1530 - 1535 & 1535 - 1559 MHz		
46.	1668 - 1675MHz		
47.	2290 - 2300 MHz	Telkom;	Telkom;
48.	5470 - 5725 MHz	Telkom; WAPA;	Telkom;
49.	5725 - 5850 MHz	Telkom; WAPA;	Telkom;
50.	5850 - 5925 MHz	Telkom; WAPA;	Telkom;
51.	5925 - 6425 MHz	SENTECH; Telkom; WAPA;	Telkom;

52	6425 – 7025 MHz (or 7125 MHz)	Telkom; WAPA;	Telkom;
53.	10700 - 11700 MHz	eMedia Investments (Pty) Ltd; SENTECH; MultiChoice; Telkom; WAPA;	Telkom;
54.	15400 - 15700 MHz		
55.	57 - 66 GHz	Telkom; WAPA;	Telkom;
56.	71-76 GHz and 81- 86 GHz	Cell C Limited; Telkom; WAPA;	Cell C; Telkom;

3.3. Findings and Position of the Authority

The Authority hereby finds that, the frequency bands can be priority based on the maturity of the eco-systems as well as the value society is to derive. The table below summarises these findings.

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
1.	450 – 455 & 455 – 456 & 456 – 459 & 459 – 460 & 460 - 470 MHz	Yes	Popular for specialised networks including PPDR and/or IoT – but more so for LTE 450 (Band 31) deployments for wireless broadband services. Judged both feasible and important for South Africa to release for universal coverage. Brazil, Russia, Armenia, Hungary, Scandinavian countries etc. have rolled out FWA broadband services in this band	RADIO FREQUENCY MIGRATION PLAN 2013 Government Gazette No 36334 (Notice 352 of 2013) And 2019 Government Gazette No. 42337, p 51.	Feasibility study to be reviewed and updated as 15-20 RFSAP to be reviewed and updated as part of the 2nd Consultation	**4**	Transnet (Transnet main stakeholder in 450-470). Migration Plan 2013 detailed some other small stakeholders who should have migrated by now with Transnet having migrated by 2018).	High

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
				Final Radio Frequency Spectrum Assignment Plan: Frequency Band 450 to 470 MHz Government Gazette 38640 (Notice 270 of 2015)				
2.	617-652 paired with 663-698 MHz	No	US and Canada licensed for mobile, and many countries are following the trend. Standardised within 3GPP. Identified for IMT by Colombia and Mexico. Device ecosystem is developing. Judged difficult to do much about for broadband in South Africa before WRC 2023.					Medium

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
3.	694 - 790 MHz	No (Note: this band might be a band that ICASA wants to consider as part of the second RFSAP consultation)	This is a band in use, the 700MHz band. Subject to DSO still in RSA. This release of this band is already in progress via the upcoming auction.	Terrestrial Broadcasting Frequency Plan, published in Government Gazette 36321 (Notice 298 of 2013) and RFSAP Government Gazette Number 40145 (Notice Number 438 of 2016)	RFSAP to be considered for review and updating as part of the 2nd Consultation	**10**	N/A	High
4.	733 – 758 MHz (700MHz Guard frequency bands)	Yes. (But reference 738 – 758 MHz for more detailed feedback)	Some countries (e.g., UK) have assigned for IMT. 3GPP standardised. Take-up depends on DSO plans. Initial high-level judgement as feasible to allocate and assign later for the purposes of more broadband coverage in South Africa.	Government Gazette 36321 (Notice 298 of 2013) and RFSAP Government Gazette Number 40145 (Notice Number 438 of 2016)	RFSAP to be considered for PPDR and therefore maybe to review and updating as part of the 2nd Consultation	**8**	N/A Note: need to consider SA security requirement. SA decided not to go with SDL but consider feasibility of PPDR.	High

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
							Assumption Broadcasting switched off in 2015.	
5.	790 - 862 MHz	No	This is a band in use (the 800MHz 4G band). This release of this band is already in progress via the upcoming auction.	Government Gazette 36321 (Notice 298 of 2013) and RFSAP Government Gazette Number 40145 (Notice Number 438 of 2016)	RFSAP to be considered for review and updating.	**9**	N/A	High
6.	862 - 890 MHz (including 862-876 MHz)	No	No current significant interest for IMT.	DIO FREQUENCY GRATION PLAN 2013 vernment Gazette No 36334 (Notice 352 of 2013)	RFSAP to be considered for review and updating.	**7**	Liquid Telecom (LT believe they should be migrated to another band as this band is not usable (internationally harmonised,	**High**

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
				IMT 850 consultation in Government Gazette number 38640 (notice no. 274 of 2015), Government Gazette number 41082 (Notice 678 of 2017) and Government Gazette number 41082 (Notice no. 648 of 2017). radio-frequency-spectrum-assignment-plan-for-the-frequency-band-825-to-830mhz-and-870-to-875-			equip not available)). No formal discussion has taken place or agreement reached with regard moving Liquid.	

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
				MHz, Government Gazette 42337 (Notice 165 of 2019)				
	876-960 MHz				Feasibility Study completed on part of this band so needs to be reviewed. And the RFSAP to be updated.			High
7.	890 - 942 MHz	No	No current significant interest for IMT.	Government Gazette number 38640 (Notice Number 275 of 2015)	RFSAP to be considered for review and updating.			High
	880-960 MHz			vernment Gazette 36321 (Notice 298 of 2013) Frequency Band 880 to	Feasibility Study completed on part of this band so needs to be reviewed. And the RFSAP to be updated.	**11**	Vodacom MTN Cell C (Aim was to re-farm. For each stakeholder to	High

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
				915 MHz and 925 to 960 MHz Government Gazette 38640 (Notice 275 of 2015)			have by 30 March 2020 10MHz each with 5MHz available for auction. By 30 March 2020 non had moved so there is a need to re-engage with new migration plan with agreed targets for them to move). Q. Why have they not moved: they have to coordinate amongst themselves to re-arrange their frequency without service disruption)	
8.	942 - 960 MHz	No	No current significant interest for IMT.	Government Gazette number 38640	RFSAP to be considered for review and updating.			Medium

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
				(Notice Number 275 of 2015)				
9.	1350 - 1375 MHz paired with 1492-1518 MHz	No	No current significant interest for IMT.	Government Gazette number 38640 (Notice Number 275 of 2015) 2. And RADIO FREQUENCY MIGRATION PLAN 2019 Government Gazette No. 42337,	Feasibility Study completed on part of this band so needs to be reviewed. And the RFSAP to be updated.			Medium
10.	1375 – 1400 MHz paired with 1427 – 1452 MHz	No	No current significant interest for IMT.	MIGRATION PLAN 2019 Government Gazette No. 42337, p 55.	Feasibility Study to be completed on this band. And the RFSAP to be developed.			Medium

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
11.	1452 - 1492 MHz	Yes	This band is released in several European countries. Ecosystem is evolving slowly. 3GPP has identified many different arrangements for 4G and 5G services, with different duplexing schemes including FDD (in Japan), TDD (ecosystem timeline is uncertain), and SDL. Initial high-level judgement as feasible to allocate and assign in South Africa.	RADIO FREQUENCY MIGRATION PLAN 2013 Government Gazette No. 36334 (Notice 352 of 2013) MIGRATION PLAN 2019 Government Gazette No. 42337, p 55.	Feasibility Study to be completed on this band. And the RFSAP to be developed.	**3**	Refer and study documents referenced and propose Q. Are there any incumbents we need to talk to? Still need to go through the assignments Data base to validate. But view is to publish migration plan and ask those who might use to comment on the proposed (2-3 yr. migration period) migration plan.	Low
12.	1492-1518 MHz	Yes	3GPP standardized. Ecosystem is evolving slowly. Initial high-level judgement as feasible to allocate and assign in South Africa – but with less confidence	RADIO FREQUENCY MIGRATION PLAN 2013 Government Gazette No.	Feasibility Study to be completed on this band. And the RFSAP to be developed.			

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
			than say the 1452 – 1492 MHz band.	36334 (Notice 352 of 2013)				
	1598 – 1525 MHz				RFSAP to be developed.			Medium
13.	1880 - 1900 MHz (1880-1920 MHz + 1885-1980 MHz)	No	No current significant interest for IMT.	MIGRATION PLAN 2019 Government Gazette No. 42337, p 58.				High
15.	2010-2025 MHz Planned for IMT	No	Unpaired band for TDD operation but no deployments to date. Initial high-level judgement no urgency to allocate and assign in South Africa given lack of deployments to date.		Feasibility Study to be completed on this band. And the RFSAP to be developed.			High

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
16.	2025 – 2110 paired with 2200 - 2285 MHz	No	No current significant interest	Government Gazette Number 41164 (Notice 782 of 2017)	RFSAP to be developed.			Medium
17.	2300 - 2450 MHz	Yes	Many countries assigned for IMT. 3GPP standardized and mature ecosystem available. Initial high-level judgement as feasible to allocate and assign in South Africa.	RADIO FREQUENCY MIGRATION PLAN 2013 Government Gazette No. 36334 (Notice 352 of 2013)	**HIGH PRIORITY URGENT** Feasibility Study to be completed on this band. And the RFSAP to be reviewed & amended.	**1**	Telkom (Band used for P2P links. Existing migration plan talks to migration of the P2P links so band available for IMT. Need to update Migration Plan ahead of then refreshing the AP). IMT component is 23-2400. Q. on whether the 24-2450 is important. Need	High

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
							to focus on moving other stakeholder's P2P links. Also, Telkom using some of this spectrum (60MHz) for IMT).	
18.	2500 - 2690 MHz	No	This is a band in use in RSA – and has been subject to a band replanning from FDD to TDD. It is also part of the upcoming auction.	An amendment to the Radio Frequency Spectrum Assignment Plan IMT2600 to be undertaken in order to change the channel arrangement from FDD to TDD to maximise the efficient use of spectrum.	RFSAP to be reviewed & amended.			Medium

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
19.	3300 - 3400 MHz	Yes	Some countries assigned for IMT. *WRC23 agenda item*. Increasing interest. Initial high-level judgement as feasible to allocate and assign in South Africa. Timing before or after WRC 2023?	MIGRATION PLAN 2019 Government Gazette No. 42337, p 60.	**HIGH PRIORITY URGENT** Feasibility Study to be completed on this band. And the RFSAP to be developed.	**2**	Refer and study documents referenced and propose (Spreadsheet does not contain information for this band. Think mainly used by Defence – but cannot be confirmed – so write migration plan so asking for comments)	Medium
20.	3400 - 3600 MHz	No	This is a band in use. It is also part of the upcoming auction.	MIGRATION PLAN 2019 Government Gazette No. 42337, p 61.	RFSAP to be reviewed & amended.			Medium
21.	3600 - 3800 MHz	Yes	Many countries assigned for IMT. *WRC23 agenda item.* Significant interest by the industry. Mature ecosystem available. Initial high-level	MIGRATION PLAN 2019 Government Gazette No. 42337, p 58.	RFSAP to be developed.			High

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
			judgement as feasible to allocate and assign in South Africa. Timing before or after WRC 2023?					
22.	3800 - 4200 MHz	Yes	Some countries assigned for IMT and local access schemes. Some interest from the industry. Ecosystem is evolving. Initial high-level judgement as feasible to allocate and assign in South Africa. Timing before or after WRC 2023?	MIGRATION PLAN 2019 Government Gazette No. 42337, p 61.	RFSAP to be developed.			High
23.	4800-4990 MHz	Although not on the questionnaire the band has subsequently been highlight for consideration for IMT as one of the 15-20 bands that	No current significant interest However, FCC (USA) recently (Oct 2021) designated 4900MHz band for public safety.		**HIGH PRIORITY URGENT** Feasibility Study to be completed on this band. And the RFSAP to be developed.	**12**	Refer and study documents referenced and propose (Treat similar to previous – consult and ask for comments)	Medium

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
		should be considered.						
	5150 – 5250 & 5250 – 5255 & 5255 – 5350 MHz			RADIO FREQUENCY GRATION PLAN 2013 Government Gazette No. 36334 (Notice 352 of 2013	sibility Study to be completed on this band. RFSAP to be developed	**13**	Refer and study documents referenced and propose (Treat similar to previous – consult and ask for comments). Q. Why this made it into the National RF Plan but not a lot of history (RLAN - Annexure B of the RF Regulations)	High
24.	24.25 - 27.5 GHz	Yes	Globally identified for IMT and many countries assigned for IMT. Significant interest by the industry. Ecosystem is maturing. Initial high-level judgement as feasible to		**HIGH PRIORITY URGENT** Feasibility Study to be completed on this band.			

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
			allocate and assign in South Africa.		And the RFSAP to be developed.			
	31.8-33.4 GHz				**HIGH PRIORITY URGENT** Feasibility Study to be completed on this band. And the RFSAP to be developed.			High
	37-40.5 GHz				**HIGH PRIORITY URGENT** Feasibility Study to be completed on this band. And the RFSAP to be developed.			High
	40.5-42.5 GHz				**HIGH PRIORITY URGENT**			High

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No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
					Feasibility Study to be completed on this band. And the RFSAP to be developed.			
25.	37 - 43.5 GHz (including 38-39.5 GHz for HAPS)	Yes	Globally identified for IMT. Ecosystem is yet to mature. Initial high-level judgement as feasible to allocate and assign in South Africa. Timing?		**HIGH PRIORITY URGENT** Feasibility Study to be completed on this band. And the RFSAP to be developed.			Medium
26.	45.5 - 47 GHz	Yes	Globally identified for IMT. Ecosystem is yet to mature. Initial high-level judgement as feasible to allocate and assign in South Africa. Timing?		**HIGH PRIORITY URGENT** Feasibility Study to be completed on this band. And the RFSAP to be developed.			Medium

No	Band	Was band one of 14 IMT bands selected for detailed stakeholder questions?	Commentary (High Level)	Relevant Regulations	Activity required (Feasibility study to be conducted or update RFSAP rules and technical conditions)	Priority	Stakeholders identified	Spectrum Usage
27.	47.2 - 48.2 GHz (identified for IMT in Region 2 and another 69 countries from Regions 1 and 3)	Yes	Globally identified for IMT. Ecosystem is yet to mature. Initial high-level judgement as feasible to allocate and assign in South Africa. Timing?		**HIGH PRIORITY URGENT** Feasibility Study to be completed on this band. And the RFSAP to be developed.			Medium
28.	66 - 71 GHz	One of 8 'other radiocommunications frequency' (non-IMT) listed in questionnaire for more detail	Globally identified for IMT. Industry interest in increasing. However, initial high-level judgement as feasible to allocate and assign in South Africa for unlicensed access like the lower half of the band from 57-66 GHz.		**HIGH PRIORITY URGENT** Feasibility Study to be completed on this band. And the RFSAP to be developed.			

4. Stakeholder Interviews

The Authority conducted one-on-one meetings with the following stakeholders:

- Airports Company South Africa SOC Ltd
- Cell C Limited
- City of Cape Town
- Denel Group
- Eskom Holdings SOC Ltd
- Liquid Intelligent Technologies
- MTN Pty Ltd
- South African National Defence Force (SANDF)
- Telkom SA SOC Ltd
- Transnet SOC Ltd
- Vodacom Pty Ltd

5. Conclusion

The inquiry and consultation process set out above informs the Draft Implementation of the Radio Frequency Migration Plan and the International Mobile Telecommunications (IMT) Roadmap set out below.

The Authority has accordingly decided to prioritise developing feasibility studies on a number of bands (contained in the annexures to this draft Implementation Plan) as they are mandated by the Radio Frequency Migration Plan 2013[8] and 2019[9] as well as the International Mobile Telecommunication Roadmap 2014[10] and 2019.[11]

Details of the issues raised in stakeholder submissions and in the one-on-one stakeholder meetings are addressed in the Annexures below.

The Authority may consider other bands that stakeholders have commented on at a later stage.

[8] Government Gazette Number 36334 (Notice 352 and 353 of 2013)
[9] Government Gazette Number 42337 (Notice 166 of 2019)
[10] Government Gazette Number 38213 (Notice 1009 of 2014)
[11] Government Gazette Number 42361 (Notice 197 of 2019)

6. Definitions

In this Draft Implementation Plan, terms used shall have the same meaning as in the ECA; unless the context indicates otherwise. Where terms are not detailed below then they can be found within the ITU document reference number R – ITURM 1036-6.

"3GPP" means 3rd Generation Partnership Project

"Act" means the Electronic Communications Act, 2005 (Act No. 36 of 2005) as Amended.

"BS Tx" means Base Station Transmit

"BFWA" means Broadband Fixed Wireless Access

"ICT" means Information Computer Technology

"IMT" means International Mobile Telecommunications; a global standard for mobile communications adopted by the ITU.

"ITU" means the International Telecommunication Union.

"ITU Radio Regulations" means an International Treaty governing radiocommunication services and the utilisation of radio frequencies. It is supplementary to the Constitution and Convention of the ITU.

"MS Tx" means Mobile Station Transmit

"National Radio Frequency Plan" means the radio frequency plan specified in s34(2) of the ECA which must set out the specific frequency bands designated for use by particular types of services.

"PPDR" means Public Protection and Disaster Relief.

"RFSAP" means Radio Frequency Spectrum Assignment Plan

"SADC FAP" means the Southern African Development Community Frequency Allocation Plan.

"UAV" means Unmanned Aerial Vehicle

"User" means a licenced or licence exempt user of the radio frequency spectrum; and

"WRC" means the ITU World Radiocommunication Conference.

7. Consideration of Legislation and Public Policy.

a. ECA

The Authority's approach begins with considering the objectives set out in section 2 of the ECA, which include the following:

> *"c) promote the universal provision of electronic communications networks and electronic communications services and connectivity for all"*
> *"(d) encourage investment and innovation in the communications sector"*
> *"(e) ensure efficient use of the radio frequency spectrum"*
> *"(f) promote competition within the ICT sector"*
> *"(m) ensure the provision of a variety of quality electronic communications services at reasonable prices"*
> *"(n) promote the interests of consumers with regard to the price, quality and the variety of electronic communications services"*
> *"(z) promote stability in the ICT sector"*

All the Authority's spectrum-related interventions require carefully balancing of the various objectives of the ECA. Indeed, all the bands being consulted on in this document balance most – if not all – of the ECA Objectives above from (c) to (z), as follows:

1. The primary driver for *all* the bands being consulted on in this document is Objective (e) above, i.e., ensuring efficient use of radio frequency spectrum. Most or all of the bands being consulted upon in this document are either inefficiently assigned (e.g., some licensees have non-contiguous spectrum in some bands) or the bands are not in their highest value use (since standardisation and harmonisation have evolved in many bands increasing the value of the bands) or both.
2. Some bands being consulted upon in this document, post their new RFSAPs, would be assigned through an ITA leading to the promotion of more competition within the ICT sector, i.e., Objective (f) – and/or the promotion of a more stable ICT sector, i.e., Objective (z).
3. Some bands being consulted upon in this document, post their new RFSAPs, would both encourage investment and innovation in the communications sector, i.e., Objective (d) and/or promote the universal provision of electronic networks and services for all, i.e., Objective (c).
4. Several of the bands in this document would promote the interests of consumers with regards to price, quality and variety of electronic communications services, i.e., Objective (n).

In summary, all the ECA objectives above would be enhanced by the realisation of the implementation plans for the radio migration plans 2013 and 2019, as well as the implementation of the IMT roadmaps 2014 and 2019.

In addition, section 30 of the ECA provides that:

> *"(2) "In controlling, planning, administering, managing, licensing and assigning the use of the radio frequency spectrum, the Authority must—*
> *(a) comply with the applicable standards and requirements of the ITU and its Radio Regulations, as agreed to or adopted by the Republic, as well as with the national radio frequency plan contemplated in section 34;*
> *(b) take into account modes of transmission and efficient utilisation of the radio frequency spectrum, including allowing shared use of radio frequency spectrum when interference can be eliminated or reduced to acceptable levels as determined by the Authority;*
> *(c) give high priority to applications for radio frequency spectrum where the applicant proposes to utilise digital electronic communications facilities for the provision of broadcasting services, electronic communications services, electronic communications network services, and other services licenced in terms of this Act or provided in terms of a licence exemption.*
> *(d) plan for the conversion of analogue uses of the radio frequency spectrum to digital, including the migration to digital broadcasting in the Authority's preparation and modification of the radio frequency spectrum plan; and*
> *(e) give due regard to the radio frequency spectrum allocated to security services."*

This means that shared use of spectrum must be considered, that broadcasting and electronic communications and network services among other applications must be prioritised, and that conversion from analogue to digital must be planned for, while having regard to allocations to the security services. In addition, digital services are preferred.

Furthermore, section 34 of the ECA sets out that the Authority must take cognisance of internationally accepted methods for radio frequency planning:

> *"(7) In preparing the national radio frequency plan as contemplated in subsection (4), the Authority must—*
> *(a) take into account the ITU's international spectrum allocations for radio frequency spectrum use, in so far as ITU allocations have been adopted or agreed upon by the Republic, and give due regard to the*

reports of experts in the field of spectrum or radio frequency planning and to internationally accepted methods for preparing such plans;"

The Authority must therefore take into account international trends in the use of radio frequency spectrum.

b. Radio Frequency Migration Regulations

The Authority published Radio Frequency Migration Regulations on 3rd April 2013 in Government Gazette number 36334 (Notice 352; 'The RFMR'). The RFMR sets out the following principles:

1. *"Radio frequency spectrum migration must be in accordance with the Radio Frequency Migration Plan.*
2. *Radio frequency spectrum migration must be consistent with the National Radio Frequency Plan.*
3. *The National Radio Frequency Plan itself must be consistent with the International Telecommunication Union (ITU) Radio-regulations as updated by WRC, and with the SADC FAP.*
4. *Allocations and assignments of radio frequency spectrum that are no longer in line and in accordance with the National Radio Frequency Plan will be migrated.*
5. *The users to be migrated shall not be entitled to be compensated by the Authority for the costs of the migration.*
6. *To the extent that it is possible, the cost of migration should be minimised by considering, amongst other things, the duration of the licence and the economic lifetime of the equipment.*
7. *Frequency migration is required in the core and central astronomy advantage areas in terms of section 22(2) (c) of the Astronomy Geographic Advantage Act (Act No. 21 of 2007)."*

The Radio Frequency Migration Regulations also sets out the process for migration:

"The Authority shall initiate a process of radio frequency migration in the following circumstances:

(a) As specified in the Frequency Migration Plan;
(b) Where a change in the use of a radio frequency band is required to bring the South African National Frequency Plan into line with the ITU's Radio-Regulations or the final acts of the latest WRC;
(c) Where a change in the use of a radio frequency band is required to ensure harmonisation of the South African National Radio Frequency Plan with the SADC FAP;

(d) Where the Authority has determined that a change in use of the frequency is necessary for efficient utilisation of the radio frequency spectrum and to otherwise meet the objectives of the Act;

(e) Where the Authority has determined that a change in a radio frequency spectrum licence holder's assignment within a radio frequency band is required to enable more efficient use of the radio frequency spectrum (in-band migration) or

(f) Where a South Africa specific requirement must be accommodated, such as that arising from protecting radio frequency spectrum for radio astronomy purposes in core and central astronomy advantage areas in terms of the Astronomy Geographic Advantage Act (Act No. 21 of 2007).”

The Radio Frequency Migration Regulation also prescribes how Radio Frequency Spectrum Assignment Plans (RFSAPs) are to be developed, including that the RFSAP may include a migration plan and time period. Next, the RFMR sets out how Radio Frequency Spectrum Licences are amended, including that a notice of amendment be issued, which may in turn specify the date on which transmission is to cease or commence, and which may specify other terms and conditions of the amended licence.

c. SA Connect

The ‘South Africa Connect’[12] broadband policy (*SA Connect*), published by the Department of Communications in 2013, sets out South Africa’s national broadband plan, which includes a broadband access speed target of 100 Mbps by 2030 (see table below). This means that considerably greater amounts of radio frequency spectrum will be needed for broadband access. For example, the Authority considers that at least 80-100 MHz of mid-band spectrum and a further 400 MHz - 1 GHz in high bands is needed to enable 5G.[13]

SA Connect targets

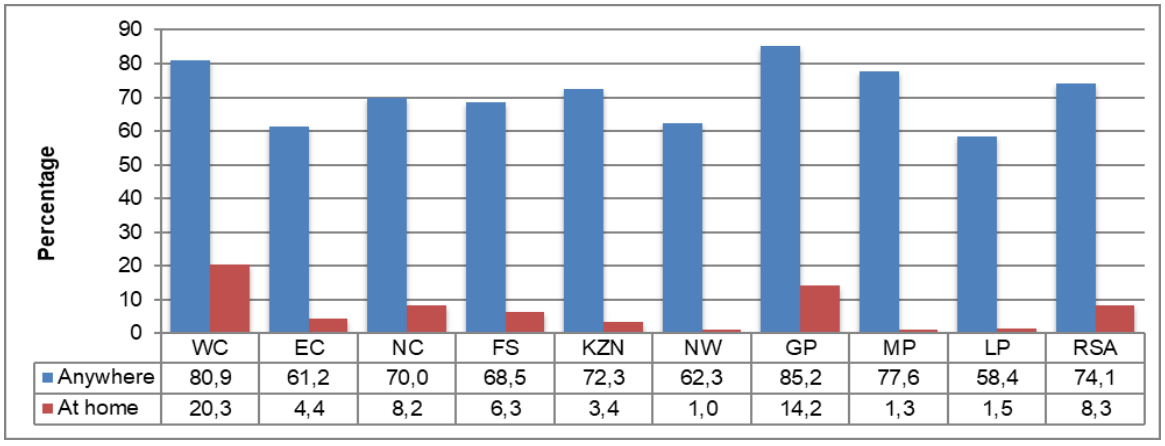
Target	Penetration measure	Baseline (2013)	By 2016	By 2020	By 2030
Broadband access in Mbps user	% of population	33.7% Internet access	50% at 5 Mbps	90% at 5 Mbps 50% at 100 Mbps	100% at 10 Mbps 80% at 100 Mbps

[12] Department of Communications, December 2013, ‘South Africa: Creating opportunities, ensuring inclusion. South Africa’s broadband policy.’, Government Gazette number 37119.

[13] ‘The State of 5G in South Africa: from Readiness to Recommendations’, 2021. Available at: https://www.icasa.org.za/legislation-and-regulations/5g-annual-report-2021

experience					
Schools	% of schools	25% connected	50% at 10 Mbps	100% at 10 Mbps 80% at 100 Mbps	100% at 1 Gbps
Health facilities	% of health facilities	13% connected	50% at 10 Mbps	100% at 10 Mbps 80% at 100 Mbps	100% at 1 Gbps
Public sector facilities	% of government offices		50% at 5 Mbps	100% at 10 Mbps	100% at 100 Mbps

Internet connectivity in South Africa is well behind these targets. For example, only 8.3% of households have fixed Internet access at home, according to Statistics South Africa (see figure below). In more rural provinces, such as the North-West and Mpumalanga, only 1% and 1.3% of households have fixed access at home. While 74.1% of households have at least one household member able to connect to the Internet via mobile, this does not mean that all members of the household have access to the Internet.



	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
Anywhere	80,9	61,2	70,0	68,5	72,3	62,3	85,2	77,6	58,4	74,1
At home	20,3	4,4	8,2	6,3	3,4	1,0	14,2	1,3	1,5	8,3

Percentage of households with access to the Internet at home, or anywhere, by province, 2020 (Statistics South Africa, General Household Survey 2020)

Similarly, only 20% of schools in South Africa have Internet access for teaching and learning purposes.[14] This suggests that more spectrum needs to be assigned

[14] 4,738 out of 23,276 ordinary schools have Internet Connectivity for Teaching and Learning. See: National Education Infrastructure Management System Report as at 12 April 2021, available at:

for broadband purposes in South Africa in order to expand connectivity and reach the targets set out in SA Connect.

https://www.education.gov.za/Portals/0/Documents/Reports/NEIMS%20STANDARD%20REPORT%202021.pdf?ver=2021-05-20-094532-570

8. Summary: Proposals Arising out of Feasibility Study

The following tables show the summary of the Radio Frequency Migration Plans for IMT and other radio frequency bands.

Service	Band	Summary
IMT	450 – 455 & 455 – 456 & 456 – 459 & 459 – 460 & 460 - 470 MHz	The regulations in force mentioned in **Section 1.4 Current usage and constraints** are very clear on the fact that the entire band should be cleared. IMT usage in this band should be a main target to support future data demands for SA Connect. Therefore, all licensees should contribute to the realisation of the clearance of the band. The clearance of the band also provides an opportunity to modernize the legacy technologies with more spectrally efficient technologies resulting in an increased efficiency of use of spectrum. The Authority plan to proceed with the implementation of the RF migration plan for the 450 MHz band is: 1. Clear the band as per the current regulation 2. Licence to IMT System either Band 31 or Band 72 3. Licence to additional services subject to co-existence studies. This will be informed by the RFSAP. 4. The Authority recognises that there are government services used in this band. and will develop exclusive zones during the RFSAP to protect them, if required.
IMT	880 - 960 MHz	This feasibility study supports the spectrum efficiency attained with new 2x5 900MHz MHz block. The Authority will make this block available through a future ITA assignment process. This feasibility study suggests that the value to South Africa for the new 2 x 5 MHz block in the hands of a new entrant in the band (who is not one of the incumbents) and the incremental value of a contiguous block of 900 MHz spectrum to two (2) existing incumbents (who do not have contiguous spectrum) net (i.e., minus) any re-farming costs and value lost by surrendering 2 x 1 MHz would be significantly positive.

IMT	1452 - 1492 MHz	The Authority proposes to proceed with a RFSAP for IMT in this band. However, the responses from Stakeholders to the September 2021 Inquiry Questionnaires (on Category 1 and 2 bands) only showed one existing mobile operator most interested in IMT identification for this band. Stakeholders are encouraged to comment further on this assessment.
IMT	2300 - 2450 MHz	The Authority plans to proceed with a RFSAP for IMT in this band.
IMT	3300 - 3400 MHz	The Authority plans to proceed with a RFSAP for IMT in this band.
Radio communications for specific services	138 - 144 MHz	The Authority confirms that this band will be used for: - Single frequency ('SF') alarms (such as those that warn people of an event such as intrusion or fire, as explained in the 2018 RFSAP). - Single (SF) and dual frequency links used in private and communal radio repeaters, which boost and retransmit weak radio signals (as explained in the 2018 RFSAP). The 2019 IMT Roadmap documented that these repeaters are used for mining, farming and by other small businesses. - Remote control industrial apparatus (as explained in the 2018 RFSAP).
	156.8375 - 174 MHz	The Authority concludes that its thinking on this band at this stage is the following: • The MTX DF and BTX DF swap shown in Figure 18 may be desirable but not feasible • It may be feasible, but it would require significant stakeholder galvanisation on the part of the Authority with a likely low probability of success. Stakeholders are requested to provide any further information in this context to the Authority to assist in this matter relating to the swap.
	335.4 - 380 MHz	The Authority concludes that its thinking on this band at this stage is that there is a high risk of leading to a more inefficient use of this spectrum band if it proceeds with an exclusive assignment just for BFWA and UAVs.

		Stakeholders are requested to provide any information on the above analysis to the Authority.
	380 - 387 & 387 - 390 & 390 - 399.9 MHz	The Authority plans to proceed with a RFSAP for PPDR services in this band.
	406.1 - 410 MHz	The Authority plans the use of digital mobile radio and fixed services operating in this band along with radio astronomy service.
	410 - 420 & 420 - 430 MHz	In light of emerging trends, the Authority plans to make the band available for other potential emerging applications such as broadband PPDR and IoT, in addition to digital public trunking. The Authority plans that all other Radio communications for specific services migrate out of the band[15] and proceed to a RFSAP for the band.
	440 - 450 MHz	The Authority concludes that its thinking on this band at this stage is that there is a high risk of leading to a more inefficient use of this spectrum band if it proceeds with a PPDR allocation and subsequent PPDR-based RFSAP. Given no evidence of PPDR emerging in this band, there is a strong case for largely maintaining the *status quo* and taking a longer-term outlook watching brief (i.e. > 3 years) for this band. The Authority will also closely watch the activities happening in 446-446.2 MHz on Analogue and Digital PMR to make any further decisions given developments in Europe. In summary, it would be helpful for stakeholders to comment on the optimal use of this band.
	825 - 830 MHz and 870 - 875 MHz	The Authority plans to use the lower part of this band for IMT use.
	1429 - 1452 MHz	The Authority plans to use this band for IMT.

[15] ICASA. 2013. Frequency Migration Regulation and Frequency Migration Plan.

	1518 - 1525 MHz	The Authority plans to encourage mixed use of all co-primary users i.e., Fixed, Mobile, and Mobile-Satellite.

1. Annex 1: 450 – 455 & 455 – 456 & 456 – 459 & 459 – 460 & 460 - 470 MHz band: implementation of the IMT roadmap 2014 and 2019.

This feasibility study concerning the 450–470 MHz band is mandated by the Frequency Band Migration Regulation and Plan contained in the IMT Roadmap 2014[16] and IMT Roadmap 2019[17].

1.1. Introduction

Along with the 700 MHz band, the 450 MHz band is one of the key bands currently being considered for LTE and 5G in the sub 1 GHz bands[18]. This band is getting significant momentum across the world for the deployment of LTE broadband, IoT and PPDR services.

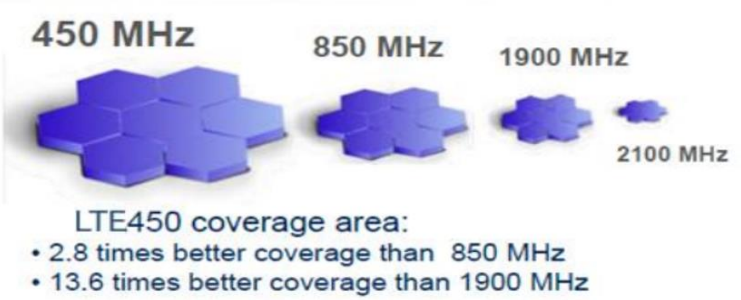


Figure 1: Indicative coverage comparison between different spectrum bands used for wireless communications[19]

The 450 MHz band has significantly better propagation characteristics compared to the spectrum bands currently used for wireless communications. Figure 1 shows an indicative coverage comparison between the 450 MHz bands and a few other bands used for wireless communications.

[16] Final (Draft) IMT Roadmap 2014, Government Gazette Vol. 593 Pretoria, 14 November 2014 No. 38213
[17] Final (Draft) IMT Roadmap 2019, Government Gazette Vol. 645, 29 March 2019 No. 42361
[18] https://gsacom.com/paper/low-band-spectrum-for-lte-and-5g-may-2021/
[19] Annual Global Update 450 MHz Alliance, September 2021

1.2. Status of ITU, SADC and South African National Frequency Allocation for the band

1.2.1. Status of ITU Frequency Allocation for the band

Table 1 shows the ITU allocations for the 450-470 MHz band. The whole 450-470 MHz band is allocated for Mobile and Fixed services on a primary basis within Region 1 and identified for IMT.

Allocation to services		
Region 1	**Region 2**	**Region 3**
455-456 FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E	**455-456** FIXED MOBILE 5.286AA MOBILE-SATELLITE (Earth-to-space) 5.209 5.286A 5.286B 5.286C	**455-456** FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E
456-459	FIXED MOBILE 5.286AA 5.271 5.287 5.288	
459-460 FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E	**459-460** FIXED MOBILE 5.286AA MOBILE-SATELLITE (Earth-to-space) 5.209 5.286A 5.286B 5.286C	**459-460** FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E
460-470	FIXED MOBILE 5.286AA Meteorological-satellite (space-to-Earth) 5.287 5.288 5.289 5.290	

Table 1: **ITU frequency allocations for 450-470 MHz band**

In WRC 19, Resolution 646 further encouraged administrations to consider parts of the 380-470 MHz frequency range for their PPDR applications in Region 1.

1.2.2. Status of SADC Frequency Allocation for the band

Table 2 shows the SADC Radio Frequency Spectrum Allocation Plan[20].

[20] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
450-455 MHz FIXED MOBILE 5.286AA 5.209 5.271 5.286 5.286A 5.286B 5.286C 5.286D 5.286E	**450-455 MHz** FIXED MOBILE 5.286AA 5.286 5.286A	Fixed links (PTP) IMT (450-470 MHz) PMR and/or PAMR	This band is currently used for a variety of fixed and mobile systems in the various SADC countries. This band is also identified for IMT (Res.224 applies).
455-456 MHz FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E	**455-456 MHz** FIXED MOBILE 5.286AA 5.2095.286A		
456-459 MHz FIXED MOBILE 5.286AA 5.271 5.287 5.288	**456-459 MHz** FIXED MOBILE 5.286AA 5.287 5.288		
459-460 MHz FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E	**459-460 MHz** FIXED MOBILE 5.286AA 5.209 5.286A		
460-470 MHz FIXED MOBILE 5.286AA Meteorological-satellite (space-to-Earth) MOD 5.287 5.288 5.289 5.290	**460-470 MHz** FIXED MOBILE 5.286AA Meteorological-satellite (space-to-Earth) MOD 5.287 5.289		

Table 2 SADC Radio Frequency Spectrum Allocation Plan

1.2.3. Status of National Frequency Plan for South Africa.

Table 3 shows the National Radio Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments

files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

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450-455 MHz FIXED MOBILE 5.286AA 5.209 5.271 5.286 5.286A 5.286B 5.286C 5.286D 5.286E	**450-455 MHz** FIXED MOBILE 5.286AA NF9 SPACE OPERATION (Earth-to-space) SPACE RESEARCH (Earth-to-space) 5.209 5.286 5.286A 5.286B 5.286C	Fixed links (450 – 453 MHz) Government Services Single Frequency Mobile (453 – 454 MHz) Paging (454 – 454.425 MHz) Trunked Mobile BTX (454.425 – 460 MHz) IMT450 PMR and/or PAMR	Paired with 460 – 463 MHz Paired with MTX (464.425 – 470 MHz) This band is currently used for a variety of fixed and mobile systems in the various SADC countries. ITU-R Recommendation M.1036-6 latest version. Resolution 224 (Rev WRC-19) Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015). Radio Frequency Spectrum Assignment Plan 2015, Government Gazette 38640 (Notice 270 of 2015) International Mobile Telecommunication Roadmap (GG No. 42829 Notice 600 of 2019). New RFSAP to be developed.
455-456 MHz FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E	**455-456 MHz** FIXED MOBILE 5.286AA NF9 5.209 5.286A 5.286B 5.286C	Government Services Trunked mobile BTX (454.425 – 460 MHz) IMT450	Paired with 464.425 – 470 MHz ITU-R Recommendation M.1036-6 latest version Resolution 224 (Rev WRC-19) Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015). Radio Frequency Spectrum Assignment Plan 2015, Government Gazette 38640 (Notice 270 of 2015) International Mobile Telecommunication Roadmap (GG No. 42829 Notice 600 of 2019). New RFSAP to be developed
456-459 MHz FIXED MOBILE 5.286AA	**456-459 MHz** FIXED MOBILE 5.286AA NF9	Trunked mobile BTX (454.425 – 460 MHz) IMT450	Paired with 464.425 – 470 MHz ITU-R Recommendation M.1036-6 latest version

5.271 5.287 5.288	5.287	Government Services	Resolution 224 (Rev WRC-19) Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015). Radio Frequency Spectrum Assignment Plan 2015, Government Gazette 38640 (Notice 270 of 2015) International Mobile Telecommunication Roadmap (GG No. 42829 Notice 600 of 2019). New RFSAP to be developed
459-460 MHz FIXED MOBILE 5.286AA 5.209 5.271 5.286A 5.286B 5.286C 5.286E	**459-460 MHz** FIXED MOBILE 5.286AA NF9 5.209 5.286A 5.286B 5.286C	Trunked Mobile BTX 454.425 – 460 MHz IMT450 Government Services	Paired with 464.425 – 470 MHz ITU-R Recommendation M.1036-6 latest version Resolution 224 (Rev WRC-19) Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015). Radio Frequency Spectrum Assignment Plan 2015, Government Gazette 38640 (Notice 270 of 2015) International Mobile Telecommunication Roadmap (GG No. 42829 Notice 600 of 2019). New RFSAP to be developed

460-470 MHz FIXED MOBILE 5.286AA Meteorological-satellite (space-to-Earth) 5.287 5.288 5.289 5.290	**460-470 MHz** FIXED MOBILE 5.286AA NF9 Meteorological-satellite (space-to-Earth) Earth exploration-satellite (space-to-Earth) 5.287 5.289	Fixed Links (460 – 463 MHz) Single Frequency Mobile (463.025 – 463.975 MHz) Low Power Mobile Radio (463.975 MHz, 464.125 MHz, 464.175 MHz, 464.325 MHz, 464.375 MHz) Single Frequency Mobile (464.375 – 464.425 MHz) Trunked Mobile MTX (464.425 – 470 MHz) IMT450 Security Systems (464.5375 MHz) Non-specific SRDs (464.5 – 464.5875 MHz) Government Services	Paired with 450 – 453 MHz Paired with BTX (454.425 – 460 MHz) ITU-R Recommendation M.1036-6 latest version Resolution 224 (Rev WRC-19) Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015). Radio Frequency Spectrum Assignment Plan 2015, GG 38640 (Notice 270 of 2015) International Mobile Telecommunication Roadmap (GG No. 42829 Notice 600 of 2019). New RFSAP to be developed

Table 3: National Radio Frequency Plan for South Africa for 450-470 MHz band[21]

The National Radio Frequency Plan for South Africa aligns with the SADC Radio Frequency Spectrum Allocation Plan and ITU frequency allocations for 450-470 MHz band. The Authority also notes that in all of the 3 allocation plans, the allocation for both Mobile and Fixed services are on a primary basis. This band is also identified for IMT (Res. 224).

The National Radio Frequency Plan 2021 shows the South African allocations and footnotes to be Fixed and Mobile 5.286AA NF9, with typical applications being: fixed links (450 – 453 MHz), government services, single frequency mobile (453 – 454 MHz), paging (454 – 454.425 MHz), trunked mobile BTX (454.425 – 460 MHz), IMT 450, PMR and/or PAMR.

The recommended frequency arrangements for implementation of IMT in the band 450-470 MHz are summarised in Table 4 and Figure 2.

[21] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

Frequency arrangements	Paired arrangements				Unpaired arrangements (e.g., for TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
D8					450-470 TDD
D12	450.0-455.0	5.0	460.0-465.0	10	None
D13	451.0-456.0	5.0	461.0-466.0	10	None
D14	452.5-457.5	5.0	462.5-467.5	10	None

Table 4: Frequency arrangements in the band 450-470 MHz[22]

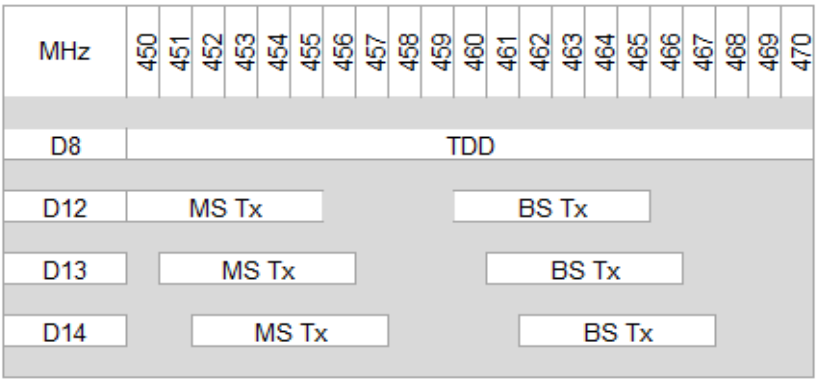


Figure 2: Frequency arrangements D8, D12, D13 and D14

1.3. International trends with country examples, standardisation status and maturity of the ecosystem

The 450 MHz band has gained some interest during recent years. The major development in the last twelve months has been the spectrum allocation in Germany, which is currently one of the main markets driving LTE progress for the lower bands. The CITC, the regulator of the Kingdom of Saudi Arabia has progressed with a consultation and plan to award spectrum in both 410 MHz and 450 MHz. In addition, Brazil, Colombia, Argentina, Suriname and Mexico in the Americas are consulting/considering the use of Band 31[23] for broadband and IoT deployments in 450-470 MHz.

[22] ITU-R Recommendation M.1036-6 - latest version.

[23] Band 31 is 452.5–457.5 MHz/462.5–467.5 MHz

In Asia, China (Unicom holds the Band 31 licence in China), Philippines, Indonesia (Net1 holds a licence covering both Bands 31 and 72[24]), Vietnam, Malaysia (Malaysia Telecom has held the Band 31 licence) and Sri Lanka are using Band 31 (and Band 72 in Indonesia) or investigating its use. In addition, Pakistan has consulted in order to evaluate the interest in evolving the current use to a technology neutral or LTE licence.

Below are the most active countries on this band in the African region during the last 12 months[25]:

- Telecom Namibia has held the Band 31 licence for several years.
- The Band 31 licence in Senegal is being evaluated for LTE with several different options for end user scenarios.
- Open Sky Services holds the Band 31 licence in Nigeria and is still working on business models with potential partners.
- The 450 MHz spectrum in Angola is in the process of evolving from CDMA to LTE by Angola Telecom.
- The Botswana regulator BOCRA has announced an auction of the 450 – 470 MHz band for broadband use.

3GPP has standardised three different band plans for 450-470 MHz band (see below).

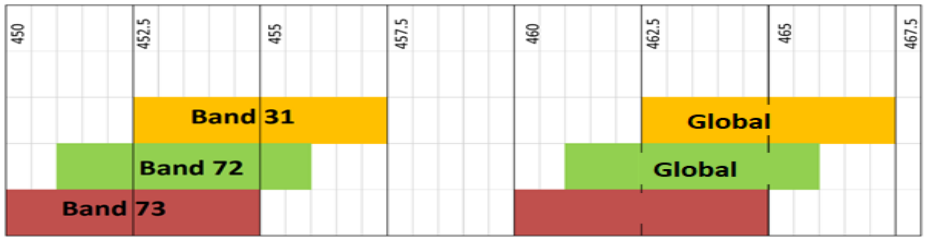


Figure 3: 3GPP band plans for 450-470 MHz band[26]

Out of these 3 bands standardised within 3GPP, Band 31 and Band 72 are the most popular bands with the highest number of devices. According to the Annual Device update 450 MHz Alliance report April 2021[27], there are 187 devices supporting Band 31. GSA reports that there are 14 operators are investing in LTE at 450 MHz (Band 31) and at least ten of them have launched LTE in this band[28].

[24] Band 72 is 451–456 MHz/461–466 MHz
[25] https://450alliance.org/
[26] Presentation on Telecoms, Technology and spectrum perspective by Noel Kirkaldy, Nokia 25/07/2017
[27] https://450alliance.org/wp-content/uploads/2021/10/450Alliance-annual-device-update-P-rev-Final.pdf
[28] https://gsacom.com/paper/low-band-spectrum-for-lte-and-5g-may-2021/

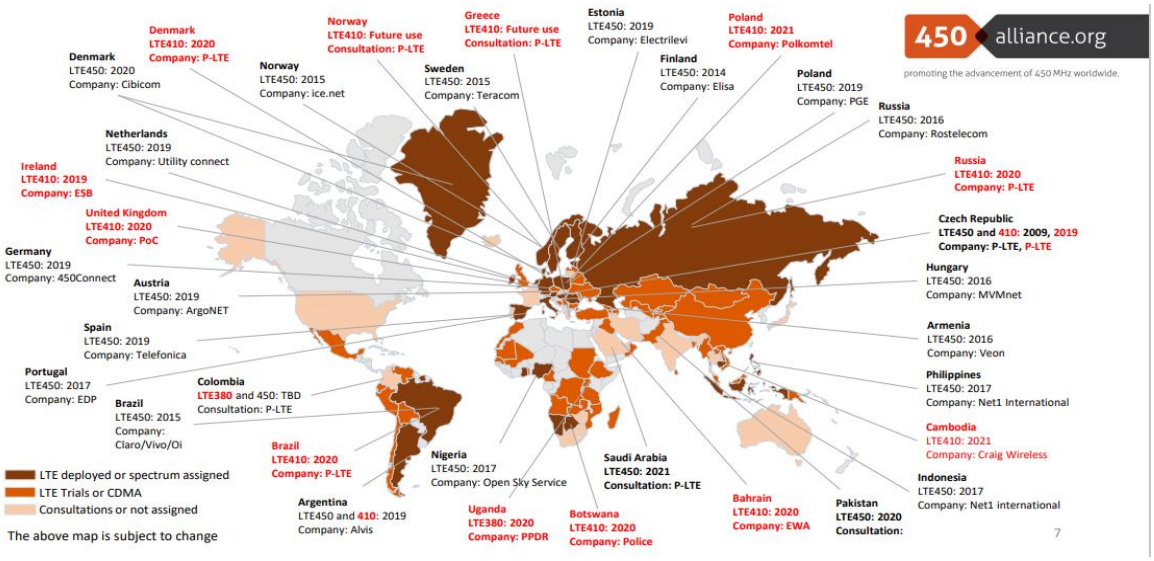


Figure 4 The world map of 380 MHz, 410 MHz and 450 MHz deployment[29]

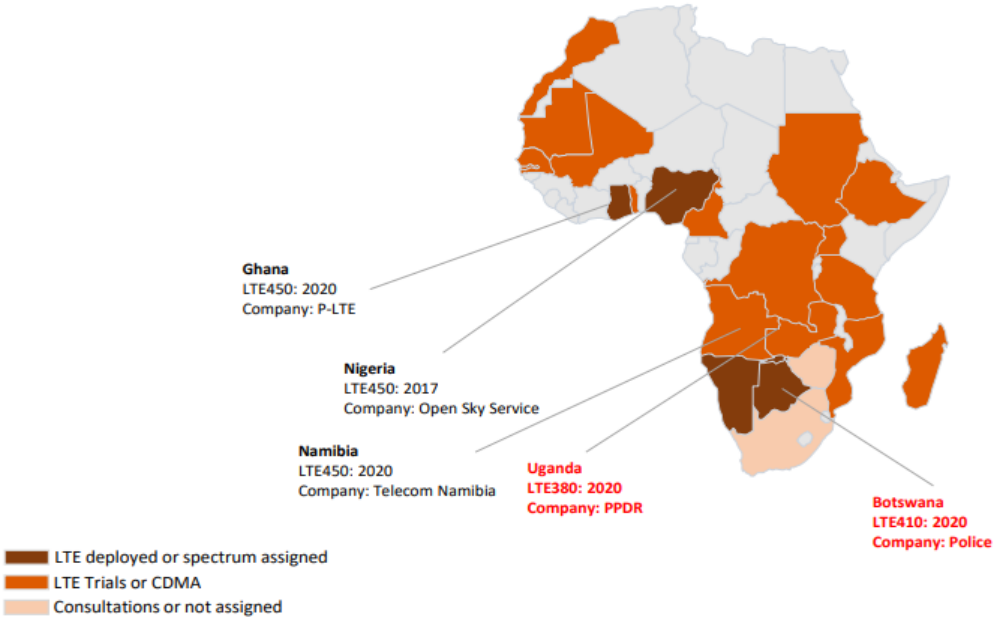


Figure 5 Africa map of 380 MHz, 410 MHz and 450 MHz deployment[30]

In Europe, Band 31 and 72 are considered during the development of harmonised technical conditions and frequency bands for the implementation of Broadband Public Protection and Disaster Relief (BB-PPDR)[31] - as recommended by Resolution 646 of WRC 2019.

[29] 450 Alliance, https://450alliance.org/

[30] *ibid*

[31] ECC Decision (16)02, Harmonised technical conditions and frequency bands for the implementation of Broadband Public Protection and Disaster Relief (BB-PPDR) systems Approved 17 June 2016

Although Band 73 arrangement is recognised in ITU and standardised within 3GPP, according to the 450 MHz Alliance, Band 73 is not used[32].

In Europe the ETSI standard TETRA, with its new TETRA Enhanced Data Service (TEDS), is expected to be used to provide wideband data applications for Public Protection as well as Disaster Relief wireless communications. There is significant PMR usage in 450-470 MHz in the UK, Netherlands, and Switzerland within Europe. Within Europe there are approximately 5 times more licences in 450-470 MHz compared to the 410-430 MHz band.

In summary, both Band 31 and Band 72 configurations are most widely being considered or used around the world for IMT and PPDR systems in the 450-470 MHz band. The ecosystem for Band 31 is currently available and the ecosystem for Band 72 is rapidly emerging.

1.4. Current usage and constraints

Currently there are some users who use this band for fixed links including some Government services. Any IMT use of this band needs to be coordinated with the fixed use of this band. Those fixed links have bandwidths of 12.5 and 25 KHz.

According to the information provided in the GG No 36334, covering the Draft Feasibility Study on 450-470 MHz band for consultation, there are incumbent users operating in the frequencies that would constitute 3GPP Bands 31 and 72. This is confirmed by Figure 6 below. Therefore, the FDD use of IMT with Band 31 or 72 configuration requires migration of services out of the band and significant coordination with the existing users who do not have to migrate. The Authority also recognises that there are some Government services operating in this band. The Authority will develop necessary mitigation mechanisms to protect the existing Government services when developing the RFSAP.

[32] https://450alliance.org/

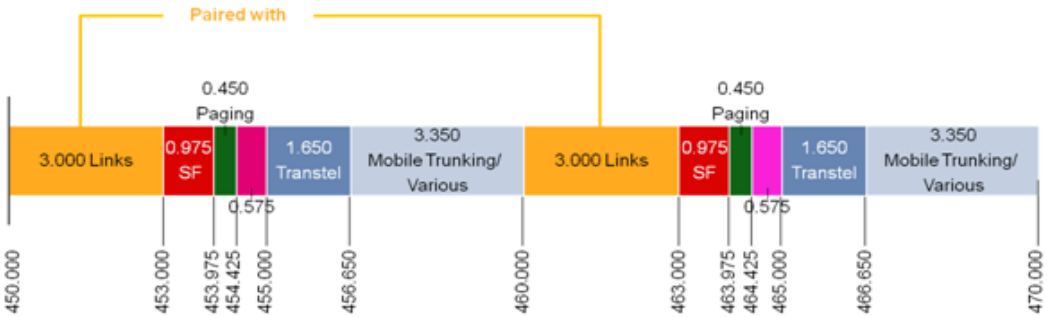


Figure 6: 2012 assignments 450-470 MHz[33]

Though Figure 6 refers to the usage in 2012, in discussions with licensees in this band, it is still relevant to current use today in December 2021.

1.5. Scenario plans

1.5.1. 2014 IMT Roadmap Government Gazette decision

The IMT roadmap Government Gazette decision 2014[34] proposed the full migration of all licensees of 450-470 MHz with a timeframe that will be concluded in 2022. The 2014 roadmap states:

> "*The intention is to afford existing users sufficient time and to ensure that most equipment will have reached near end-of-lifetime before migration is finalised. In order to release spectrum for IMT in the 450 MHz band for the SA Connect initiative, the migration process for rural areas could start in 2015 and existing users should have vacated the band in rural areas by no later than the end of 2018. For urban areas, existing users should have migrated out of the band by the end of 2022. Summary of 700 and 800 MHz Bands*".

The IMT Roadmap 2019 clearly identifies the time plan for the migration[35]. It states:

- Other licensees of 450-470 MHz band start migration to:
  - 403-406 MHz (unpaired);
  - 426-430 MHz (unpaired); or
  - 440-450[36] MHz bands (paired or unpaired); and

[33] Feasibility Studies of the Frequency Band Migration Based on the Frequency Band Migration Regulation and Plan Contained in the Government Gazette No 36334, Notice No 352 of the 3rd April 2013, Draft Feasibility Study on 450-470 MHz band for consultation

[34] Government Gazette Vol. 593 Pretoria, 14 November 2014 No. 38213

[35] Government Gazette Vol. 653, 8 November 2019, No. 42829 (Part 1 of 3)

[36] It might be necessary to also clear the 449-450 MHz band to increase IMT-spectrum.

- In case of PPDR-use - also to 387-390//397-400 MHz migration completed by 2022 (max 3 years).
- Fixed links (e.g., Telkom) potentially migrated to 2025-2110 MHz band and/or 2200 – 2285 MHz band. RFSAP has been finalised in 2019.

It also identifies the time plans for migration. i.e., migration should start in rural areas to clear spectrum for new IMT450 licensees:

- Phase 1 target: >80% of rural-used licences is cleared for IMT450 end of 2020 (6 years as of 2014);
- Phase 2: 80% of urban used licences is cleared for IMT450 end of 2021 (7 years as of 2014); and
- Phase 3: 100% of 450-470 MHz is cleared by the end of 2022 (8 years as of 2014).

The Authority therefore considers the following scenarios for this band:

- *Scenario 1*: In light of these decisions, the Authority will require all incumbents to clear the band by the time scales provided by the Authority. Once all the current regulations in force are abided by, when there is a clear band, the spectrum can be assigned to deploy LTE 450 with either 3GPP Band 31 or Band 72. In this case the whole 450-470 MHz band is assigned to users for the operation of LTE450 without any other users within the band.

- *Scenario 2:* Following the licensing of LTE 450, other narrow band services will also be assigned to the band subject to co-existence studies whilst maximising the efficient use of spectrum. Other services could include narrowband analogue PMR, point-to-point or point-to-multipoint links, digital mobile radio (DMR-P25), Tetra TDMA, CDMA systems.

1.6. Economic feasibility analysis

As explained above, there are two scenarios for this band. In what follows, the Authority considers the economic feasibility of implementing Scenario 1. While Scenario 2 may also be implemented in future, this is subject to coexistence studies, and will result in even greater benefits if implemented. It is therefore not a counterfactual scenario for which costs and benefits need to be considered.

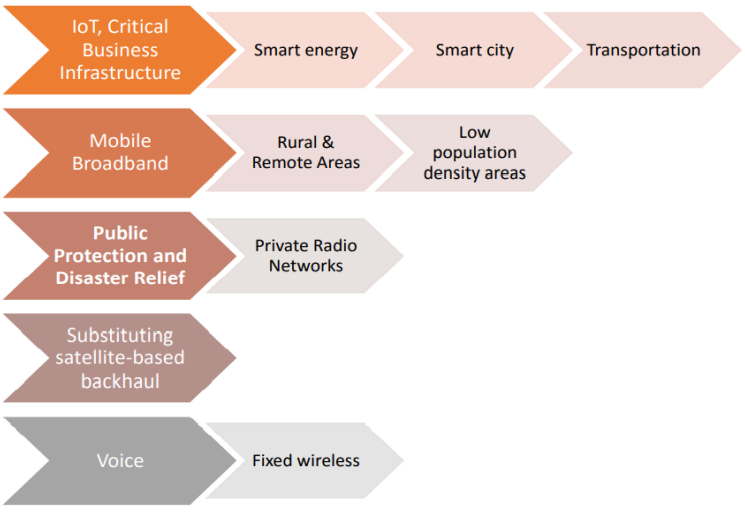
In this economic feasibility analysis, current users are first considered. This is followed by an assessment of the benefits of the use of the band for IMT, including for mobile broadband and for Internet of Things and critical business infrastructure purposes. Next, the costs of migrating Transnet, Telkom and the Government Services out of the band are considered. A summary is then provided.

Current uses

The 450-470 MHz band is occupied by a number of Government and industry incumbents such as Transnet, Telkom, Government Services and the Airports Company of South Africa (ACSA). However, this band is not being used in the most efficient manner as spectrum usage is quite low and most incumbents mostly use outdated technologies for non-IMT purposes.[37] Migration has been planned since 2013. In 2014, the Authority published a feasibility study for the band as part of the 2014 IMT Roadmap.[38] Nonetheless, the 2019 Roadmap also highlights the full migration of current users out of the band by 2022 in favour of new IMT450 licensees.[39] The 2019 Roadmap sets out that the 450-470 MHz band should be used exclusively for IMT, though potential coexistence scenarios could be deployed depending on satisfactory trial results. Current users therefore have been on notice for some time that they need to migrate out of the band. At the same time, there are Government users in the band that may have to continue using parts of the band, which means that Scenario 2 (shared use) will need to be considered.

Benefits of use of the band for IMT

There are two main applications for the band using IMT technologies, as shown Figure 7: (i) for Internet of Things and critical business infrastructure such as smart energy, smart city or transportation applications, and (ii) mobile broadband. These two applications are not mutually exclusive and involve using the band using IMT technologies.



[37] ICASA. 2019. Radio Frequency Migration Plan 2019.

[38] Final International Mobile Telecommunications (IMT) Roadmap 2014, Government Gazette number 38213 (notice 1009 of 2014), November 2014.

[39] The RFSAP describes the necessary migrations to allocate the band for IMT use. The incumbents include the Government Services, Transnet, and other licensees.

Figure 7: The value of the band for IoT and critical business infrastructure (450 MHz Alliance[40])

Internationally, there are many commercial customers that use services in this band, including in the railway, water and electricity sectors, and there are a number of private LTE deployments. Similarly, in Bahrain the Water and Electricity Authority plans to use the band to connect to its infrastructure using LTE.[41]

A number of European countries are using 450 MHz frequency bands for Smart Grids. For example, in Poland, the electricity utility PGE System is testing LTE in the 450 MHz for smart-grid purposes[42]. The German Ministry of Economics and Technology commissioned Ernst & Young to undertake a cost-benefit analysis on the comprehensive use of smart metering and found that CDMA450 Technology could improve the economic benefit of introducing smart meters in the country by up to €2.6 billion.[43]

IMT technologies are therefore commonly used in this band for Internet of Things and critical business infrastructure applications, and the value of the band for IMT is very high in this regard.

Value of the band for mobile broadband

This band allows for coverage of large areas using relatively few radio network sites. For example, the 2014 Roadmap explained that using the next available spectrum in the 700 MHz band, 55-85% more sites would be needed than when using the 450-470 MHz band. Mobile broadband services in this band would mostly be offered using routers and Mi-Fi dongle devices that can provide fixed-wireless access for homes and offices (see Figure 8)[44].

[40] http://450alliance.org/wp-content/uploads/2015/11/450-MHz-Alliance-Value-Prop2.pdf
[41] https://450alliance.org/nokia-private-lte-chosen-by-bahrains-electricity-and-water-authority-to-digitalize-distribution-network/
[42] https://enterpriseiotinsights.com/20200407/channels/news/nokia-deploys-private-lte-for-polish-smart-grid
[43] https://450alliance.org/germany-expects-start-deployment-450-mhz-networks-2015/
[44] *https://450alliance.org/2021-device-report-is-out/*

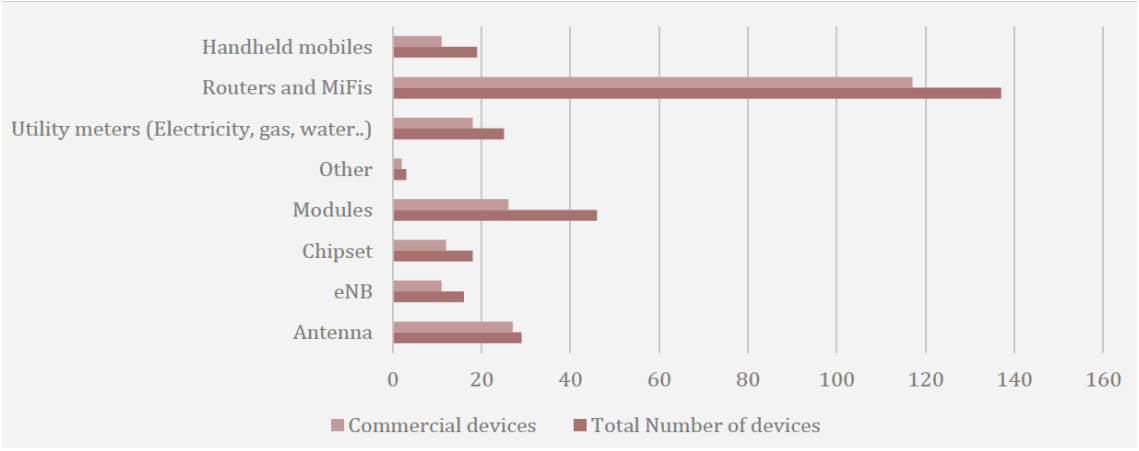
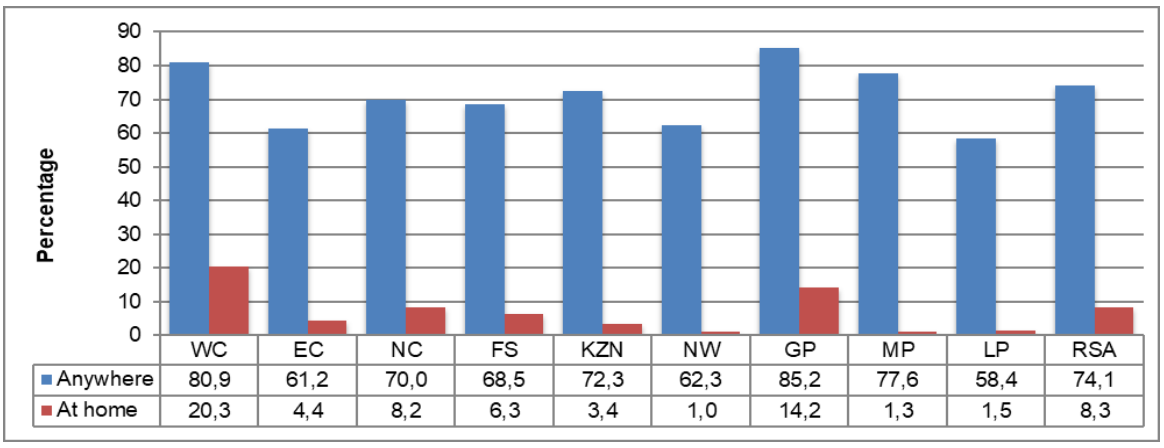


Figure 8: Global 450 MHz devises (450 MHz Alliance)

The use of this band for mobile broadband purposes is especially important given the lack of fixed Internet at home in South Africa. According to Statistics South Africa, only 8.3% of households have fixed Internet access at home (see figure 9 below). In more rural provinces, such as the North-West and Mpumalanga, only 1% and 1.3% of households have fixed access.



	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
Anywhere	80,9	61,2	70,0	68,5	72,3	62,3	85,2	77,6	58,4	74,1
At home	20,3	4,4	8,2	6,3	3,4	1,0	14,2	1,3	1,5	8,3

Figure 9: Internet availability by Province[45]

The 450-470 MHz band could therefore be used to expand broadband coverage in rural and commercially less attractive areas, which will help achieve the universal service objective set out in the ECA, and also achieve the targets set out in SA Connect.

The band has been used for this purpose in other countries. For example, in Brazil, the 450 MHz band was envisioned to serve 27.3 million rural individuals with 4G LTE mobile Internet.[46] Furthermore, it was estimated that a 10% increase in

[45] Statistics South Africa, General Household Survey 2020)
[46] https://www.commsupdate.com/articles/2014/08/08/lte-450-projects-approved-worth-usd197m/

broadband penetration in Brazil could result in a 0.08[47] percentage point increase in GDP growth.[48]

The 2014 Roadmap also explains how this band might help with in-building coverage, which is increasingly a problem in South Africa. Telkom, for example, documents that it faces significant constraints in shopping malls, and needs access to distributed antenna systems for this purpose.[49] Greater in-building coverage is therefore a further benefit of using this band for mobile broadband purposes.

Auction values for IMT applications

The value of the band for IMT purposes internationally can be considered in terms of the results of spectrum auctions. For instance, in Sweden and Norway, 2 x 5 MHz of spectrum sold for between USD 0.5m and USD 4.4m (see table 5 below). These are not very high values compared to other auctions for other bands, and likely reflect the limited device support mentioned above, and in particular that devices are typically fixed-wireless rather than smartphones. There were no auction bids on this band in Brazil, possibly due to the coverage obligations associated with it and the fact that Brazil was an early mover in this band in 2012. In the Brazilian auction, the 450 MHz spectrum (2 x 7 MHz) was later bundled with other spectrum.[50]

Country	Date	Volume	Auction price (USD million)
Sweden	2018	10	4.422
Norway	2019	10	0.55

Table 5: Auction values in the 450-470 MHz spectrum band.[51]

Note: These values are merely indicative. Adjustments for GDP per capita, PPP and US inflation will have to be taken into account in order to make these values comparable in Rand terms for South Africa. The local currency auction prices were as follows: Sweden = SEK40.2 million and Norway = NOK25.01 million.

[47] Not found to be statistically significant.

[48] https://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf

[49] Telkom submission on the Authority's Draft Mobile Broadband Services Regulations and Findings Document on Mobile Broadband Services Inquiry, Published on 26 March 2021 (Government Gazette Vol. 669, No. 44337).

[50] In 2012, Brazil's national telecommunications agency (Anatel), auctioned its 2.5 GHz band alongside the 450 MHz band, with the latter being coupled with the 2.5 GHz band as it failed to attract bidders. Access to the 450 MHz band came with strict coverage commitments. Anatel then decided to bundle the 450 MHz band with the 2.5 GHz band so that winners of the 2.5 GHz band could utilise it for rural coverage. In order to promote rural broadband access Anatel placed specific coverage requirements which required 30% of rural areas being covered by June 2014, 60% by December 2014 and 100% by December 2015. See: CommsUpdate. 2012. Big four secure frequencies in Brazil's 4G auction, but 450MHz band fails to excite. Available at: https://www.commsupdate.com/articles/2012/06/13/big-four-secure-frequencies-in-brazils-4g-auction-but-450mhz-band-fails-to-excite/

[51] Where applicable, USD values were calculated using a spot USD exchange rate: (USD/SEK = 0.11), (USD/NOK = 0.11). Figures are not inflation adjusted.

Costs of the Transnet migration

In South Africa, Transnet is the main user of the 450 MHz band, and currently uses the band for two analogue systems that connect to thousands of Transnet locomotives. Transnet's current analogue systems, deployed in the 1990s and early 2000s, need to be replaced. This was anticipated in the 2014 Roadmap, which allowed a migration period until 2022. The IMT Roadmap 2019 clearly mentioned that the incumbents who use the band for PPDR, should migrate to 387-390/397-400 MHz by 2022.

Since Transnet equipment is at the end of its life, they will need to invest in new equipment, regardless of the need to migrate to a different band. Transnet therefore needs to roll out a new network, or buy services from a third party. While Transnet itself might roll out a private LTE network along railway lines in the coming years, it has not yet done so, and there is no evidence of plans to fund the very large expenditure required in its annual reports.[52] In any event, the limited coverage planned means that this band is not and will not be used for its highest value application. The benefits of Transnet using this band for a private broadband network are therefore very low compared to the benefits of using this band for an IMT network available to the public.

There is a concern that if a third party bids for and wins this spectrum in a competitive assignment process, Transnet would be dependent on such a third party. At the same time, Transnet is likely to face competition in the coming years in the use of its railway and port network, and so having a third party offer LTE service in this band to all possible users of the railway network is pro-competitive.

It may also be possible to study shared use of this band by Transnet and a third party, full-coverage network so as to ensure Transnet is not dependent on such a third party.

The costs of migrating Telkom out of the band

Telkom currently uses the band for several hundred narrowband connections that fall outside the 2 x 5 MHz 3GPP Bands 31 and 72 assignment plans, and hence will not incur migration costs if this band plan is used. If the TDD band plan is used, then a migration plan for Telkom would be needed.

Costs of the Government Services migration

The Government Services have been in the process of migrating out of this band for some time to their PPDR assignment in the 380-400 MHz band. This migration has been partially achieved, with the Government Services having partially rolled

[52] https://www.transnet.net/InvestorRelations/AR2021/Transnet%20Integrated%20Report%202021.pdf

out a digital network in the latter band. While Government Services are incurring costs to upgrade to digital, it would incur these costs regardless of whether it had an assignment in the 450 MHz band or not. These costs are therefore not relevant to considering whether Scenario 1 ought to be implemented in South Africa or not.

Summary

This analysis suggests that the costs of implementing Scenario 1, i.e., migrating current users out and identifying the band for IMT, will not result in significant costs to incumbents. At the same time, there will be substantial benefits from implementing this migration plan, including the expansion of mobile broadband, and increasing the availability of Internet of Things and critical commercial applications. It will also be possible to implement Scenario 2, which adds further use of the band. Allocating this band for IMT, possibly coexisting with other services, is therefore economically feasible.

1.7. Summary proposals arriving out of feasibility study

The regulations in force mentioned in **Section 1.4 Current usage and constraints** are very clear on the fact that the entire band should be cleared. IMT usage in this band should be a main target to support future data demands for SA Connect. Therefore, the entire band should be cleared as per the regulations in force. The clearance of the band also provides an opportunity to modernise the legacy technologies with more spectrally efficient technologies resulting in an increased efficient of use of spectrum.

In summary, the Authority's plan to proceed with the implementation of the RF migration plan for the 450 MHz band is:

1. Clear the band as per the current regulations;
2. Licence to IMT System either Band 31 or Band 72;
3. Licence to additional services subject to co-existence studies. This will be informed by the RFSAP;
4. We recognise there are Government services used in this band. The Authority will develop exclusive zones during the RFSAP to protect them, where required.

The responses from Stakeholders to the September 2021 Inquiry Questionnaires (on Category 1 and 2 bands) broadly support this summary too.

2. Annex 2: 880-960 MHz band: implementation of the IMT Roadmap 2014 and 2019

This feasibility study concerning the 880–960 MHz band is mandated by the Frequency Band Migration Regulation and Plan contained in the IMT Roadmap 2014[53] and IMT Roadmap 2019[54].

2.1. Introduction

This band is widely known as the 900 MHz band and a large number of operators across the world have deployed 2G technology in this band. The propagation characteristics of this band enable achieving a longer cell range (hence wider coverage areas) and deep indoor coverage compared to many other spectrum bands used for the deployment of mobile services. Towards the latter part of 2010-2020 decade, many operators have re-farmed this band to deploy 3G technologies. Currently, some operators are switching off 2G technology and re-farming the band to deploy 4G/5G technologies.

2.2. Status of ITU, SADC and South African National Frequency Allocation for the band

2.2.1. Status of ITU Frequency Allocation for the band

Table 6 shows the ITU allocations for the 880-960 MHz band. The whole band is allocated for fixed, mobile and broadcasting services on a primary basis within Region 1 and identified for IMT.

Region 1	Region 2	Region 3
862-890 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 5.319 5.323	BROADCASTING 5.317 5.318	 5.149 5.305 5.306 5.307 5.320

[53] Final (Draft) IMT Roadmap 2014, Government Gazette Vol. 593 Pretoria, 14 November 2014 No. 38213
[54] Final (Draft) IMT Roadmap 2019, Government Gazette Vol. 645, 29 March 2019 No. 42361

890-942 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 Radiolocation 5.323	**890-902** FIXED MOBILE except aeronautical mobile 5.317A Radiolocation 5.318 5.325 **902-928** FIXED Amateur Mobile except aeronautical mobile 5.325A Radiolocation 5.150 5.325 5.326 **928-942** FIXED MOBILE except aeronautical mobile 5.317A Radiolocation 5.325	**890-942** FIXED MOBILE 5.317A BROADCASTING Radiolocation 5.327
942-960 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 5.323	**942-960** FIXED MOBILE 5.317A	**942-960** FIXED MOBILE 5.317A BROADCASTING 5.320

Table 6: ITU frequency allocations for 880-960 MHz band

2.2.2. Status of SADC Frequency Allocation for the band

Table 7 shows the SADC Radio Frequency Spectrum Allocation Plan[55].

[55] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
862-890 MHz FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 5.319 5.323	**862-890 MHz** MOBILE except aeronautical mobile 5.317A 5.322 SADC14	862-876 MHz IMT	This band is paired with 824-849 MHz
		876 880 MHz IMT PMR and/or PAMR	This band is paired with 921-925 MHz.
		880-915 MHz IMT	Paired with 925-960 MHz.
890-942 MHz FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 Radiolocation 5.323	**890-942 MHz** MOBILE except aeronautical mobile 5.317A	915-921 MHz PMR and/or PMR	
		921-925 MHz IMT PMR and/or PAMR	Paired with 876-880 MHz.
		925-960 MHz IMT	Paired with 880-915 MHz
942-960 MHz FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 5.323	**942-960 MHz** MOBILE except aeronautical mobile 5.317A 5.322		

Table 7: SADC Radio Frequency Spectrum Allocation Plan

2.2.3. Status of the National Frequency Plan for South Africa.

Table 8 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
862-890 MHz FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322	**862-890 MHz** FIXED MOBILE except aeronautical mobile 5.317A NF10	Fixed Links (856 – 864.1 MHz) Wireless Access (872.775 877.695 MHz) GSM-R MTX (877.695 – 880 MHz) NF10 IMT900 MTX (880-915 MHz) IMT850 BTX (870-875 MHz) Wireless Audio systems and Wireless microphones (863 – 865 MHz) CT2 cordless phones (864.1 – 868.1 MHz) FWA (864.1 – 868.1 MHz) RFID (865 – 868 MHz) Non-specific SRD and RFID (869.4 – 869.65 MHz)	Paired with 868.1 – 876 MHz Paired with 827.775 – 832.695 MHz Paired with 921 – 925 MHz Paired with BTX (925 – 960 MHz) Paired with MTX (825-830 MHz) Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015). Recommendation ITU-R M.1036-6 Radio Frequency Spectrum Assignment Plan GG 42337 Notice 165 of 2019

5.319 5.323		Non-Specific SRDs (868 – 868.6 MHz, 868.7 – 869.2 MHz, 869.4 – 869.65 MHz, 869.7 – 870.0 MHz) Alarms (868.6 – 868.7 MHz, 869.25 – 869.3 MHz, 869.65 – 869.7 MHz	Radio Frequency Spectrum Assignment Plan (GG 38640 Notice 275 of 2015) as amended International Mobile Telecommunication Roadmap GG No. 42829 Notice 600 of 2019).
890-942 MHz FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 Radiolocation 5.323	**890-942 MHz** FIXED MOBILE except aeronautical mobile 5.317A NF9 NF10 NF11 Radiolocation	IMT900 MTX (880 – 915 MHz) GSM-R (BTX) (921 - 925 MHz) RFID (including, passive tags and vehicle location (915.1 – 921 MHz)	Paired with BTX (925 – 960 MHz Paired with MTX (877.695 – 880 MHz) Radio Frequency Spectrum Assignment Plan (GG 38640 Notice 275 of 2015) as amended International Mobile Telecommunication Roadmap GG No. 42829 Notice 600 of 2019). Final Frequency Migration Plan 2019 (GG No. 42337 Notice 36 of 2019)
942-960 MHz FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 5.323	**942-960 MHz** FIXED MOBILE except aeronautical mobile 5.317A NF9	IMT900 BTX (925 – 960 MHz)	Paired with MTX (880 – 915 MHz) Recommendation ITU-R M.1036-6

Table 8: National Radio Frequency Plan for South Africa for 880-960 MHz band[56]

The recommended frequency arrangements for implementation of IMT in the band 880-960 MHz are summarised in Table 9 and Figure 10.

	Paired arrangements (FDD)	

[56] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

Frequency arrangements	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	Un-paired arrangements (TDD) (MHz)
A2	880-915	10	925-960	45	None

Table 9: Frequency arrangements in the 880-960 MHz frequency range [57]

Figure 10: Frequency arrangements in the 880-960 MHz frequency range

2.3. International trends with country examples, standardisation status and maturity of the ecosystem

This band is widely known as the 900 MHz band. Originally, a large number of operators across the world have deployed 2G technology in this band before the year 2000.

Within Europe, the 900 MHz band was subject to several harmonisation measures taken at EU level or by the ECC[58] [59] [60] [61]. The following compatibility studies were carried out to assess the compatibility between UMTS and GSM operating in the 900 MHz band

- ECC Report 82 on the compatibility study for UMTS operating within the GSM 900 and GSM 1800 frequency bands[62];
- ECC Report 96 on the compatibility between UMTS 900/1800 and systems operating in adjacent bands[63].

[57] ITU-R Recommendation M.1036-6 latest version.

[58] Council Directive 87/372/EEC of 25 June 1987 on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community

[59] Council Recommendation 87/371/EEC of 25 June 1987 on the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community

[60] ERC Decision (94)01: "The frequency bands to be designated for the coordinated introduction of the GSM digital pan-European communications system", October 1994

[61] ERC Decision (97)02: "The extended frequency bands to be used for the GSM Digital Pan-European Communication System", March 1997

[62] ECC Report 82: "Compatibility study for UMTS operating within the GSM 900 and GSM 1800 frequency bands", May 2006

[63] ECC Report 96: "Compatibility between UMTS 900/1800 and systems operating in adjacent bands", April 2007

The European Parliament and European Council amended Council Directive 87/372/EEC[64] in 2009 that approving the opening of the 900 MHz band to the Universal Mobile Telecommunications System (UMTS) and to other terrestrial systems capable of providing electronic communications services that can co-exist with the Global System for Mobile communications (GSM)[65]. Many operators (i.e., Vodafone, O2 in the UK, Elisa in Finland) used this opportunity to re-farm the 900 MHz band to deploy UMTS based 3G technology in this band. 3GPP has standardised the above frequency arrangement as Band 8 and n8 for LTE and 5G respectively.

GSMA[66] data shows that there are more than 200 5G devices supporting this band.

2.4. Current usage and constraints

The current assignment of the 900 MHz band in South Africa is shown in the figure 11 below.

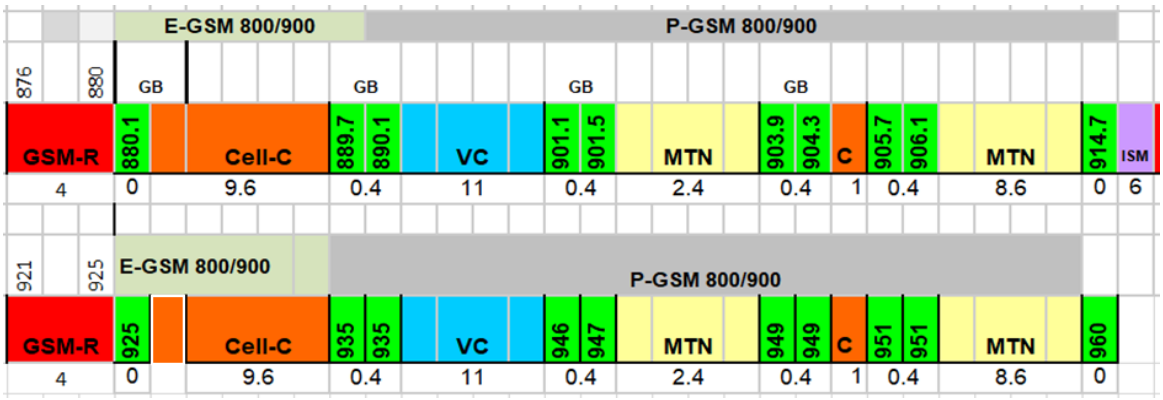


Figure 11: Current assignments of 900 MHz band in South Africa (Source: ICASA)

As can be seen above, MTN and Cell C have disjointed assignments of spectrum. This militates against the efficient use of spectrum. Government Gazette No. 38640[67] states that in the short term, the operators must coordinate on the reduction of guard bands. The Authority has decided that the following assignments (see Figure 12) within the IMT900 band are to be achieved by March 2020 at the latest.

[64] Council Directive 87/372/EEC of 25 June 1987 on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community

[65] https://docdb.cept.org/download/1595

[66] www.GSMA.com, Device availability by March 2021.

[67] Government Gazette Vol. 597 Pretoria, 30 March 2015 No. 38640

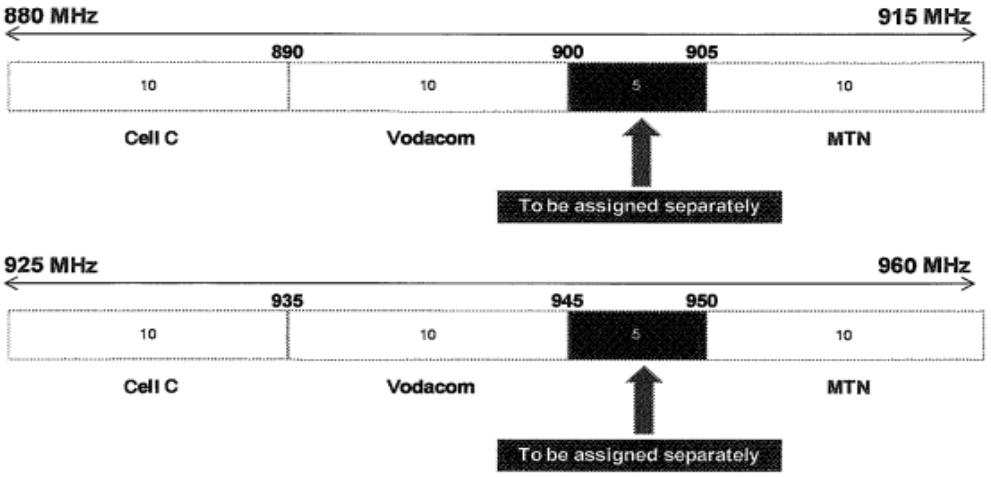


Figure 12 Required assignments for 900 MHz band

2.5. Scenario plans

The Authority carried out a feasibility study for this band in the 2014 Roadmap[68], which provided for several scenarios for migration.

> "The feasibility study in the 880-960 MHz band involves the harmonisation of GSM assignments for higher efficiency. The harmonisation of GSM assignments is required because the 880-960 MHz GSM band is unnecessarily fragmented, making it technically and financially suboptimal for licensees to provide services. For instance, over 2 MHz of the 35 MHz are used for guard bands and 2 of the licensees are unable to deploy broadband in the narrow fragments of their assignments. Three scenarios are proposed with benefits of increased spectrum (1.2, 1.8 and 1.8 MHz more respectively), and contiguous assignments for all 3 licensees. The differences between the proposed scenarios include the removal or not of guard bands and uneven-sized assignments proportionate to the spectrum requirements of each of the licensees".

The Authority then issued an RFSAP for this band in 2015, which called for the completion of in-band migration by March 2020. While various meetings have been held to start this process, the migration has not yet begun.

In conclusion the only scenario is to realise Figure 7 as per the Government Gazette No. 38640[69] (as shown in Figure 12 above).

[68] 2014-08-11-IMT Road Map and feasibility Studies, Government Gazette, Draft IMT Roadmap for Consultation August 2014
[69] Government Gazette Vol. 597 Pretoria, 30 March 2015 No. 38640

2.6. Economic feasibility analysis and deployment costs

This economic feasibility considers the implementation of the Authority's existing RFSAP, and is structured as follows. First, the overall benefits and costs of implementing the Authority's proposed migration are discussed. Next, the benefits and costs to incumbent holders of spectrum are considered, followed by a discussion on whether 2 x 5 MHz ought to be made available to a new entrant. A summary is then provided.

Overall benefits and costs

The 2014 Roadmap identified a number of benefits and costs associated with in-band migration:

1. *Benefits:* There is currently inefficiently assigned spectrum in this band due to non-contiguous assignments, which results in additional guard bands. Freeing up these guard bands would release 2 x 1.8 MHz of spectrum. In addition, there are inefficiencies arising from non-contiguous spectrum assignments for operators. Cell C and MTN would, post-migration, have 10 MHz of contiguous spectrum each (Vodacom already has a contiguous assignment of 10 MHz). Furthermore, the option that the Authority selected for the 2015 RFSAP, 2 x 10 MHz for 3 operators and 2 x 5 MHz for a fourth operator, permits the elimination of internal and external guard bands, subject to arrangements for the GSM-R band. Thus, 2 x 2 MHz would be freed up as a result of implementing the Authority's 2015 RFSAP.

2. *Costs:* In the 2014 Roadmap, the Authority documented that MTN indicated that it would have to retune 4,000 sites at a cost of R40m. Vodacom estimated that it would cost R86.2m to migrate, due to the replacement of 15,000 low power and 100 high-power cell extenders, the replacement of distributed antenna systems (DAS) installed at 19 locations, and as a result of re-tuning (re-planning) sites. The ref-arming cost, after inflation since 2014, may cost MTN and Vodacom R173m in total. Both parties considered that there would be poor network quality country-wide during migration. Cell C may incur some costs to achieve the re-farming proposed by the Authority, though it is in the process of switching off its physical radio access network in the coming years.

The benefits and costs for stakeholders

Cell C and MTN: As a result of Cell C's network migration, the benefits of contiguous spectrum may be less today than they were in 2014. Overall, it is not clear whether Cell C and MTN stand to gain from the refarming: though they do each lose 2 x 1 MHz, the benefit from having 2 x 10 MHz contiguous spectrum

would exceed this cost. There are a number of benefits to having contiguous spectrum, as it enables mobile operators to have fewer base stations, resulting in less capital expenditure and maintenance costs while providing greater coverage.[70] Mobile operators are also willing to pay more for contiguous spectrum due to the efficiency and performance benefits of having larger block sizes

Vodacom: The costs would exceed the benefits for Vodacom since Vodacom's assignment is already contiguous.

Consumers: In the short term, consumers may be harmed during the migration process due to network disruption. However, the forthcoming spectrum auction should provide sufficient additional spectrum for licensees to minimise such disruptions. In the medium to longer term, the migration plan will result in contiguous spectrum assignments for MTN and Cell C, resulting in lower costs and higher network quality. Furthermore, the licensing of an additional operator in the band will promote competition, resulting in lower prices, greater consumer choice and better quality.

Considering whether 2 x 5 MHz should be made available to a new entrant in the band

A question arises as to (i) whether the benefit of freeing up 2 x 2 MHz of additional GSM 900 spectrum should accrue to incumbents in the band, or (ii) whether this should rather be combined with 1 x 1 MHz from each of the incumbents to create 2 x 5 MHz for a fourth operator in this band, as set out in the Authority's 2015 RFSAP. As explained in the 2014 Roadmap, a number of countries have implemented the latter arrangement, in order to facilitate entry and competition. Both France and Sweden in 2010-2011 introduced additional licensees in their respective bands, while a fourth licensee was introduced in Hong Kong after an auction in 2018. The need to promote competition in South Africa is highlighted in the Authority's finding document on the Mobile Broadband Inquiry, which found there is inadequate competition in a number of markets where IMT spectrum is used.[71] The Authority's 2015 RFSAP for this band helps achieve this by facilitating the entry of a fourth operator. It is highly likely that there will be demand for this fourth assignment in the 900 MHz band in South Africa, given the substantial auction values derived from spectrum in this band (see Table 10 below), which range between USD 87m and USD 1,534m for 40 MHz in Norway and 70 MHz in Germany, respectively.

[70] See, for example, Deloitte. 2013. Second Digital Dividend - Final Report and Implementation. Available: https://www.ellipsis.co.za/wp-content/uploads/2014/04/Second-Digital-Dividend-Final-Report-and-Implementation-Plan-April-2014.pdf

[71] 'Draft Mobile Broadband Services Regulations and Findings Document on Mobile Broadband Services Inquiry', Published on 26 March 2021 (Government Gazette Vol. 669, No. 44337).

Country	Date	Volume	Reservation price (USD million)	Auction price (USD million)	Price per 2 x 5 lots (USD million)
Germany	2015	70	598.5	1 534.09	219.16
Norway	2017	40	61.6	86.93	21.73
Hong Kong	2018	50	247	348.4	69.68

Table 10: Auction values in the 900 GSM band (2 x 5 lot).[72]

These values are merely indicative. Adjustments for GDP per capita, PPP and US inflation will have to be taken into account in order to make these values comparable in Rand terms for South Africa. The local currency auction prices were as follows: Germany = €1 345.69 million, Norway = NOK790.24 million and Hong Kong = HDK2 680 million.

In addition, in 2018, Ofcom, the UK regulator, assessed the licence fees for 900 MHz band as £1.093 million per MHz per annum[73] which is approximately equal to RAND 23.5 million per MHz per annum. The value for 2 x 5 MHz would be approximately RAND 235 million per annum. Given these high fees in the UK, it is likely that there will be considerable demand for spectrum in this band from a fourth operator in South Africa.

Furthermore, at least Telkom has indicated that its lack of sub-1 GHz spectrum has impeded its entry into the market. This information, together with the value of the spectrum in assignment processes in other countries, including for new entrants, suggests that there are significant benefits of making available 2 x 5 MHz in this band for a new entrant.

Summary

The Authority's 2015 RFSAP, which creates contiguous assignments for two incumbents in the band and creates room for a fourth operator in the band, is economically feasible. While the incumbent operators will incur some costs to implement the migration, and consumers may be harmed in the short-term due to network disruption, the latter will be mitigated through additional spectrum being made available via the upcoming auction, and the former cost is far exceeded by permitting contiguous spectrum assignments and freeing up guard bands, and by permitting new entry into the band. The latter will also improve outcomes in terms of price, quality and innovation for consumers, once the additional spectrum (2 x 5 MHz) is made available to a new entrant in the band.

[72] Where applicable, USD values were calculated using a spot USD exchange rate: (USD/EUR = 1.14), (USD/NOK = 0.11), (USD/HK$ = 0.13) and (R/USD = 16). Figures are not inflation adjusted.

[73] https://www.ofcom.org.uk/data/assets/pdf_file/0020/130547/Statement-Annual-licence-fees-900-MHz-and-1800-MHz.pdf

2.7. Summary proposals arriving out of feasibility study

In summary, this feasibility study supports the spectrum efficiency attained with new 2x5 900MHz MHz block.

The Authority will make this block available through a future ITA assignment process. This feasibility study suggests that the value to South Africa for the new 2 x 5 MHz block in the hands of a new entrant in the band (who is not one of the incumbents) and the incremental value of a contiguous block of 900 MHz spectrum to two (2) existing incumbents (who do not have contiguous spectrum) net (i.e., minus) any re-farming costs and value lost by all operators surrendering 2 x 1 MHz would be significantly positive.

3. Annex 3: 1452 - 1492 MHz band: implementation of the IMT roadmap 2014 and 2019

This feasibility study concerning the 1452–1492 MHz band is mandated by the Frequency Band Migration Regulation and Plan contained in the IMT Roadmap 2014[74] and IMT Roadmap 2019[75].

3.1. Introduction

The frequency band (1452-1492) is identified for IMT globally except CEPT countries. However, this is not a mainstream band considered for IMT. Although the band is standardised within 3GPP, the ecosystem is still maturing.

In line with Region 1, South Africa has 4 primary allocations in this band: Fixed, Mobile, Broadcasting and Broadcasting Satellite.

The IMT Roadmap 2019[76] indicated that studies called for Resolution 761 (WRC-15) on the

> "Compatibility of International Mobile Telecommunications and broadcasting-satellite service and take appropriate regulatory and technical studies, with a view to ensuring the compatibility of IMT and BSS (sound)"

are undertaken within the ITU-R Res. 223 (Rev.WRC-15).

3.2. Status of ITU, SADC and South African National Frequency Allocation for the band

3.2.1. Status of ITU Frequency Allocation for the band

Table 11 shows the ITU allocations for the 1452-1492 MHz band. The whole band is allocated for fixed, mobile, broadcasting and broadcasting satellite services on a primary basis within Region 1 including South Africa.

[74] Final (Draft) IMT Roadmap 2014, Government Gazette Vol. 593 Pretoria, 14 November 2014 No. 38213
[75] Final (Draft) IMT Roadmap 2019, Government Gazette Vol. 645, 29 March 2019 No. 42361
[76] IMT Roadmap 2019, Government Gazette 42361 29 March 2019

Region 1	Region 2	Region 3
1 452-1 492 FIXED MOBILE except aeronautical mobile 5.346 BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.342 5.345	**1 452-1 492** FIXED MOBILE 5.341B 5.343 5.346A BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.344 5.345	

Table 11: ITU frequency allocations for 1452–1492 MHz band

3.2.2. Status of SADC Frequency Allocation for the band

Table 12 shows the SADC Radio Frequency Spectrum Allocation plan.

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
1 452-1 492 MHz FIXED MOBILE except aeronautical mobile 5.346 BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.342 5.345	**1 452-1 492 MHz** FIXED MOBILE except aeronautical mobile 5.346 BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.345	1 452-1 467 MHz Terrestrial Digital Audio Broadcasting (T-DAB) IMT Res. 223 (Rev.WRC-15)	.
		1 467-1 492 MHz Satellite Digital Audio Broadcasting (S-DAB) IMT Res. 223 (Rev.WRC-15)	

Table 12 SADC Radio Frequency Spectrum Allocation Plan[77]

3.2.3. Status of National Frequency Plan for South Africa.

Table 13 shows the National Frequency Plan for South Africa. the Authority notes that the Digital Sound Broadcasting Regulations were recently published in 2021.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
1 452-1 492 MHz FIXED	**1 452-1 492 MHz** FIXED NF14		

[77] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

MOBILE except aeronautical mobile 5.346 BROADCASTIN G BROADCASTING-SATELLITE 5.208B 5.341 5.342 5.345	MOBILE except aeronautical mobile 5.346 BROADCASTING BROADCASTING-SATELLITE 5.208B 5.341 5.345	IMT Terrestrial Digital Audio Broadcasting (T-DAB)	Resolution 528 (Rev. WRC-19) Resolution 739 (Rev. WRC-19) Recommendation ITU-R M.1036-6 International Mobile Telecommunications (IMT)) Final Frequency Migration Plan 2019 (GG No. 42337 Notice 36 of 2019) RFSAP to be Developed.

Table 13: National Radio Frequency Plan South Africa for 1452-1492 MHz band[78]

The Authority's 2013 Frequency Migration Plan states that a feasibility study has to be conducted after WRC-15 with consideration to the mention of the band in ITU-R Working Party 5D - IMT Systems (WP 5D) as a possible candidate band for IMT WRC-15 Agenda item 1.1. There was consensus in the WRC-15 preparatory meetings for the band to be supported for IMT since broadcasters were no longer interested in the band.[79]

The recommended frequency arrangements for implementation of IMT in the band 1452 to 1492 MHz are summarised in Figure 13[80]. There are currently three options available that use the full range, which will be used for the different IMT technologies: supplemental downlink (SDL), frequency division duplex (FDD) or time division duplex (TDD).

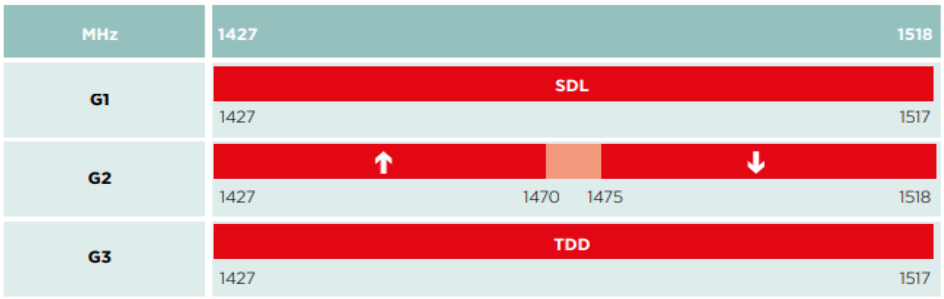


Figure 13: Possible Frequency arrangements for the 1452-1492 MHz band[81]

[78] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa
[79] ICASA. 2019. International Mobile Telecommunications (IMT) Roadmap 2019.
[80] https://www.gsma.com/spectrum/wp-content/uploads/2017/06/L-band-1500-MHz-IMT-Range.pdf
[81] *Ibid.*

3.3. International trends with country examples, standardisation status and maturity of the ecosystem

Historically, in Region 1 this band has been allocated to T-DAB[82] and S-DAB[83]. However, there has been a trend for other services to replace DAB in this band, including in Africa. There is also a clear trend of IMT seeking an exclusive identification of the band.

In Europe, CEPT Report 54 proposed the harmonisation of the 1452-1492 MHz band for wireless broadband supplemental downlink use, while allowing Member States to adapt to national circumstances in parts of the band (such as 1452-1479.5 MHz) for terrestrial broadcasting. Supplemental downlink is downlink-only use whereby spectrum within the band is used for unidirectional base station transmission providing electronic communications services, in combination with use of spectrum in another frequency band.

In the European Union, the 1452-1492 MHz bands were specifically harmonised for mobile network supplemental downlink (SDL) in May 2015[84]. This means the spectrum can be used to provide additional capacity in the downlink. In the UK Vodafone and H3G acquired this spectrum to meet demand for mobile data on their networks. SDL should be particularly useful for running download-heavy services, such as video-on-demand, enabling services such as YouTube to be delivered seamlessly to smartphone devices over a cellular data connection. It will also improve downlink user experience through aggregation with licenced frequency-division duplexing (FDD) spectrum. Japan already uses the 1427-1518 MHz band for IMT services. In Europe, the 28 countries of the European Union support 1427-1518 MHz for IMT. Four of the biggest European countries i.e., Germany, Italy, Switzerland and the UK have licenced L-band spectrum. CITEL, representing all of the Americas, supports the designation of 1427-1518 MHz for IMT, although in the US current use of the band by aeronautical telemetry means it will not be used for IMT services[85]. According to GSMA, there are over 70 smartphones from Apple, Huawei and Samsung supporting this band.[86]

However, despite the above efforts from various countries, the IMT ecosystem in this band is still maturing compared to the mainstream IMT bands.

3.4. Current usage and constraints

[82] Terrestrial Digital Audio Broadcasting.
[83] Satellite Digital Audio Broadcasting.
[84] COMMISSION IMPLEMENTING DECISION (EU) 2015/ 750 - of 8 May 2015 - on the harmonisation of the 1•452-1•492 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Union - (notified under document C(2015) 3061) (europa.eu)
[85] https://www.gsma.com/spectrum/wp-content/uploads/2015/10/1-4-1-5GHz-L-band-for-IMT-OCTOBER-2015.pdf
[86] https://www.gsma.com/spectrum/wp-content/uploads/2019/10/L-band-for-mobile-broadband_web.pdf

The Radio Frequency Migration Plan 2013[87] stated that a feasibility study may be conducted for this band after WRC-15.

According to the Radio Frequency Migration Plan 2019, the 1452 - 1492 MHz band is allocated to T-DAB[88] and S-DAB[89] due to the South African allocation of the band to broadcasting and broadcasting-satellite. While Worldspace was licenced within the band to use it for digital audio broadcasting (terrestrial and space), it does not appear as though this firm is operational.[90] Further, the DAB+ allocation in the VHF band (from 214-230 MHz) is sufficient to meet the requirements of T-DAB. This means that receivers will only need to use one band instead of two which should result in lower equipment costs. In addition, the Authority documented in the 2019 Roadmap that the potential of S-DAB in South Africa is very limited.

Therefore, in the 2019 Radio Frequency Migration plan, the Authority proposed the following:

1. "Modify the allocation in this band and align it with the ITU Region 1 to include FIXED, MOBILE except aeronautical mobile, BROADCASTING and BROADCASTING SATELLITE.
2. Consider developments and outcome of WP5D (i.e., sharing and compatibility studies and the development of a channelling plan).
3. Allocate this band to PTP/ PMP/BFWA depending upon the availability of equipment. Communal/ private repeaters could also operate in this band.
4. Consider the band for Public Mobile and Emergency and Temporary transmissions"

From the above list, the Authority has implemented the Items 1 and 2. This feasibility is taking due consideration of Items 3 and 4.

Post this feasibility study, the Radio Frequency Spectrum Assignment Plan will be developed in line with the study results conducted within ITU-R WP 5D as well as in accordance with the latest version of Recommendation 1036[91] in respect of L-Band. The Authority will also take into consideration relevant compatibility studies for potential applications within the band. Indeed, the IMT Roadmap of 2019[92] indicated studies called for in Resolution 761 (WRC-15) on the Compatibility of IMT and broadcasting-satellite services. This is to realise appropriate regulatory and technical studies, with a view to ensuring the compatibility of IMT and BSS (sound) are undertaken within the ITU-R Res. 223 (Rev.WRC-15).

[87] Radio Frequency Migration Plan, Government Gazette number 36334, 3 April 2013
[88] Terrestrial Digital Audio Broadcasting.
[89] Satellite Digital Audio Broadcasting.
[90] https://en.wikipedia.org/wiki/1worldspace
[91] Recommendation ITU-R M.1036-6 (10/2019), Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications in the bands identified for IMT in the Radio Regulations
[92] IMT Roadmap 2019, Government Gazette 42361 29 March 2019

3.5. Scenario plans

Given the improving IMT ecosystem for this band, the Authorities view is that IMT is emerging as the highest value use of the band.

3.6. Economic feasibility analysis and deployment costs

In this feasibility study, the scenario analysed is the implementation of IMT in this band. While there was, historically, a digital audio broadcaster using this band, this firm appears to have shut down, and the band is currently vacant. The value of this band for IMT applications has increased substantially over time, from USD 11 million in 2008 in the UK,[93] for example, to around USD 376- USD 527 million in Germany and Italy in 2015 (see Table 14 below), which reflects the growing use of the band for mobile broadband services. Furthermore, a 2015 report revealed that the economic benefits of utilising the 1452-1492 MHz band for IMT in Europe and Sub-Saharan Africa amounted to around USD13.05 billion and USD2.17 billion respectively (and USD 40 billion globally), using South Africa and Nigeria to model the benefits for Sub-Saharan Africa.[94] In addition, the lack of usage of the band means that IMT can be made available relatively quickly in South Africa.

Country	Date	Volume	Reservation price (USD million)	Auction price (USD million)
UK	2008	40		11.17
Germany	2015	40	171	375.81
Italy	2015	40		526.68

Table 14: Auction values in the 1452-1492 MHz spectrum band.[95]

In summary, it appears as though there are no T-DAB or S-DAB users of the 1452-1492 MHz band in South Africa, and the band is currently vacant. Given the auction values for this spectrum band in other countries, and estimates of the value of its use for IMT, the value of the band for IMT likely far exceeds T-DAB and S-DAB. It is therefore economically feasible for this band to be allocated to IMT services.

[93] In 2015, Ofcom varied the 1452 – 1492 MHz licence so it can be used for mobile or fixed communication network supplemental downlink (SDL) in the UK.

[94] Plum Consulting. October 2015. Global momentum and economic impact of the 1.4/1.5 GHz band for IMT. Available: https://www.gsma.com/spectrum/wp-content/uploads/2015/10/1-4-1-5GHz-L-band-for-IMT-October-2015.pdf

[95] Where applicable, USD values were calculated using a spot USD exchange rate: (USD/GBP = 1.34), (USD/EUR = 1.14). Figures are not inflation adjusted.

3.7. Summary proposals arriving out of feasibility study

The Authority proposes to proceed with a RFSAP for IMT in this band. However, the responses from Stakeholders to the September 2021 Inquiry Questionnaires (on category 1 and 2 bands) only showed one existing operator most interested in IMT identification for this band.

Stakeholders are encouraged to comment further on this assessment.

4. Annex 4: 2300 – 2450 MHz: implementation of the IMT roadmap 2014 and 2019

This feasibility study concerning the 2300–2450 MHz band is mandated by the Frequency Band Migration Regulation and Plan contained in the IMT Roadmap 2014[96] and IMT Roadmap 2019[97].

4.1. Introduction

The ICASA 2019 IMT Roadmap proposed to clear the 2300-2400 MHz band from incumbents use and allocate for IMT (Terrestrial) services. Further it proposes to continue to retain allocation of the band above 2400 i.e., 2400 – 2483.5 MHz for ISM. The Authority also proposed to carry out a feasibility study in this band. Due to the absence of a feasibility study, this band was later removed from the current first ICASA ITA awards process which now covers the 700 MHz, 800 MHz, 2600 MHz and 3500 MHz bands[98].

4.2. Status of ITU, SADC and South African National Frequency Allocation for the band

4.2.1. Status of ITU Frequency Allocation for the band

Table 15 shows the ITU allocations for the 2300-2450 MHz band. The band is allocated for fixed and mobile services on a primary basis.

Region 1	Region 2	Region 3
2 300-2 450 FIXED MOBILE 5.384A Amateur Radiolocation 5.150 5.282 5.395	**2 300-2 450** FIXED MOBILE 5.384A RADIOLOCATION Amateur 5.150 5.282 5.393 5.394	

Table 15: ITU frequency allocations for 2300-2450 MHz band

[96] Final (Draft) IMT Roadmap 2014, Government Gazette Vol. 593 Pretoria, 14 November 2014 No. 38213
[97] Final (Draft) IMT Roadmap 2019, Government Gazette Vol. 645, 29 March 2019 No. 42361
[98] Government Gazette Staatskoerant REPUBLIC OF SOUTH AFRICA REPUBLIEK VAN SUID AFRIKA Vol. 664 2 October Oktober 2020 No. 43768

4.2.2. Status of SADC Frequency Allocation for the band

Table 16 shows the SADC Radio Frequency Spectrum Allocation Plan[99].

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
2 300-2 450 MHz FIXED MOBILE 5.384A Amateur Radiolocation 5.150 5.282 5.395	**2 300-2 450 MHz** FIXED MOBILE 5.384A Amateur Radiolocation 5.150 5.282	2300-2400 MHz Fixed links PTP/PTMP IMT (TDD) BFWA	Fixed paired with 2400-2500 MHz. IMT Radio Frequency Channel arrangement according to ITU-R M.1036
2 450-2 483.5 MHz FIXED MOBILE Radiolocation 5.150 5.397	**2 450-2 483.5 MHz** FIXED MOBILE Radiolocation 5.150 5.397	2400-2500 MHz Fixed links PTP/PTMP The band 2 400-2 500 MHz is designated for ISM applications (5.150). SRD applications (2 400-2 483.5 MHz)	FS paired with 2300-2400 MHz. The band 2483.5-2500 MHz is identified for satellite component of IMT; Res.225 applies. Common international SRD band; see ITU-R Rec.SM.2153

Table 16 SADC Radio Frequency Spectrum Allocation Plan 2 300 – 2 450 MHz[100]

4.2.3. Status of National Frequency Plan for South Africa.

Table 17 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
2 300-2 450 MHz FIXED MOBILE 5.384A	**2 300-2 450 MHz** FIXED MOBILE 5.384A NF9	IMT2300 TDD (2300 – 2400 MHz) WLAN, FDDA and model ctrl. (2400 – 2483.5 MHz)	International Mobile Telecommunication Roadmap (GG No. 42829 Notice 600 of 2019) as amended.

[99] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

[100] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

Amateur Radiolocation 5.150 5.282 5.395	Amateur Radiolocation Amateur-satellite 5.150 5.282 5.395	Non-Specific SRDs and low power video surveillance (2400 – 2483.5 MHz) RFID (2 400 – 2 483.5 MHz) ISM applications (2400 – 2483.5 MHz) Amateur-satellite (2400 – 2450 MHz)	Common international SRD band; see ITU-R Rec. SM.1896 latest version (above 2400 MHz) Radio Frequency Spectrum Assignment Plan (GG N. 38640) as amended 30 March 2015. Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015). Recommendation ITU-R M.1036 (International Mobile Telecommunications (IMT)) Radio Frequency Spectrum Assignment Plan to be amended to incorporate capabilities and requirements for IMT2020. Final Frequency Migration Plan 2019 (GG No. 42337 Notice 36 of 2019)

Table 17: National Radio Frequency Plan for South Africa for 2300 - 2450 MHz band[101]

According to the National Radio Frequency Plan 2021, the current South African allocations for this band are: fixed, mobile 5.384A NF9, amateur, radiolocation and amateur satellite. The typical applications being IMT2300 TDD (2300 – 2400 MHz), WLAN, FDDA and model ctrl. (2400 – 2483.5 MHz), Non-Specific SRDs and low power video surveillance (2400 – 2483.5 MHz), RFID (2 400 – 2 483.5 MHz), ISM applications (2400 – 2483.5 MHz) and Amateur satellite (2400 – 2450 MHz). This band is likely to be used for IMT-TDD.

The recommended frequency arrangements for implementation of IMT in the band 2300-2400 MHz are summarised in Figure 14.

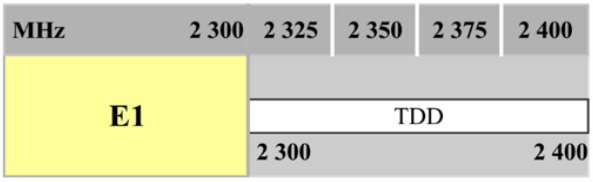


Figure 14: Frequency arrangements, 2300 – 2400 MHz[102]

[101] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

[102] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

4.3. International trends with country examples, standardisation status and maturity of the ecosystem

This band is extensively used for IMT in Asia and increasingly so too in Europe and in the other parts of the world. It is standardised within 3GPP as Band 40 and there is a matured ecosystem available.

LTE TDD Band	Number of devices
2300 MHz Band 40	5,921
2600 MHz Band 38	4,600
2600 MHz Band 41	4,568
1900 MHz Band 39	3,214
2000 MHz Band 34	484
3500 MHz Band 42	355
3700 MHz Band 43	260

Table 18 TDD LTE Ecosystem[103]

Table 18 provides the device availability for TDD bands. It shows that the 2300 MHz band shows the highest number of devices.

In India, Reliance Jio is carrying hundreds of millions of 4G subscribers in this band.

4.4. Current usage and constraints

The band was historically used for several services including[104]:

- Fixed links – 2307 – 2387 MHz paired with 2401 – 2481 MHz
- Outside broadcasting links (28 MHz) – primary basis at (2377, 2471 MHz), secondary basis at (2321, 2349 MHz, 2415, 2443 MHz).
- ISM – 2400 – 2483.5 MHz

As per SADC FAP and the NRFP proposed common sub-allocation/ utilization, it is proposed to:

- Allocate 2300 – 2400 MHz for IMT (Terrestrial).
- Continue to retain allocation of 2400 – 2483.5 MHz for ISM.
- Existing Fixed links could be migrated above 3 GHz.
- Migrate outside-broadcasting links in line with the DTT migration (potentially to 1518 – 1559 MHz band).

The Authority recognises that there are also some Government services operating in this band.

[103] https://uk5g.org/media/uploads/resource_files/GSA-LTE-Ecosystem-Status-July-2020.pdf
[104] Final Radio Frequency Migration Plan 2019, Government Gazette number. 42337, 29 March 2019

The IMT Roadmap 2014[105] states that:

> "IMT2300 is already in use for IMT TDD by Telkom et al including some regional operators. The band from 2380-2400 MHz was not used. IMT2300 TDD from 2360-2380 MHz (others) and 2380-2400 MHz is to be assigned with mutual alignment to the already assigned licences. In the case of different TDD configurations, a 5 MHz guard band has to be considered within the new assignment. A guard band of 5 MHz is not required between IMT2300 and the 2400 MHz ISM band. In case of interference, other Wi-Fi-channel settings might be selected appropriately. In the case of IMT2300, South Africa is to take into consideration, as appropriate, the relevant ITU-R report".

4.5. Scenario plans

Consistent with the Final Radio Frequency Migration Plan 2019 for this band, the Authority plans to:

- Allocate 2300 – 2400 MHz for IMT (Terrestrial) TDD abiding by ITU band arrangement E1 as shown in the Figure 14.
- Continue to retain allocation of 2400 – 2483.5 MHz for ISM.
- Existing Fixed links should be migrated above 3 GHz.
- Migrate outside-broadcasting links in line with the DTT migration (potentially to 1518 – 1559 MHz band).

4.6. Economic feasibility analysis

This band is currently used mainly for TDD LTE in South Africa, applying the band 40 LTE band plan (i.e., TDD). This is its highest-value use in South Africa, not least because this is the most popular LTE TDD band in the world, including as a result of its use by Reliance-JIO in India. The TDD use of the band permits greater benefits than FDD, since TDD allows for asymmetric downlink and uplink patterns, common in broadband Internet services. While FDD arrangements were useful historically for symmetric voice services, which require the same uplink and downlink capacity, typical consumer and business Internet use involves considerably greater downloads than uploads. TDD therefore results in more efficient use of spectrum. In addition, South Africa can benefit from the economies of scale arising from the large equipment and device ecosystem that has developed as a result of the use of TDD in the band by Reliance-Jio in India. There is therefore no justification for other band plans.

It is important to note that the potential benefits from IMT in this band are significantly higher than from other possible services such as fixed links etc. This

[105] Final International Mobile Telecommunications (IMT) Roadmap 2014, Government Gazette number 38213 (notice 1009 of 2014), November 2014.

is evident from the very high auction values for the band when used for IMT (see Table 19 below).

It is therefore economically feasible to use this band for IMT in South Africa, since this band is currently used for TDD-LTE, its most efficient use, and there are no plausible alternatives that might have a higher value use.

It should be noted that the usage of the "junk" 2400 MHz ISM band has turned out to be the most populated band on earth, with the highest overall value. It is therefore important to preserve and protect, and where feasible, extent the availability of ISM / licence-exempt bands in South Africa.[106]

Country	Date	Volume	Reservation price (USD million)	Auction price (USD million)
Denmark	2019	10	3	-
UK	2018	40	53.6	275.9
Nigeria	2013	30	23	23
Sweden	2020	80	17.6	44
Kyrgyzstan	2021	100	0.372	12.12

Table 19: Auction values in the 2300-2450 MHz spectrum band.[107]

4.7. Summary proposals from feasibility study

The Authority proposes to proceed with a RFSAP for IMT in this band.

[106] https://www.researchgate.net/publication/265260673_The_Economic_Significance_of_Licence-_Exempt_Spectrum_to_the_Future_of_the_Internet

[107] Where applicable, USD values were calculated using a spot USD exchange rate: (USD/DKK = 0.12), (USD/GBP = 1.34), (USD/SEK = 0.11), (USD/KGS = 0.012). Figures are not inflation adjusted.

5. Annex 5: 3300 - 3400 MHz band: implementation of the IMT roadmap 2014 and 2019

This feasibility study concerning the 3300–3400 MHz band is mandated by the Frequency Band Migration Regulation and Plan contained in the IMT Roadmap 2014[108] and IMT Roadmap 2019[109].

5.1. Introduction

This band is part of Agenda 1.2 of the forthcoming WRC 2023 conference. However, though it is not allocated for Mobile in the Region 1, South Africa along with twenty-two other African countries have a primary allocation for mobile since WRC 2019. This is confirmed in the World Radiocommunication Conference 2019 (WRC-19), Article 5, MOD 5.429A, additional allocation:

5.2. Status of ITU, SADC and South African National Frequency Allocation for the band

Table 20 shows the ITU allocations for the 3300-3400 MHz band. The band is currently allocated to Radiolocation services in Region 1.

Region 1	Region 2	Region 3
3 300-3 400 RADIOLOCATION 5.149 5.429 5.429A 5.429B 5.430	**3 300-3 400** RADIOLOCATION Amateur Fixed Mobile 5.149 5.429C 5.429D	**3 300-3 400** RADIOLOCATION Amateur 5.149 5.429 5.429E 5.429F

Table 20: ITU frequency allocations for 3300-3400 MHz band

Resolution 223 (WRC-15) calls for compatibility studies to assess the feasibility of co-channel sharing between IMT and radiolocation (including land, maritime and airborne radars) and adjacent band sharing between IMT operating in the 3300-3400 GHz band and Radiolocation systems deployed in the 3100-3300 GHz

[108] Final (Draft) IMT Roadmap 2014, Government Gazette Vol. 593 Pretoria, 14 November 2014 No. 38213
[109] Final (Draft) IMT Roadmap 2019, Government Gazette Vol. 645, 29 March 2019 No. 42361

band.[110] The channelling arrangement for 3300 – 3400 MHz is under study at the ITU-R Working Party 5D.[111]

5.2.1. Status of SADC Frequency Allocation for the band

Table 21 shows the SADC Radio Frequency Spectrum Allocation Plan[112].

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
3 300-3 400 MHz RADIOLOCATION 5.149 5.429 5.429A 5.429B 5.430	**3 300-3 400 MHz** RADIOLOCATION MOBILE except aeronautical mobile 5.149 5.429 5.429A 5.429B	IMT Res. 223 (Rev.WRC-19)	IMT Radio Frequency Channel arrangement according to ITU-R M.1036

Table 21 SADC Radio Frequency Spectrum Allocation Plan 3300 – 3400 MHz

5.2.2. Status of National Frequency Plan for South Africa

Table 22 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
3 300-3 400 MHz RADIOLOCATION	**3 300-3 400 MHz** RADIOLOCATION MOBILE except aeronautical mobile	Radio astronomy (CH Molecules) IMT Res. 223 (Rev.WRC-15)	See section 5 for coordination with radio astronomy Recommendation ITU-R M.1036-6 (International Mobile Telecommunications (IMT))

[110] ICASA. 2019. Final International Mobile Telecommunications Roadmap 2019. https://www.icasa.org.za/legislation-and-regulations/final-international-mobile-telecommunications-roadmap-2019

[111] ICASA. 2021. National Radio Frequency Plan 2021.

[112] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

5.149 5.429 5.429A 5.429B 5.430	5.149 5.429A 5.429B		Develop a RFSAP for the band

Table 22: National Radio Frequency Plan for South Africa for 3300-3400 MHz band[113]

Figure 15 shows the frequency arrangements for 3300 to 3600 MHz band.

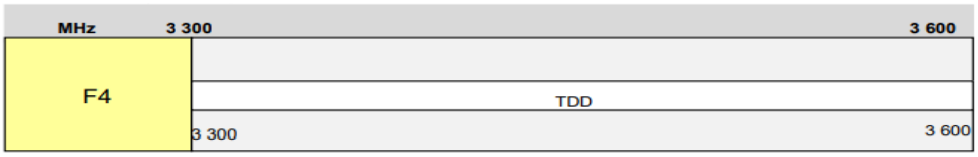


Figure 15: Frequency arrangements, 3300 – 3600 MHz[114]

5.3. International trends with country examples, standardisation status and maturity of the ecosystem

During WRC-19, 3300 to 3400 MHz band was allocated to, or upgraded to, mobile service in 36 countries worldwide. IMT identification was carried out in 33 Region 1 countries, 6 Region 2 countries and 6 Region 3 countries. Hence, the ecosystem has started developing rapidly despite it being discussed under the WRC-23 Agenda Item 1.2.

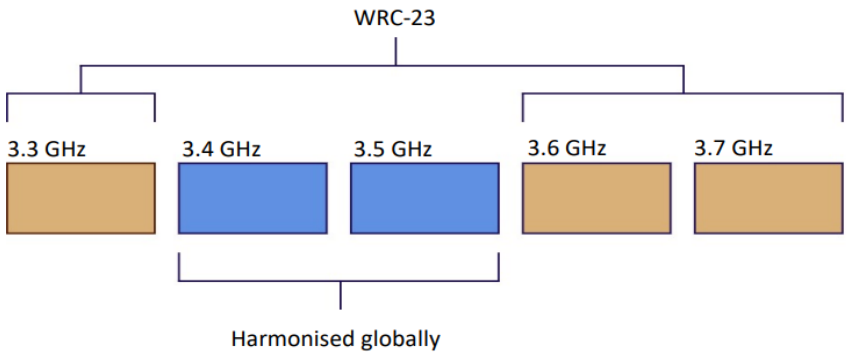


Figure 16 Current status of the mid band spectrum[115]

[113] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

[114] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

[115] ASEAN-Mid-band-mmWaves_21-Oct-2021.pdf (gsma.com)

3GPP has standardised this band as n77 (i.e., from 3300 to 4200 MHz). Figure 17 shows the deployment and device availability status of currently used 5G bands. From the device availability point this band has more than 500 devices, currently the 4th highest band for 5G devices. Together with n78, n77 is the band most widely used for 5G.

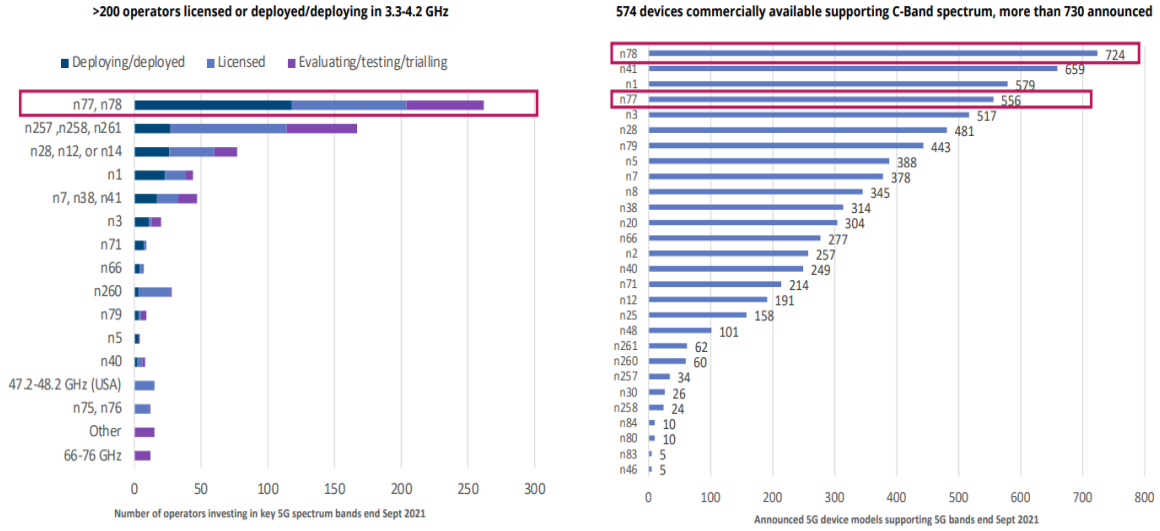


Figure 17: Deployment and device availability status of 5G bands[116]

The band is being used for IMT in a number of countries. For example, in Hong Kong, 100 MHz of spectrum in the 3300-3400 MHz band was allocated to mobile services (including 5G services) on a co-primary basis in addition to existing allocations for radiolocation. The mobile services there were restricted to indoor use only to avoid interference with the territory-wide radiolocation services being operated outdoors. When assessing the competing demands for this band the Hong Kong Communications Authority took into account the limited bandwidth in frequency bands below 6 GHz suitable for mobile use, potential 5G developments, and expected supply of 5G compliant equipment and devices supporting this band.[117]

Furthermore, there are 5G networks operating in China operating in the 3300-3400 MHz band, and there are plans to auction this spectrum in India. In addition, the African Telecommunications Union (ATU) and Inter-American Telecommunication Commission (CITEL) in Region 2 have indicated a preference

[116] *ibid*

[117] Ofca. 2018. Arrangements for Assignment of the Spectrum in the 3.3 GHz and 4.9 GHz Bands for the Provision of Public Mobile Services and the Related Spectrum Utilisation Fee. Available: https://www.coms-auth.hk/filemanager/en/content_711/cp20180828_e.pdf

to operate 5G services in the band.[118] These international developments mean that large numbers of consumers will soon have access to networks and devices in the 3300-3400 MHz band.

5.4. Current usage and constraints

According to the Radio Frequency Migration Plan 2019, this band had been primarily allocated for radiolocation purposes (such as for radar) in South Africa[119]. It should be noted that the 3300-3400 MHz band was first identified for IMT at WRC-15 through Resolution 223 (Rev WRC-15). This band can also now form a contiguous block of IMT spectrum ranging from 3300 to 3600 MHz. In this vein, South Africa has a couple of assignments already in this 3300-3600 MHz band. As of Q2 2019, Liquid had 56 MHz and Telkom had 28 MHz in this band.

The use of this frequency band shall be in accordance with Resolution 223 (Rev.WRC-19). The use of the frequency band 3300-3400 MHz by IMT stations in the mobile service shall not cause harmful interference to, or claim protection from, systems in the radiolocation service, and administrations wishing to implement IMT shall obtain the agreement of neighbouring countries to protect operations within the radiolocation service. This identification does not preclude the use of this frequency band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (WRC-19).[120]

Radiolocation services (e.g., radar) operating in the 3.3-3.4 GHz portion of the band are protected by the ITU Radio Regulations. Therefore, implementing IMT in 3.3-3.4 GHz must comply with limits and provisions set in footnotes 5.429B, 5.429D and 5.429F.[121] Results presented in this report[122] show clearly that mitigation techniques and measures are necessary for the coexistence of future deployment of IMT-Advanced systems with incumbent radar systems in these bands.

5.5. Scenario plans

The Radiolocation primary allocation is not the highest value use of this band. Due to the fact that there appears to be no Radiolocation services in the 3300 – 3400 MHz in South Africa currently, the logical step for the Authority is to carry out a feasibility study which precedes the development of a RFSAP for IMT in this band.

[118] Ministry of Business, Innovation and Employment. 2021. 3.3 GHz Regional & nonnational use in New Zealand. Discussion paper. Available: https://www.rsm.govt.nz/assets/Uploads/documents/consultations/2021-3-3ghz/3-3-ghz-consultation-document.pdf

[119] ICASA. 2019. Radio Frequency Migration Plan 2019.

[120] ITU. 2019. World Radiocommunication Conference 2019 (WRC-19)

[121] GSMA. 2017. Considerations for the 3.5 GHz IMT range: getting ready for use. Available: https://www.gsma.com/spectrum/wp-content/uploads/2017/06/Considerations-for-the-3.5-GHz-IMT-range-v2.pdf

[122] Report ITU-R M.2481-0 (09/2019)

5.6. Economic feasibility analysis

As noted in the examples above including Hong Kong and China who have already assigned the band to 5G operators, the highest value use of the band is almost certainly IMT. This is further evidenced in Table 23 which shows recent auction values in Hong Kong and the Dominican Republic.

Country	**Date**	**Volume**	**Auction price (USD million)**
Hong Kong	2019	100	86.45
Dominican Republic	2021	70	53,11

Table 23: Auction values in the 3300-3400 MHz spectrum band[123]

Therefore, it is highly likely that the band's highest value use will be for IMT in South Africa. It is therefore economically feasible to allocate the band for IMT, as IMT3500.

5.7. Summary proposals arriving out of feasibility study

The Authority proposes to proceed with a RFSAP for IMT in this band.

[123] Where applicable, USD values were calculated using a spot USD exchange rate: (USD/HKD = 0.13. Figures are not inflation adjusted.

6. Annex 6: 138 - 144 MHz band: Implementation of the Radio Frequency Migration Plan 2013 and 2019

This feasibility study concerning the 138-144 MHz band is mandated by the Radio Frequency Migration Plan 2019[124].

6.1. Introduction

This band is primarily used by Repeaters (Private, Communal) in several applications such as mining, farming and other small businesses along with SF alarms. In addition, there is an assignment for remote controlled industrial apparatus (ISM Licence exempt band 141 – 142).

The Final Radio Frequency Spectrum Assignment Plan published in Government Gazette Number 41512 (Notice 146 of 2018)[125] for 138-143.6 MHz clearly states the requirements for the utilisation of this band for:

1. Single frequency alarms
2. Other single frequency and dual frequency links
3. Remote control industrial apparatus

It goes on to state that a feasibility study will be conducted for the above three utilisation cases. The Radio Frequency Migration Plan 2019[126] states that a feasibility study will also be performed to establish the destination band for some of Transnet and Eskom's operations in other band.

6.2. Status of ITU, SADC and South African National Frequency Allocation for the band

6.2.1. Status of ITU Frequency Allocation for the band

Table 24 shows the ITU allocations for the 138-144 MHz band. This band is allocated for Aeronautical and space research services on a primary basis within Region 1.

[124] Final Radio Frequency Migration Plan 2019, Government Gazette Number. 42337, 29 MARCH 2019
[125] The Final Radio Frequency Spectrum Assignment Plan published in Government Gazette Number 41512
[126] Final Radio Frequency Migration Plan 2019, Government Gazette Number. 42337, 29 MARCH 2019

Region 1	Region 2	Region 3
138-143.6 AERONAUTICAL MOBILE (OR) 5.210 5.211 5.212 5.214	**138-143.6** FIXED MOBILE RADIOLOCATION Space research (space-to-Earth)	**138-143.6** FIXED MOBILE Space research (space-to-Earth) 5.207 5.213
143.6-143.65 AERONAUTICAL MOBILE (OR) SPACE RESEARCH (space-to-Earth) 5.211 5.212 5.214	**143.6-143.65** FIXED MOBILE RADIOLOCATION SPACE RESEARCH (space-to-Earth)	**143.6-143.65** FIXED MOBILE SPACE RESEARCH (space-to-Earth) 5.207 5.213
143.65-144 AERONAUTICAL MOBILE (OR) 5.210 5.211 5.212 5.214	**143.65-144** FIXED MOBILE RADIOLOCATION Space research (space-to-Earth)	**143.65-144** FIXED MOBILE Space research (space-to-Earth) 5.207 5.213

Table 24: ITU frequency allocations for 138-144 MHz band

6.2.2. Status of SADC Frequency Allocation for the band

Table 25 shows the SADC Radio Frequency Spectrum Allocation Plan[127].

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation
138-143.6 MHz AERONAUTICAL MOBILE (OR) 5.210 5.211 5.212 5.214	**138-143.6 MHz** MOBILE 5.211 5.212 5.214 SADC5	PMR and / or PAMR
143.6-143.65 MHz AERONAUTICAL MOBILE (OR) SPACE RESEARCH (space-to-Earth) 5.211 5.212 5.214	**143.6-143.65 MHz** MOBILE 5.211 5.212 5.214	PMR and/or PAMR
143.65-144 MHz AERONAUTICAL MOBILE (OR) 5.210 5.211 5.212 5.214	**143.65-144 MHz** MOBILE 5.211 5.212 5.214	PMR and/or PAMR

[127] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

Table 25: SADC Radio Frequency Spectrum Allocation Plan for 138-144 MHz band

6.2.3. Status of National Frequency Plan for South Africa

Table 26 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
138-143.6 MHz AERONAUTICAL MOBILE (OR) 5.210 5.211 5.212 5.214	**138-144 MHz** FIXED MOBILE	Single Frequency Alarms (140.5 – 141 MHz) Mobile 1 MTX (138 – 140.5 MHz) Single Frequency Mobile (141 – 141.5 MHz) Mobile 1 BTX (141.5 – 144 MHz) Remote control industrial apparatus (141 – 142 MHz) PMR and / or PAMR Mobile 1 BTX (141.5 – 144 MHz) PMR and / or PAMR	Paired with 141.5 - 144 MHz Paired with 138 – 140.5 MHz Radio Frequency Spectrum Regulations (Annex B) (GG. No. 38641, 30 March 2015). Paired with 138 – 140.5 MHz
143.6-143.65 MHz AERONAUTICAL MOBILE (OR) SPACE RESEARCH (space-to-Earth) 5.211 5.212 5.214			Allocation includes BTX assignments at 142.8 – 143.275 MHz and 143.325 - 143.975 MHz Radio Frequency Spectrum Assignment Plan GG 41512 Notice 146 of 2018 Final Frequency Migration Plan 2019 (GG No. 42337 Notice 36 of 2019)
143.65-144 MHz AERONAUTICAL MOBILE (OR) 5.210 5.211 5.212 5.214			

Table 26: National Radio Frequency Plan for South Africa for 138-144 MHz band[128]

[128] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

6.3. International trends with country examples, standardisation status and maturity of the ecosystem

In the EU the VHF 138 - 144 MHz band is typically channelized for double sideband amplitude modulation with 12.5 kHz steps – and typically used for military aeronautical use by NATO.

In the US[129],

> "the military services use the 138-144 MHz band to support air-to-ground, air-to-air, and air-ground-air (AGA) tactical communications; air traffic control operations; Land Mobile Radio (LMR) nets for sustaining base and installation infrastructure support; and for tactical training and test range support. The frequencies 143.75 and 143.90 MHz are used by the Civil Air Patrol for air rescue operations and to support Drug Enforcement Administration and the U.S. Customs Service operations along border areas. The Air Force Auxiliary, Coast Guard Auxiliary, and Military Affiliate Radio System (MARS) also use frequencies in this band in search and rescue and other emergency operations. An allocation plan was formulated by the Military Communications Electronics Board (MCEB) in 1971 which created 240 25-kHz channels within the 138-144 MHz band allotted to the Air Force, Army, and Navy. In the 138-144 MHz band there are 80 channels allotted to the Air Force, 70 to the Army, and 90 to the Navy. There is also some use of the interstitial channels by narrowband systems".

In addition,

> "the [US] Air Force has 3,371 frequency assignments in the 138-144 MHz band, used primarily for tactical air-to-air, air-to-ground, and non-tactical intra-base ground-to-ground communications. In general, all Air Force aircraft have the capability to communicate using the 138-144 MHz band with an estimated investment cost in airborne radios of $100 million. In addition, the Air Force estimates that they have approximately $123 million in LMR assets that operate in the 138-144 MHz band".
>
> The LMR usage in the 138-144 MHz band has a diverse range of applications. Below are 2 examples:
>
> 1. "[T]he Air Force Office of Special Investigations (AFOSI) which uses frequencies in the 138-144 MHz band for conducting investigative services for the DoD agencies. These services include but are not limited to: criminal investigations, counter-intelligence activities, anti-terrorism operations, protective services, and fraud investigations. In order to satisfy these mission operations, AFOSI utilizes an integrated system that combines LMR, surveillance

[129] https://www.ntia.doc.gov/files/ntia/publications/section3a.pdf

equipment, and **alarms systems** on the same frequencies providing the functional capability to conduct mission operations in a covert fashion. This integration design also provides cost savings benefits by consolidating equipment into condensed mobile packages. The AFOSI has an estimated investment of $7 million in equipment capable of operating in the 138-141 MHz frequency band".

2. "Various LMR networks at Robins AFB. Several individual LMR networks are used to satisfy typical base communication requirements: Security Police and Law Enforcement LMR network; Depot Maintenance LMR network; and the Defence Logistics Agency Supply LMR network. The **base fire alarm systems** also employ frequencies in the 138-141 MHz band. There is an estimated current investment of $2.5 million in LMR and fire alarm equipment at Robins AFB that is capable of operating in the 138-141 MHz frequency band. It is also anticipated that an additional $93,765 will be spent on modifications to the existing configurations".

The key summary from the preceding uses in the US and EU is that the highest value uses in these jurisdictions are Aeronautical and LMR services. There is also some use of the interstitial channels by narrowband systems. This means there is not much commercial-driven harmonisation activities in this band.

6.4. Current usage and constraints

This band is primarily used by repeaters (private/communal e.g., by Eskom) in several applications such as mining, farming and other small businesses along with single frequency (SF) alarms. In addition, there is an allocation for remote controlled industrial apparatus (Licence Exempt band 141-142)[130], and other single frequency and dual frequency links as well as remote control industrial apparatus.

Within South Africa, there has been a significant usage of alarms and this trend is expected to continue. With the expected growth, the current band allocations for SF alarms in 140.5-141 MHz and 152.05-152.55 MHz will be insufficient to meet the demand. Modern alarm systems are also more spectrally efficient, and if users migrate to such spectrally efficient systems, then it is expected that the current allocation could meet South Africa's current and future needs[131].

Therefore, only systems using digital technologies which have a higher spectral efficiency compared to the analogue systems will be issued with a licence.

[130] Radio Frequency Spectrum Regulations (Annex B) GG. No. 34172, 31 March 2011)

[131] Frequency Migration regulation and Frequency Migration Plan March 2013, STAATSKOERANT No 36334, 3 April 2013

The proposed utilisation for this band is to expand allocation for single frequency alarms to (140.5-141.5 MHz). No change is proposed for the Mobile 1 MTX-BTX pairing.

6.5. Scenario plans

The scenario being considered for this band is set out in the Authority's RFSAP for this band, explained in the Authority's 2018 RFSAP. The Authority indicated that this band is to be used for:

- Single frequency ('SF') alarms (such as those that warn people of an event such as intrusion or fire, as explained in the 2018 RFSAP).
- SF and dual frequency (DF) links used in private and communal radio repeaters, which boost and retransmit weak radio signals (as explained in the 2018 RFSAP). The 2019 IMT Roadmap documented that these repeaters are used for mining, farming and by other small businesses.
- Remote control industrial apparatus (as explained in the 2018 RFSAP).

6.6. Economic feasibility analysis and deployment costs

In the 2018 RFSAP for this band, the Authority required that SF mobile users migrate out of the band 141-141.5 MHz.[132] Similarly, activities involving remote controlled industrial apparatus using spectrum between 141-142 MHz were encouraged to migrate to an ISM band. At the same time, 141-141.5 MHz was to be allocated to SF alarms, in addition to the existing allocation between 140.5-141 MHz.

The Authority also indicated that 138-144 MHz might be a destination band for Eskom's UHF Repeaters in 407/417 MHz and for Transnet's locomotive radios.

There is therefore an expansion of the use of spectrum for SF alarm systems, Repeaters and possibly use by Eskom of this band, at the expense of SF mobiles. SF mobile users might include taxis or security companies using push to talk radios, and they may be using older, analogue technologies in 25 kHz channels that are not spectrally efficient. Migrating such users to digital technologies would therefore result in the more efficient use of spectrum.

In addition, the very high and increasing levels of criminal activity in South Africa indicate that using additional radio frequency spectrum for alarms is likely an economically feasible undertaking. For example, murder and armed robbery

[132] Government Gazette number 41512 (notice number 146 of 2018).

increased by 37% and 43% respectively in the eight years to March 2020.[133] As a result, there are now many more private security guards in South Africa than there are police men and women.[134] This indicates the significant extent to which private security is being used in South Africa, including for alarm system monitoring. This feasibility study concludes that the Authority's proposed uses of the band are feasible.

Current and potential users of the band are encouraged to provide further information on the optimal use of the band during the consultation process.

6.7. Summary proposals arriving out of feasibility study

In summary, the Authority confirms that this band would be used for:

- Single frequency ('SF') alarms (such as those that warn people of an event such as intrusion or fire, as explained in the 2018 RFSAP).
- SF and dual frequency links used in private and communal radio repeaters, which boost and retransmit weak radio signals (explained in the 2018 RFSAP). The 2019 IMT Roadmap documented that these repeaters are used for mining, farming and by other small businesses.
- Remote control industrial apparatus (explained in the 2018 RFSAP).

[133] Lizette Lancaster, June 2021, 'South Africa needs a murder reduction strategy', *Institute for Security Studies,* available at: https://issafrica.org/iss-today/south-africa-needs-a-murder-reduction-strategy

[134] BusinessTech, 16 November 2021, 'How many security guards vs police officers there are in South Africa – and why things are changing', available at: https://businesstech.co.za/news/lifestyle/538024/how-many-security-guards-vs-police-officers-there-are-in-south-africa-and-why-things-are-changing/

7. Annex 7: 156.8375 - 174 MHz: Implementation of the Radio Frequency Migration Plan 2013 and 2019

This feasibility study concerning the 156.875 - 174 MHz band is mandated by the 2013[135] and 2019[136] RF migration plans.

7.1. Introduction

As per the Government Gazette 36031, MTX-DF (165.55-167.5 MHz) and BTX-DF (172.05-174 MHz) were interchanged in this band[137]. The outcome of the consultation in 2012 recommended:

- Step 1: swapping MTX and BTX
- Step 2: conducting a feasibility study into simplex frequencies (FDMA or TDMA) with different channel spacing, including coexistence of multiple technologies, bandwidths etc. Depending on the outcome, the band would need to be re-planned (year 2 + after studies have been completed).
- Step 3: Develop RFSAP

This is consistent with the 2013[138] and 2019[139] RF migration plans.

7.2. Status of ITU, SADC and South African National Frequency Allocation for the band

7.2.1. Status of ITU Frequency Allocation for the band

Table 27 shows the ITU allocations for the 156.8375 - 174 MHz band. The band is currently allocated to fixed mobile and maritime mobile-satellite services in the Region 1.

[135] Frequency Migration regulation and Radio Frequency Migration Plan March 2013, Government Gazette No 36334, 3 April 2013
[136] ICASA. 2019. Radio Frequency Migration Plan 2019. Government Gazette No 42337, 29 March 2019
[137] https://www.gov.za/sites/default/files/gcis_document/201409/36031gen106440.pdf
[138] Frequency Migration regulation and Radio Frequency Migration Plan March 2013, Government Gazette No 36334, 3 April 2013
[139] ICASA. 2019. Radio Frequency Migration Plan 2019. Government Gazette No 42337, 29 March 2019

Region 1	Region 2	Region 3
156.8375-157.1875 FIXED MOBILE except aeronautical mobile 5.226	**156.8375-157.1875** FIXED MOBILE 5.226	
157.1875-157.3375 FIXED MOBILE except aeronautical mobile Maritime mobile-satellite 5.208A 5.208B 5.228AB 5.228AC 5.226	**157.1875-157.3375** FIXED MOBILE Maritime mobile-satellite 5.208A 5.208B 5.228AB 5.228AC 5.226	
157.3375-161.7875 FIXED MOBILE except aeronautical mobile 5.226	**157.3375-161.7875** FIXED MOBILE 5.226	
161.7875-161.9375 FIXED MOBILE except aeronautical mobile Maritime mobile-satellite 5.208A 5.208B 5.228AB 5.228AC 5.226	**161.7875-161.9375** FIXED MOBILE Maritime mobile-satellite 5.208A 5.208B 5.228AB 5.228AC 5.226	

161.9375-161.9625 FIXED MOBILE except aeronautical mobile Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226	**161.9375-161.9625** FIXED MOBILE Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226	
161.9625-161.9875 FIXED MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.228F 5.226 5.228A 5.228B	**161.9625-161.9875** AERONAUTICAL MOBILE (OR) MARITIME MOBILE MOBILE-SATELITE (Earth-to-space) 5.228C 5.228D	**161.9625-161.9875** MARITIME MOBILE Aeronautical mobile (OR) 5.228E Mobile-satellite (Earth-to-space) 5.228F 5.226
161.9875-162.0125 FIXED MOBILE except aeronautical mobile Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226 5.229	**161.9875-162.0125** FIXED MOBILE Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226	
162.0125-162.0375 FIXED MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.228F 5.226 5.228A 5.228B 5.229	**162.0125-162.0375** AERONAUTICAL MOBILE (OR) MARITIME MOBILE MOBILE-SATELITE (Earth-to-space) 5.228C 5.228D	**162.0125-162.0375** MARITIME MOBILE Aeronautical mobile (OR) 5.228E Mobile-satellite (Earth-to-space) 5.228F 5.226
162.0375-174 FIXED MOBILE except aeronautical mobile 5.226 5.229	**162.0375-174** FIXED MOBILE 5.226 5.230 5.231	

Table 27: ITU frequency allocations for 156.875 - 174 MHz band

7.2.2. Status of SADC Frequency Allocation for the band

Table 28 shows the SADC Radio Frequency Spectrum Allocation Plan[140].

[140] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

156.8375-157.1875 MHz FIXED MOBILE except aeronautical mobile 5.226	**156.8375-157.1875 MHz** FIXED MOBILE except aeronautical mobile 5.226	156.8375-157.45 MHz Maritime mobile communications (ship stations). Land mobile in areas remote from coast.	Paired with 161.5-162.0 MHz and single frequency applications; ITU RR Articles 31 and 52 and Appendix 18 applies
157.1875-157.3375 MHz FIXED MOBILE except aeronautical mobile Maritime mobile-satellite 5.208A 5.208B 5.228AB 5.228AC 5.226	**157.1875-157.3375 MHz** FIXED MOBILE except aeronautical mobile Maritime mobile-satellite MOD 5.208A 5.208B 5.228AB 5.228AC 5.226	157.450-160.6 MHz PMR and/or PAMR	
157.3375-161.7875 MHz FIXED MOBILE except aeronautical mobile 5.226	**157.3375-161.7875 MHz** FIXED MOBILE except aeronautical mobile 5.226	160.600-160.975 MHz Maritime mobile communications (Coast stations). Land mobile in areas remote from coast.	Paired with 156.025-156.350 MHz; ITU RR Articles 31 and 52 and Appendix 18 applies
161.7875-161.9375 MHz FIXED MOBILE except aeronautical mobile Maritime mobile-satellite 5.208A 5.208B 5.228AB 5.228AC 5.226	**161.7875-161.9375 MHz** FIXED MOBILE except aeronautical mobile Maritime mobile-satellite 5.208A 5.208B 5.228AB 5.228AC 5.226	160.975-161.475 MHz PMR and/or PAMR	Single frequency applications.
161.9375-161.9625 MHz FIXED	**161.9375-161.9625 MHz** FIXED		

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
MOBILE except aeronautical mobile Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226	MOBILE except aeronautical mobile Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226		
161.9625-161.9875 FIXED MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.228F 5.226 5.228A 5.228B	**161.9625-161.9875** FIXED MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.228F 5.226 5.228A 5.228B		
161.9875-162.0125 FIXED MOBILE except aeronautical mobile Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226 5.229	**161.9875-162.0125** FIXED MOBILE except aeronautical mobile Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226 5.229		
162.0125-162.0375 FIXED MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) ADD 5.F110 5.226 5.229 ADD 5.A110 ADD 5.B110	**162.0125-162.0375** FIXED MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) ADD 5.F110 5.226 5.229 ADD 5.A110 ADD 5.F110 ADD 5.B110		
162.0375-174 FIXED MOBILE except aeronautical mobile 5.226 5.229	**162.0375-174** FIXED MOBILE except aeronautical mobile 5.226 5.229 SADC7		

Table 28: SADC Radio Frequency Spectrum Allocation Plan

7.3. Status of National Frequency Plan for South Africa

Table 29 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments

156.8375-157.1875 MHz FIXED MOBILE -except aeronautical mobile 5.226	**156.8375-157.1875 MHz** FIXED MOBILE -except aeronautical mobile 5.226	Government Services 156.8375-157.45 MHz Maritime mobile communications (ship stations). Land mobile in areas remote from coast.	Paired with 161.5-162.0 MHz and single frequency applications; ITU RR Articles 31 and 52 and Appendix 18 apply
157.1875-157.3375 MHz FIXED MOBILE -except aeronautical mobile Maritime mobile-satellite 5.208A 5.208B 5.228AB 5.228AC 5.226	**157.1875-157.3375 MHz** FIXED MOBILE -except aeronautical mobile Maritime mobile-satellite (Earth-to-space) (non-GSO) Maritime mobile-satellite (space-to-Earth) (non-GSO) 5.228AB 5.228AC 5.208A 5.208B 5.226	Government Services	Resolution 739 (Rev.WRC-19) apply MSS and Maritime mobile-satellite shall protect RAS in line with 5.208A
157.3375-161.7875 MHz FIXED MOBILE -except aeronautical mobile 5.226	**157.3375-161.7875 MHz** FIXED MOBILE -except aeronautical mobile 5.226	Government Services (157.450-160.6 MHz) PMR and/or PAMR (160.600-160.975 MHz) Maritime mobile communications (Coast stations). Land mobile in areas remote from coast (160.975-161.475 MHz) PMR and/or PAMR (161.475-162.050 MHz)	Single frequency applications Paired with 156.025-156.350 MHz; Paired with 156.9-157.4 MHz; ITU RR Article 31 and Article 52 apply Appendix 18 apply.
161.7875-161.9375 MHz FIXED MOBILE -except aeronautical mobile Maritime mobile-satellite 5.208A 5.208B 5.228AB 5.228AC	**161.7875-161.9375 MHz** FIXED MOBILE -except aeronautical mobile Maritime mobile-satellite (Earth-to-space) (non-GSO) 5.228A 5.228B 5.228AB 5.228AC	Government Services (161.475-162.050 MHz) Maritime mobile communications (Coast stations)	ITU RR Article 31 and Article 52 Appendix 18 apply.

5.226	Maritime mobile-satellite (space-to-Earth) (non-GSO) 5.228A 5.228B 5.228AB 5.228AC 5.226	Land mobile in areas remote from coast Automatic Identification System (AIS) at 161.975 MHz, 162.025 MHz and 162.050-174 MHz PMR and/or PAMR	
161.9375 - 161.9625 MHz FIXED MOBILE except aeronautical mobile Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226	**161.9375 - 161.9625 MHz** FIXED MOBILE except aeronautical mobile NF4 Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226	Sonobuoy (161.875 – 173.875) Transmission of meteorological bulletins and notice to navigators Mobile 1 MTX-DF (161.475 – 165.0375 MHz) Single Frequency Mobile (160.45 – 161.475 MHz) Single Frequency Mobile (156.8375 – 156.875 MHz) Private Maritime MTX (157.45 – 157.95 MHz)	See Section 7 for details Paired with Mobile 1 BTX-DF (156.875 – 160.4375 MHz) Inland areas only Paired with 162.05 – 162.55 MHz
161.9625-161.9875 MHz FIXED MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.228F 5.226 5.228A 5.228B	**161.9625-161.9875 MHz** FIXED MOBILE except aeronautical mobile NF4 Mobile-satellite (Earth-to-space) 5.228F 5.226 5.228A 5.228B	Search and rescue (air to ground) Mobile 1 MTX-DF (161.475 – 165.0375 MHz) Reception of AIS emissions from stations in the mms	Search and rescue operations and other safety-related communications (air to ground) Paired with Mobile 1 BTX-DF (156.875 – 160.4375 MHz)
161.9875-162.0125 MHz FIXED MOBILE except aeronautical mobile Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226 5.229	**161.9875-162.0125 MHz** FIXED MOBILE except aeronautical mobile NF4 Maritime mobile-satellite (Earth-to-space) 5.228AA 5.226	Transmission of meteorological bulletins and notice to navigators Mobile 1 MTX-DF (161.475 – 165.0375 MHz)	See Section 7 for details Paired with Mobile 1 BTX-DF (156.875 – 160.4375 MHz)

162.0125-162.0375 MHz FIXED MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.228F 5.226 5.228A 5.228B 5.229	**162.0125-162.0375 MHz** FIXED MOBILE except aeronautical mobile NF4 Mobile-satellite (Earth-to-space) 5.228F 5.226 5.228A 5.228B	Mobile 1 MTX-DF (161.475 – 165.0375 MHz) Reception of AIS emissions from stations in the mms. Search and rescue (air to ground)	Paired with Mobile 1 BTX-DF (156.875 – 160.4375 MHz) Search and rescue operations and other safety-related communications (air to ground)
162.0375-174 MHz FIXED MOBILE except aeronautical mobile 5.226 5.229	**162.0375-174 MHz** FIXED MOBILE except aeronautical mobile NF4 5.226 NF5	Sonobuoy in maritime service Mobile 1 MTX-DF (161.475 – 165.0375 MHz) Mobile 2 MTX-DF (165.05 – 165.5375 MHz) Single Frequency Mobile (168.95 – 170.05 MHz) Mobile 3 MTX-DF (165.55 – 167.4875 MHz) Single Frequency Mobile (172 – 172.0375 MHz) Mobile 4 MTX-DF (167.5 – 168.9375 MHz) Meter Reading (169.4 – 169.475 MHz) Non-specific SRD's – Telecommand only (173.2125 – 173.2375 MHz) Non-specific SRDs (173.2375 – 173.2875 MHz) Wireless microphones and assistive listening devices (173.7 – 175.1 MHz)	Paired with Mobile 1 BTX-DF (156.875 – 160.4375 MHz) Paired with Mobile 2 BTX-DF (170.05 – 170.5375 MHz) Paired with Mobile 3 BTX-DF (172.05 – 173.9875 MHz) Paired with Mobile 4 BTX (170.55 – 171.9875 MHz) Radio Frequency Spectrum Regulations (Annex B) (GG. No. 38641, 30 March 2015). .

Table 29: National Radio Frequency Plan for South Africa for 156.8375 to 174 MHz band[141]

The band is allocation to the following services on a primary basis:

[141] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

- MARITIME MOBILE
- FIXED
- MOBILE - except aeronautical mobile

We note that in the following sub bands SA allocation has additional allocation to AERONAUTICAL MOBILE on a primary basis.

- 161.9625-161.9875 MHz ITU has only FIXED and MOBILE, but SA has FIXED, MOBILE except aeronautical mobile & MOBILE-SATELLITE
- 162.0125-162.0375 MHz ITU has FIXED & MOBILE except aeronautical mobile South Africa has FIXED, MOBILE except aeronautical, MOBILE-SATELLITE

7.4. International trends with country examples, standardisation status and maturity of the ecosystem

The Authority did not find much evidence of significant international trends in this band. Stakeholders should please comment on this assessment.

7.5. Current usage and constraints

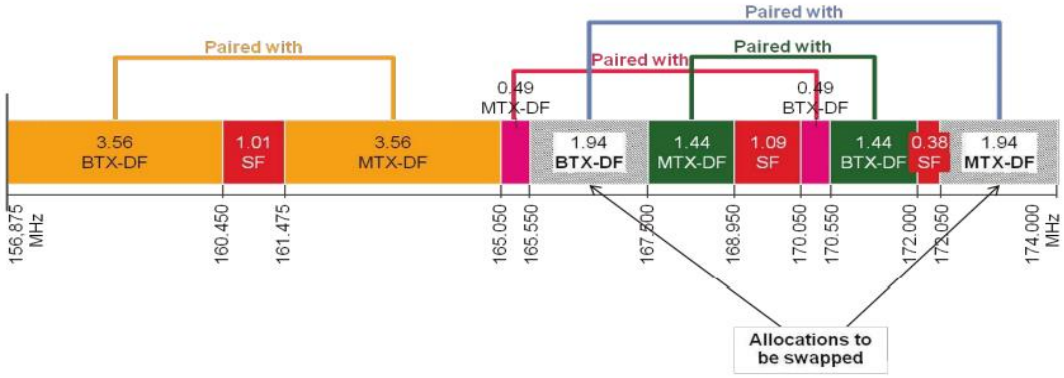


Figure 18: - The current usage in the band[142]

The purpose of the swapping of the 1.94 MHz wide BTX-DF and MTX-DF (shown in grey in Figure 18) is to optimise the usage of the band. From an engineering point of view, by aggregating the mobile frequencies (represented by MTX) in the centre of the band, interference between the four FDD pairs of frequencies may/would be minimised. This change was originally proposed in the 1997 SABRE-1.

The affected in-band users of this proposed swap are:

- Mobile 3 MTX-DF (165.55 –167.4875 MHz)

[142] ICASA. 2019. Radio Frequency Migration Plan 2019. Government Gazette, No. 42337, 29 March 2019

- Non-specific SRDs –Telecommand only (173.2125 –173.2375 MHz)
- Non-specific SRDs (173.2375 –173.2875 MHz)
- Wireless microphones and assistive listening device

The term "Short Range Device" (SRD) is intended to cover radio equipment which has a low capability to cause interference[143]. The use of SRD is usually covered by general / non-exclusive authorisations on a non-protected, non-interference basis. Wireless microphones and assistive listening devices used in this band are less likely to cause significant harmful interference to the adjacent band users as they are operated on a local basis with a low power transmission.

There is some maritime use of this band and the Authority will consider the necessary coordination arrangements during the RFSAP process for this band.

7.6. Scenario plans

There are implications of swapping include the disruption to the current users during the equipment swap. The MTX DF and BTX DF frequencies in this band that need to be swapped are very fragmented because it houses hundreds, indeed thousands, of small individual licensees. Therefore, the Authority acknowledges the risks of being able to effect this swap efficiently. This leads to two (2) scenarios:

- The swap may be desirable but not feasible;
- It may be feasible, but it would require significant stakeholder galvanisation on the part of the Authority with not a very high probability of success.

7.7. Economic feasibility analysis

The main challenge from an economic feasibility perspective pertaining to this band relates to the swap.

The large number of small users [involved in the swap] presents challenges in even raising their attention to such a potential change. Given the fragmented nature of the thousands of individual licensees that would be caught up in the swap process, the costs in terms of aggregating and galvanising them all, the time it would take and getting a full understanding of the age of the equipment operating in the band, etc. may make it very costly to realise the swap speedily and efficiently. There is likely to be much relatively new procured equipment in the band, and much research would need to be carried out to understand the age and locations of all equipment in order to decide the optimal length of the

[143] https://docdb.cept.org/download/25c41779-cd6e/Rec7003e.pdf

clearance and swap process. It may be disproportionate to licensees to proceed with this swap given they are likely to know very little about what it is all about.

Stakeholders are requested to provide any further information in this context to the Authority to assist in this matter relating to the swap.

7.8. Summary proposals arriving out of feasibility study

The Authority concludes that its thinking on this band at this stage is the following:

- The MTX DF and BTX DF swap shown in Figure 18 may be desirable but not very feasible;
- It may be feasible, but it would require significant stakeholder galvanisation on the part of the Authority with a likely low probability of success.

Stakeholders are requested to provide any further information in this context to the Authority to assist in this matter relating to the swap.

8. Annex 8: 335.4 - 380 MHz: Implementation of the Radio Frequency Migration Plan 2013 and 2019

This feasibility study concerning the 335.4-380 MHz band is mandated by the 2019 Radio Frequency Migration Plan[144].

8.1. Introduction

This band is currently allocated to fixed and mobile on a primary basis. The 2019 Radio Frequency Migration Plan proposed, as per SADC FAP, to migrate all fixed applications in the band to above 3 GHz, effectively leaving the band as a mobile band. This feasibility study concerns the above proposal.

8.2. Status of ITU, SADC and South African National Frequency Allocation for the band

Table 30 shows the ITU allocations for the 335.4-380 MHz band. The band is currently allocated to Fixed and Mobile services in Region 1.

Region 1	Region 2	Region 3
335.4-387	FIXED MOBILE 5.254	

Table 30: ITU frequency allocations for the 335.4-380 MHz band

8.3. Status of SADC Frequency Allocation for the band

Table 31 shows the SADC Radio Frequency Spectrum Allocation Plan[145].

[144] *ibid*

[145] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
335.4-387 MHz FIXED MOBILE 5.254	**335.4-387 MHz** FIXED MOBILE 5.254	335.4-336 MHz PMR and/or PAMR	
		336-346 MHz Fixed Wireless Access	PTP/PTMP rural system; Paired with 356-366 MHz
		346.0-356.0 MHz PMR and/or PAMR	
		356.0-366.0 MHz Fixed Wireless Access	PTP/PTMP rural system; Paired with 336 346 MHz
		366.0-380.0 MHz PMR and/or PAMR	
		380.0-387.0 MHz PPDR	Paired with 390.0-397.0 MHz To be used mainly for digital systems.

Table 31 SADC Radio Frequency Spectrum Allocation Plan for the 335.4-380 MHz band

8.4. Status of National Frequency Plan for South Africa

Table 32 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
335.4-387 MHz	335.4-387 MHz		
FIXED MOBILE	FIXED NF6	PTP/PTMP FWA (336 – 346 MHz) FWA (356 – 366 MHz) Government Services (366-380 MHz)	Paired with 356 – 366 MHz Paired with 336 – 346 MHz Paired with 390 – 397 MHz
	MOBILE NF7 Mobile-satellite	Digital Trunking (Emergency) (380 – 387 MHz) (PPDR[146]) PMR and/or PAMR (335.4-336 MHz) Unmanned Aerial Vehicle (UAV) (366.0-380.0 MHz)	(Coordination is required with PTP/PTMP in the implementation of UAV) Radio Frequency Spectrum Assignment Plan GG 41512 Notice 148 of 2018
5.254	5.254		

[146] http://www.crasa.org/common_up/crasa-setup/12-03-2015_GUIDELINES%20ON%20FREQUENCIES%20FOR%20PPDR%202014.pdf

387-390 MHz FIXED MOBILE Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.254 5.255	**387-390 MHz** FIXED MOBILE NF7 Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.254 5.255	Digital Trunking (387 – 390 MHz) (Govt.) PMR and/or PAMR	Paired with 397 – 399.9 MHz (To be used mainly for digital systems.) Radio Frequency Spectrum Assignment Plan GG 41512 Notice 148 of 2018 Final Frequency Migration Plan 2019 (GG No. 42337 Notice 36 of 2019)

Table 32: National Radio Frequency Plan for South Africa for 335.4 - 380 MHz band[147]

8.5. International trends with country examples, standardisation status and maturity of the ecosystem

Typically, in Europe and North America, the primary allocation is to the Mobile Service and with *Application* Defence Systems; or with *Application* GPR/WPR Ground Probing and Wall Probing Radars (ultra-wideband radars); or with *Application* Mobile Satellite Services. For example, in Europe this band is mainly used for defence services including radars: "there is no visibility as to whether it would be possible to release or share any of the military spectrum on a European basis as 240 –380 MHz is a core NATO band for command, control and communication links and 10 MHz has already been released for DAB. The frequency allocation in the UK has a similar status i.e., "responsibility for granting permissions to use frequencies in this Allocation rests with Defence. All frequency permissions are reserved exclusively for Defence use except where assignments for Civil use are agreed with Ofcom"[148]. Similar military usage is seen in the US[149].

Since military use is dominant in this band i.e., Europe and the Americas etc., the ecosystem availability for BFWA civil use is limited. There is also limited evidence of UAVs using this band too.

[147] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

[148] https://static.ofcom.org.uk/static/spectrum/fat.html

[149] https://www.ntia.doc.gov/files/ntia/publications/compendium/0335.40-0399.90_01MAR14.pdf

8.6. Current usage and constraints

The current usage/allocation is as follows:

- 335.4-336 MHz paired with 366.0-380.0 MHz for PMR and / or PAMR.
- 336-346 MHz paired with 356-366 MHz for Fixed Wireless Access/ PTP/PTMP rural system.

The Existing Allocation in as per the National Radio Frequency Plan 2018 (Applications)

- FIXED
  - FWA 336 – 346/356 – 366 MHz
  - Government use 366-380 MHz
  - Digital Trunking (Emergency) 335.4-336 MHz
  - PMR and/or PAMR
- MOBILE
  - 336-346 MHz Fixed Wireless Access
  - 336-346 Unmanned Aerial Vehicle (UAV)
  - 356.0-366.0 MHz Fixed Wireless Access
  - 366.0-380.0 MHz PMR and/or PAMR

There are 1362 licences issued in this band, mostly fixed links.

The 2019 Radio Frequency Migration Plan[150] suggests migrating existing fixed links to above 3 GHz as per SADC proposed common sub-allocation/ utilisation. It also suggests performing a feasibility study on the use of this band as per SADC FAP proposed sub-allocation/utilisation including BFWA and UAVs. The current players have shown indications that they may relinquish this spectrum due to spectrum fees imposed.

8.7. Scenario plans

The default scenario for this band is that of migrating fixed link users out of the band so that the band can be assigned for BFWA and UAVs, as prescribed in the 2019 Radio Frequency Migration Plan.

However, given little evidence of BFWA and UAV ecosystem emerging for this band *yet,* two scenarios emerge:

- Migrating all fixed links out as prescribed leaving the band available for licensing BFWA and UAVs (despite not much evidence of the BFWA/UAV ecosystems emerging for the band);
- Maintaining the *status quo* and taking a longer-term outlook watching brief (i.e. > 3 years) for the band.

[150] *ibid*

8.8. Economic feasibility analysis

This feasibility study has seen little BFWA and UAV ecosystem activity in this band as was anticipated in the 2013 Radio Frequency Migration Plan 2013[151]. In addition, the costs of migrating the fixed links (the bulk of the 1362 licences in the band) to much higher frequencies (> 3GHz) would almost certainly be problematic for current fixed links licensees. This is because of replacing long range low frequency links and shorter-range high frequency links.

Therefore, the Authority's current view is that this may result in a more inefficient use of this spectrum band, because the fixed links would be migrated out and yet no new BWA/UVA services are licensed in the band.

Stakeholders are requested to provide any information on the above analysis to the Authority.

8.9. Summary proposals arriving out of feasibility study

The Authority concludes that its thinking on this band at this stage is that there is a high risk of leading to a more inefficient use of this spectrum band if it proceeds with an exclusive assignment just for BFWA and UAVs. Stakeholders are requested to provide any information on the above analysis to the Authority.

[151] Government Gazette Number 36334 (Notice 352 and 353 of 2013)

9. Annex 9: 380 - 387 & 387 - 390 & 390 - 399.9 MHz band: Implementation of the Radio Frequency Migration Plan 2013 and 2019

This feasibility study concerning the 380 - 387 & 387 - 390 & 390 - 399.9 MHz band is mandated by the 2013[152] and 2019[153] Radio Frequency migration plans.

9.1. Introduction

The ICASA 2013 Radio Frequency Migration Plan proposed that all public safety services should be consolidated in the same radio frequency band (380-400 MHz). It also recommended that where possible public safety users adopt a common standard. The Authority anticipated likely utilisation/applications to include

1. For 380-387/390-397 for digital systems to be used for PPDR;
2. 387-390/397-399.9 MHz for PMR.

The 2013 RFMP also recommended conducting a feasibility study on the use of this band. The intention is to assign this band as a continuous block for public protection and disaster relief (PPDR) as well as public safety. This will result in all other users being migrated, making this a dedicated band for public safety.

The RFMP 2019 supports the above (i.e., assigning the band to PPDR as a continuous block) and recommends all other users will migrate out of this band. This assignment recognizes the importance of having a band dedicated for Public Safety and free of any other potential sources of interference. The Radio Frequency Spectrum Assignment Plan was published in GG No. 41512 (Notice 418 of 2018) dealing with the band 380 – 400 MHz.

9.2. Status of ITU, SADC and South African National Frequency Allocation for the band

Table 33 shows the ITU allocations for the 380 - 400 MHz band. The band is currently allocated to Fixed and Mobile services in all three Regions.

[152] Frequency Migration regulation and Radio Frequency Migration Plan March 2013, Government Gazette No 36334, 3 April 2013

[153] ICASA. 2019. Radio Frequency Migration Plan 2019. Government Gazette No 42337, 29 March 2019

Region 1	Region 2	Region 3
335.4-387	FIXED MOBILE 5.254	
387-390	FIXED MOBILE Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.254 5.255	
390-399.9	FIXED MOBILE 5.254	

Table 33: ITU frequency allocations for 380 - 400 MHz band

9.3. Status of SADC Frequency Allocation for the band

Table 34 shows the SADC Radio Frequency Spectrum Allocation Plan[154].

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
387-390 MHz FIXED MOBILE Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.254 5.255	**387-390 MHz** MOBILE Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.254 5.255 SADC10	387.0-390.0 MHz PMR and/or PAMR	Paired with 397.0-399.9 MHz To be used mainly for digital systems.
390-399.9 MHz FIXED MOBILE 5.254	**390-399.9 MHz** MOBILE 5.254 SADC10	390.0-397.0 MHz PPDR	Paired with 380.0-387.0 MHz To be used mainly for digital systems.
		397.0-399.9 MHz PMR and/or PAMR	Paired with 387.0-390.0 MHz To be used mainly for digital systems.

Table 34: SADC Radio Frequency Spectrum Allocation Plan for the 380 - 400 MHz band

9.4. Status of National Frequency Plan for South Africa

Table 35 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
335.4-387 MHz	**335.4-387 MHz**		

[154] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

FIXED MOBILE 5.254	FIXED NF6 MOBILE NF7 Mobile-satellite 5.254	PTP/PTMP FWA (336 – 346 MHz) FWA (356 – 366 MHz) Government Services (366-380 MHz) Digital Trunking (Emergency) (380 – 387 MHz) (PPDR[155]) PMR and/or PAMR (335.4-336 MHz) Unmanned Aerial Vehicle (UAV) (366.0-380.0 MHz)	Paired with 356 – 366 MHz Paired with 336 – 346 MHz Paired with 390 – 397 MHz (Coordination is required with PTP/PTMP in the implement of UAV) Radio Frequency Spectrum Assignment Plan GG 41512 Notice 148 of 2018
387-390 MHz FIXED MOBILE Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.254 5.255	**387-390 MHz** FIXED MOBILE NF7 Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.254 5.255	Digital Trunking (387 – 390 MHz) (Govt.) PMR and/or PAMR	Paired with 397 – 399.9 MHz (To be used mainly for digital systems.) Radio Frequency Spectrum Assignment Plan GG 41512 Notice 148 of 2018 Final Frequency Migration Plan 2019 (GG No. 42337 Notice 36 of 2019)
390-399.9 MHz FIXED MOBILE	**390-399.9 MHz** FIXED MOBILE NF7 Mobile-satellite	Digital Trunking Emergency) (390 – 397 MHz) (PPDR) Government Services Digital Trunking (397 – 399.9 MHz) (Govt.) PMR and/or PAMR	Paired with 380 – 387 MHz Paired with 387 – 390 MHz In accordance with Resolution 646 and Recommendation ITU-R M.2015-2 latest version.

[155] http://www.crasa.org/common_up/crasa-setup/12-03-2015_GUIDELINES%20ON%20FREQUENCIES%20FOR%20PPDR%202014.pdf

5.254	5.254		Radio Frequency Spectrum Assignment Plan GG 41512 Notice 148 of 2018 Final Frequency Migration Plan 2019 (GG No. 42337 Notice 36 of 2019)

Table 35: National Radio Frequency Plan for South Africa for 380 to 399.9 MHz band[156]

9.5. International trends with country examples, standardisation status and maturity of the ecosystem

As noted in the introduction, THE AUTHORITY intends that all PPDR services should be consolidated in this band and ideally to have a common standard. The current clear-cut standard for narrowband PPDR in this band is TETRA TDMA (and its evolutions). However, an emerging LTE standard is developing as covered below.

The following figures (Figure 19,20 and 21) show the potential use of this band across the world and in Africa[157]. There is a trend developing in this band for the LTE ecosystem. Some countries such as the US, Colombia and Uganda are consulting or conducting trials in the band for LTE.

However, there are legacy analogue PMR systems, DMR[158] and proprietary technologies that may continue to operate in this band.

[156] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

[157] https://450alliance.org/wp-content/uploads/2021/10/450Alliance-annual-device-update-P-rev-Final.pdf

[158] DMR = Digital Mobile Radio

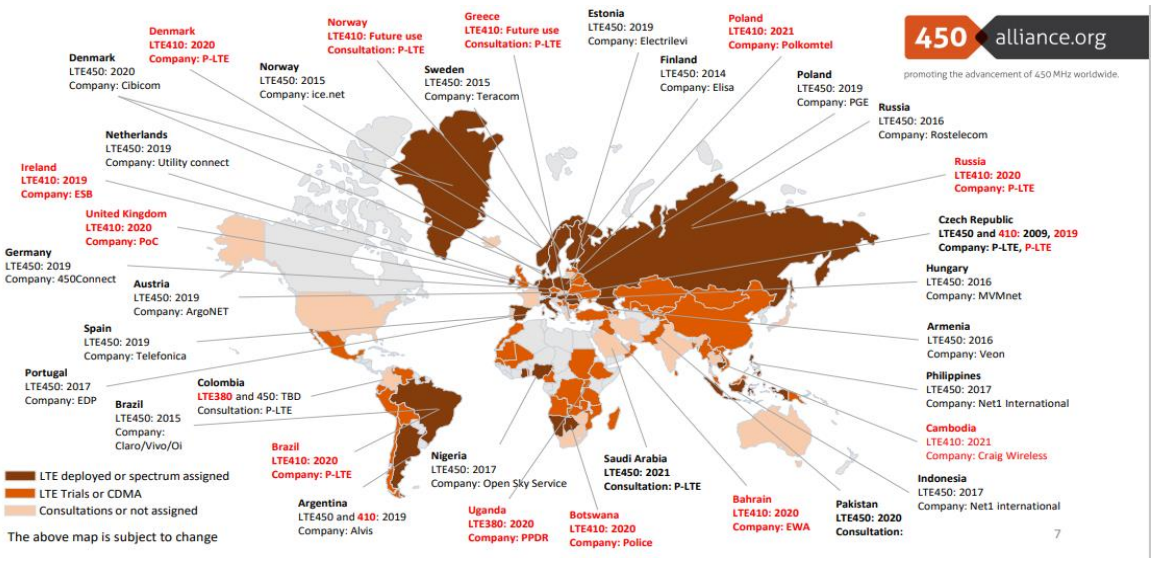


Figure 19: The world map of 380 MHz, 410 MHz and 450 MHz deployment[159]

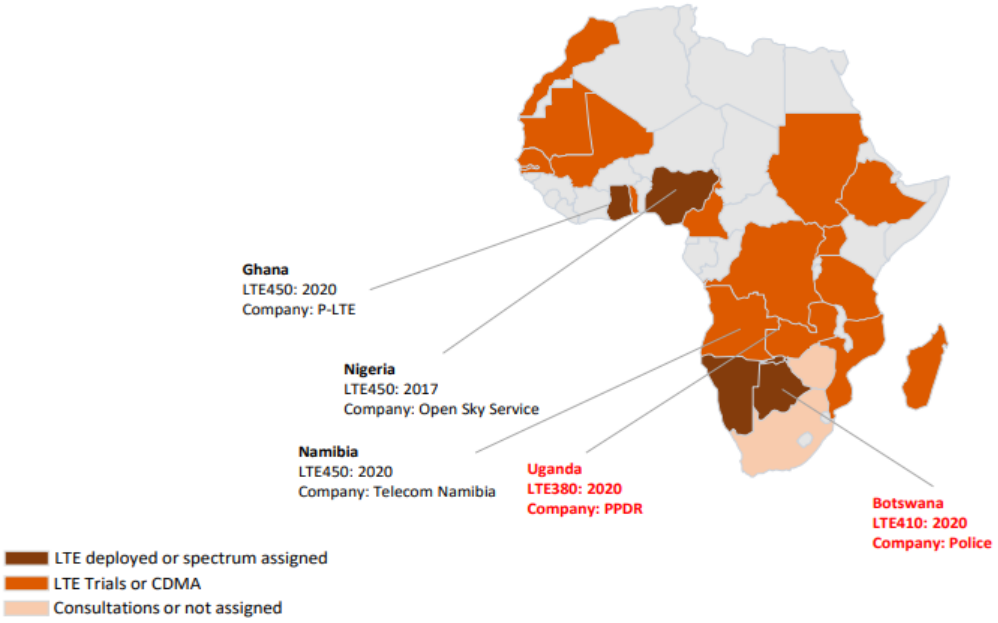


Figure 20: Africa map of 380 MHz, 410 MHz and 450 MHz deployment[160]

[159] 450 Alliance, https://450alliance.org/
[160] *ibid*

Figure 21: LTE380 map[161]

Global trends indicate that this band is considered for PPDR services. The Authority recommends South Africa to follow this trend to benefit from economies of scale.

9.6. Current usage and constraints

The ICASA 2013 Radio Frequency Migration Plan proposes that all public safety services should be consolidated in the same radio frequency band (380-400 MHz). It also recommended that (where possible) public safety users adopt a common standard. Proposed utilisation/application includes 380-387/390-397 for digital systems to be used for PPDR and 387-390/397-399.9 MHz for PMR. The 2013 RFMP also recommended conducting a feasibility study on the use of this band. The intention is to assign this band as a continuous block for public protection and disaster relief (PPDR) as well as public safety. Users include Metro Police, Fire-Fighting services, Ambulance Services and other Government Services.[162] This will result in all other users being migrated, making this a dedicated band for public safety.

As per the 2013 RFMP, a RFSAP will be developed with consideration to:

- 380-387/390-397 for PPDR
- 387-390/397-399.9 PMR
- The band be exclusively reserved for public safety and all relevant users (e.g., Government Services etc.) migrate into this band
- The adaption of a common digital trunking technology standard to allow:

[161] 450 Alliance, https://450alliance.org/
[162] ICASA. 2019. Radio Frequency Migration Plan 2019.

- Economic savings by operating and sharing a single network infrastructure
- Improving effectiveness and promoting interoperability

The RFMP 2019 supports the above (i.e., assigning the band to PPDR as a continuous block) and recommends all other users will migrate out of this band. This assignment recognizes the importance of having a band dedicated for Public Safety and free of any other potential sources of interference. In ideal circumstances these users could make use of a common digital public trunking network which could also promote interoperability between such users in periods of emergency.

9.7. Scenario plans

The Authority continues to plan the consolidation of PPDR services in this band and ideally using a common standard.

9.8. Economic feasibility analysis

The 2019 Radio Frequency Migration Plan states "this band will be assigned as a continuous block for Public Protection and Disaster Relief (PPDR) as well as Public Safety with users including Government Services, the Ambulance Service, Metro Police and Fire-Fighting Services". Implementing the Authority's plan will result in all other users being migrated, making this a dedicated band for public safety.

Costs: Migration of the Government Services into the 380-400 MHz band, from the 406-410/416-420 MHz and 413-416/423-426 MHz, bands started in 2010 at an estimated cost of R1 billion.[163] Given the delay, the Authority expects total costs of migration to be greater than the initial cost estimate. Their migration to TETRA in 380-387/390-397 MHz will leave 2 x 3 MHz available in the 380-400 MHz band for other public safety services.[164] The costs of migration for the other public safety services will in part depend on whether the equipment currently used is obsolete. While the costs of deployment in this band are significant, upgrading specific Government Services networks to digital is an activity that would have to take place regardless of the target band.

Benefits: Dedicating this band for public safety and adopting common standards can lead to benefits including infrastructure sharing, interoperability between users[165], and economies of scale in network equipment and devices. This will allow for more efficient use of the band.

[163] ICASA. 2014. International Mobile Telecommunications (IMT) Roadmap 2014.
[164] ICASA. 2019. International Mobile Telecommunications (IMT) Roadmap 2019.
[165] ICASA. 2013. Frequency Migration Regulation and Frequency Migration Plan.

Summary: The benefits of implementing the Authority's plan for the band therefore outweigh the costs of doing so. Stakeholders are requested to provide any information on the costs and benefits of using this band for alternative uses.

9.9. Summary proposals arriving out of feasibility study

The Authority proposes to proceed with a RFSAP for PPDR services in this band.

10. Annex 10: 406.1-410 MHz band: Implementation of the Radio Frequency Migration Plan 2013 and 2019

This feasibility study concerning the 406.1 - 410 MHz band is mandated by the 2013[166] and 2019[167] Radio Frequency migration plans.

10.1. Introduction

This band has co-primary allocations for Fixed, Mobile (except for aeronautical mobile) and Radio astronomy services. This band is likely to be used for PMR (like in parts of Europe), fixed trunking (like in the USA) or Radio Astronomy (like in Europe).

10.2. Status of ITU, SADC and South African National Frequency Allocation for the band

Table 36 shows the ITU allocations for the 406.1-410 MHz band. The band is currently allocated to Fixed, Mobile and Radio Astronomy services in Region 1.

Region 1	Region 2	Region 3
406.1-410	FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY 5.149 5.265	

Table 36: ITU frequency allocations for 406.1-410 MHz band

10.2.1. Status of SADC Frequency Allocation for the band

Table 37 shows the SADC Radio Frequency Spectrum Allocation Plan[168].

[166] Frequency Migration regulation and Radio Frequency Migration Plan March 2013, Government Gazette No 36334, 3 April 2013

[167] ICASA. 2019. Radio Frequency Migration Plan 2019. Government Gazette No 42337, 29 March 2019

[168] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
406.1-410 MHz FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY 5.149 5.265	**406.1-410 MHz** MOBILE except aeronautical mobile RADIO ASTRONOMY 5.149 5.265	PMR and/or PAMR PPDR	The use of this band for PPDR to be studied.

Table 37: SADC Radio Frequency Spectrum Allocation Plan for the 406.1-410 MHz band

10.2.2. Status of National Frequency Plan for South Africa

Table 38 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
406.1-410 MHz FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY 5.149 5.265	**406.1-410 MHz** FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY 5.149 5.265	Fixed Links (406.1 – 407.625 MHz) Mobile MTX (407.625 – 410 MHz) Government uses for public safety PMR and/or PAMR PPDR Radio Astronomy (continuum observations)	Paired with 416.1 – 417.625 MHz Paired with BTX (417.625 – 420 MHz) The use of this band for PPDR to be studied. See section 5 for coordination with radio astronomy.

Table 38: National Radio Frequency Plan for South Africa for 406.1 to 410 MHz band[169]

10.3. International trends with country examples, standardisation status and maturity of the ecosystem

A typical mobile use of this frequency band 406.1-410 MHz is simplex communication mode. Radio communication networks are mostly active where

[169] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

only portable and mobile radio stations are used for voice communication. They are mostly operated in private mode (i.e., PMR)[170].

In Europe, land mobile systems operating in this frequency band are mainly, but not exclusively, PMR/PAMR (Private (Professional) Mobile Radio / Public Access Mobile Radio) applications[171].

In the USA[172], this band is used by Federal agencies primarily for conventional and trunked land mobile radio communication systems. Radio astronomy continuum observations are also performed in this band.

In summary the Authority sees all co-primary services are in operation (subject to coordination) in different parts of the world. In South Africa this would or should be no different.

10.4. Current usage and constraints

The RFMP 2019 suggests the following existing Allocation in NRFP 2018 (note applications) include[173]:

- MOBILE-SATELLITE
  - (Earth-to-space) (406 – 406.1 MHz)
  - (COSPAS – SARSAT[174]: Emergency Position Indicating Radio Beacon (EPIRB)
  - Low power satellite EPIRBs (distress and safety purposes))
  - (Mobile MTX (407.625 – 410 MHz).
  - Government Use for Public Safety)
- FIXED & Mobile except aeronautical mobile
- RADIO ASTRONOMY (406.1 – 410 MHz)
  - (Mobile MTX (407.625 – 410 MHz)
  - Government use for public safety Fixed Links (406.1 – 407.625 MHz)
  - Fixed Links (407.625 – 410 MHz)
  - Mobile MTX (406.1 – 407.625 MHz)
  - Mobile MTX (407.625 – 410 MHz)
  - PMR and/or PAMR PPDR)

We note the following constraints in the band:

[170] Private mobile communications | VAS Elektroniskie sakari (vases.lv)
[171] ECC Decision (19)02, Land mobile systems in the frequency ranges 68-87.5 MHz, 146-174 MHz, 406.1-410 MHz, 410-430 MHz, 440-450 MHz and 450-470 MHz Approved 8 March 2019, https://ens.dk/sites/ens.dk/files/Tele/bilag_4_-_ecc_beslutning_1902_1.pdf
[172] https://www.ntia.doc.gov/files/ntia/publications/compendium/0406.10-0410.00_01MAR14.pdf
[173] ICASA. 2019. Radio Frequency Migration Plan 2019
[174] International Cospas-Sarsat Programme - International COSPAS-SARSAT

Frequency Band (MHz)	WRC	Res. / Rec.	Footnote	Resolution/ Footnote
406.1-410 MHz	15	205	5.265	17. Protection of the systems operating in the mobile satellite service in the frequency band 406-406.1 MHz

Table 39: Current constraints in this band[175]

We noted two constraints in this band:

- Footnote 5.149 of the Radio Regulations urges administrations to take all practicable steps to protect the radio astronomy service from harmful interference.
- The WRC 15 Resolution 205 footnote 5.265[176] requires protection of the systems operating in the mobile satellite service needed in the frequency band.

10.5. Scenario plans

This band has co-primary allocations for Fixed, Mobile (except for aeronautical mobile) and Radio astronomy services. This band is likely to be used for PMR (like in parts of Europe), fixed trunking (like in the USA) or Radio Astronomy (like in Europe). South Africa has a strong interest in Radio astronomy. As per the regulations, the protection of radio astronomy services needs to be maintained. Any analogue PMR or analogue mobile should migrate to digital services to make more efficient use of spectrum.

Exclusion/quiet zones would need to be maintained around the Radio Astronomy sites e.g., the Square Kilometre Array[177] in South Africa. Further, PMR use (under mobile allocation) and fixed use must be coordinated to minimise any interference.

10.6. Economic feasibility analysis

Outside the quiet radio astronomy zones, the operation of private digital mobile radio (PMR) in coordination with fixed services collectively offers the most efficient use of this band in South Africa.

Stakeholders are requested to provide any information on the costs and benefits of using this band for alternative uses.

[175] ICASA. 2019. Radio Frequency Migration Plan 2019

[176] ICASA. 2019. Radio Frequency Migration Plan 2019 and Frequency Migration Regulation and Frequency Migration Plan 2013.

[177] Welcome - SKA South Africa (skatelescope.org)

10.7. Summary proposals arriving out of feasibility study

The Authority plans the use of digital mobile radio and fixed services operate in this band along with radio astronomy service.

11. Annex 11: 410 - 420 & 420 - 430 MHz band: Implementation of the Radio Frequency Migration Plan 2013 and 2019

This feasibility study concerning the 410-430 MHz band is mandated by the 2013[178] and 2019[179] Radio Frequency migration plans.

11.1. Introduction

The Authority proposed in the RFMP 2013 and RFMP 2019 exclusive allocation for trunking services. However, the LTE ecosystem for PPDR services in this band is evolving. In light of these emerging trends, the Authority intends to make the band available for other potential emerging applications such as broadband PPDR and IoT, in addition to digital public trunking. The authority proposes that all other services migrate out of the band[180].

11.2. Status of ITU, SADC and South African National Frequency Allocation for the band

Table 40 shows the ITU allocations for the 410-430 MHz band. The band is currently allocated to Fixed, Mobile and Space Research (part of the band) services in Region 1.

Region 1	Region 2	Region 3
410-420	FIXED MOBILE except aeronautical mobile SPACE RESEARCH (space-to-space) 5.268	
420-430	FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271	

Table 40: ITU frequency allocations for the 410-430 MHz band

11.2.1. Status of SADC Frequency Allocation for the band

Table 41 shows the SADC Radio Frequency Spectrum Allocation Plan[181].

[178] Frequency Migration regulation and Radio Frequency Migration Plan March 2013, Government Gazette No 36334, 3 April 2013
[179] ICASA. 2019. Radio Frequency Migration Plan 2019. Government Gazette No 42337, 29 March 2019
[180] ICASA. 2013. Frequency Migration Regulation and Frequency Migration Plan.
[181] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
410-420 MHz FIXED MOBILE except aeronautical mobile SPACE RESEARCH (space-to-space) 5.268 5.268	**410-420 MHz** MOBILE except aeronautical mobile SADC11	PMR and/or PAMR PPDR	The use of this band for PPDR to be studied.
420-430 MHz FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271	**420-430 MHz** MOBILE except aeronautical mobile SADC11	PMR and/or PAMR PPDR	The use of this band for PPDR to be studied.

Table 41: SADC Radio Frequency Spectrum Allocation Plan for the 410-430 MHz band

11.2.2. Status of National Frequency Plan for South Africa

The WRC 15 Resolution 205 footnote 5.265[182] requires protection of the systems operating in the mobile satellite service needing the frequency band.

Table 42 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
410-420 MHz FIXED MOBILE except aeronautical mobile	410-420 MHz FIXED MOBILE except aeronautical mobile	Government Services Mobile MTX (410 – 413 MHz) Mobile Data MTX (413-413.7625 MHz) Digital Trunking MTX (413.7625 – 416.1 MHz)	Paired with BTX (420 – 423 MHz) (Government Services) Paired with BTX (423-423.7625 MHz) Paired with 423.7625 – 426.1 MHz Paired with MTX (406.1 – 407.625 MHz)

files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

[182] ICASA. 2019. Radio Frequency Migration Plan 2019 and Frequency Migration Regulation and Frequency Migration Plan 2013.

SPACE RESEARCH (space-to-space) 5.268	SPACE RESEARCH (space-to-space) 5.268	Mobile BTX (416.1 – 417.625 MHz) PMR and/or PAMR PPDR Communication links with an orbiting, manned space vehicle	The use of this band for PPDR to be studied. Final Frequency Migration Plan 2019 (GG No. 42337 Notice 36 of 2019)
420-430 MHz FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271	420-430 MHz FIXED MOBILE except aeronautical mobile Radiolocation	Single Frequency Links (426.1 – 430 MHz) Digital Trunked Mobile BTX (420 – 423 MHz) Mobile Data BTX (423 – 423.7625 MHz) Digital Trunking BTX (423.7625 – 426.1 MHz) PMR and/or PAMR PPDR	Frequencies will only be assigned for SF links where migration above 1 GHz would be impractical Paired with 410 - 413 MHz (Government use) Paired with MTX (413 – 413.7625 MHz) Paired with MTX (413.7626 – 416.1 MHz) The use of this band for PPDR to be studied. Final Frequency Migration Plan 2019 (GG No. 42337 Notice 36 of 2019)

Table 42: National Radio Frequency Plan for South Africa for 410 to 430 MHz band[183]

11.3. International trends with country examples, standardisation status and maturity of the ecosystem

In Europe, land mobile systems operating in this frequency band are mainly, but not exclusively, PMR/PAMR (Private (Professional) Mobile Radio / Public Access Mobile Radio) applications[184].

Land mobile systems in these frequency bands are mainly, but not exclusively, used for PMR/PAMR (Private (Professional) Mobile Radio / Public Access Mobile

[183] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

[184] ECC Decision (19)02, Land mobile systems in the frequency ranges 68-87.5 MHz, 146-174 MHz, 406.1-410 MHz, 410-430 MHz, 440-450 MHz and 450-470 MHz Approved 8 March 2019, https://ens.dk/sites/ens.dk/files/Tele/bilag_4_-_ecc_beslutning_1902_1.pdf

Radio) applications. For the frequency ranges 410-430 MHz and 450-470 MHz, this ECC Decision also includes harmonised technical conditions to be applied for land mobile systems with channel bandwidth of 1.4 MHz, 3 MHz or 5 MHz

Figures 22 and 23 below show the emerging global trends for 410-430 MHz band (and other bands used for PPDR services). In Africa, Botswana assigned this band for the PPDR use by the police services.

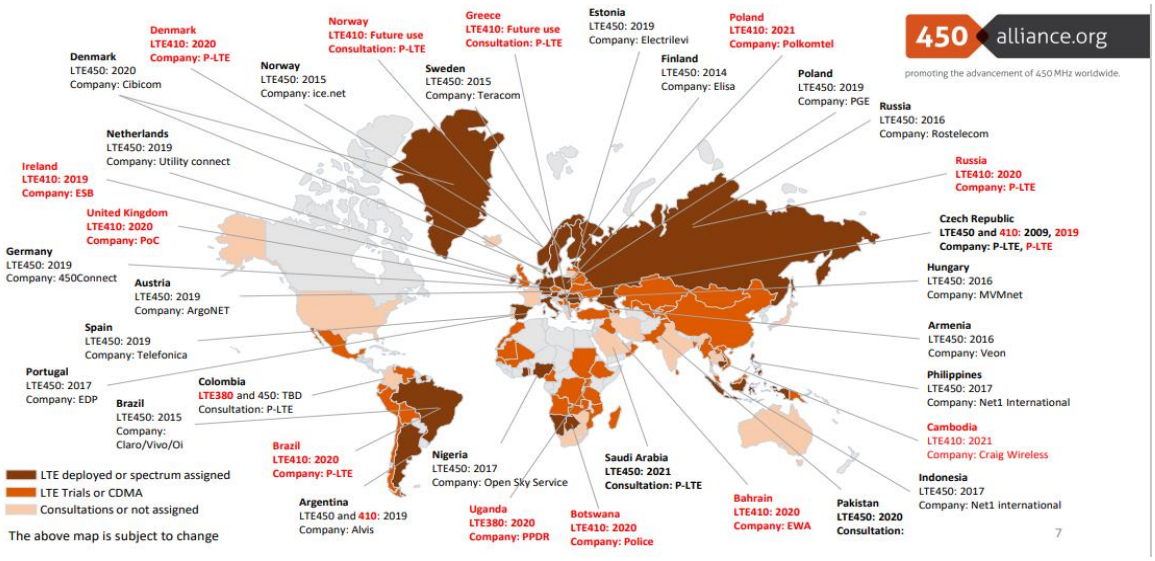


Figure 22: The world map of 380 MHz, 410 MHz and 450 MHz deployment[185]

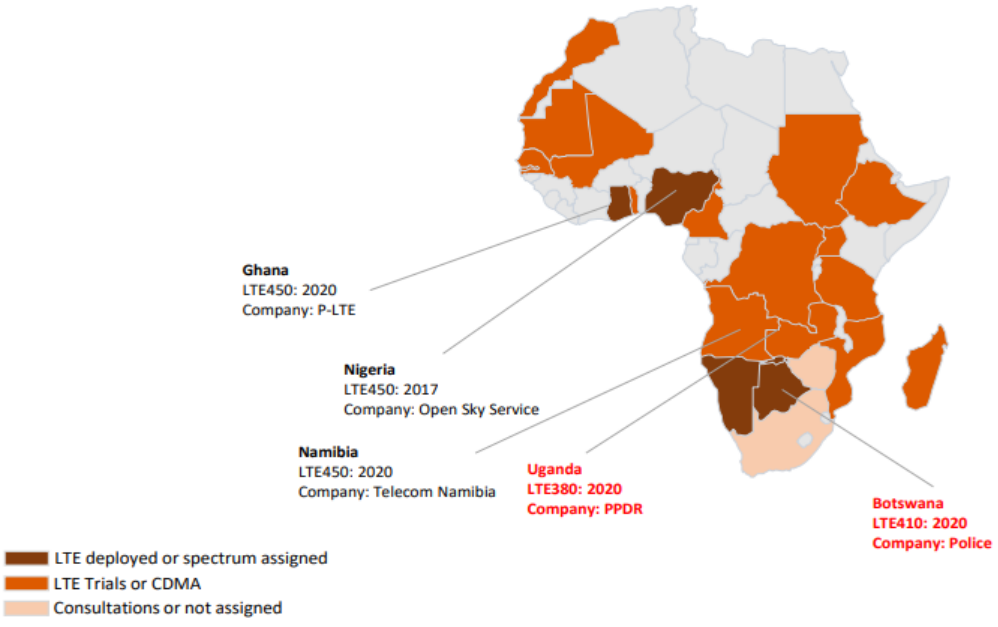


Figure 23: Africa map of 380 MHz, 410 MHz and 450 MHz deployment[186]

[185] 450 Alliance, https://450alliance.org/
[186] *ibid*

3GPP has standardised two band plans (see Figure 24) for the 410-430 MHz band[187].

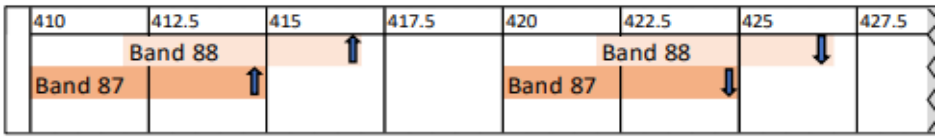


Figure 24: 3GPP band plans for 410 to 430 MHz band

As noted before, there is an emerging ecosystem for PPDR. The following are some examples:

- According to the 450 MHz Alliance[188] "The range of devices in the 410 MHz and 450 MHz is good in relation to the number of commercial operations and fairly limited in relation to the global mobile industry with main volumes in different router devices. Other types of devices are meters and handheld mobiles, these have increased in availability during the last twelve months. The router types available range from simple consumer products to advance specialized industrial routers. The handheld devices are mainly rugged and robust smartphones. Most devices support multiband. To give a complete view of the ecosystem this report also includes eNB, chipset, modules and antennas for both network and devices. Modules are the enabler of many devices and the devices suppliers are to a high degree sourcing this from third parties. Currently NB-IoT and LTE-M are the dominant technologies for chipsets and modules and therefore narrowband devices, but router and handheld devices are still mainly based on Cat.4 modules".

- "Nokia and Nordic Telecom have launched the world's first Mission Critical Communication (MCC)-ready LTE network in the recently opened up 410-430 MHz band. As a result of Nokia's advanced and future-proof mobile broadband solution, the Czech operator Nordic Telecom will be able to jumpstart public protection and disaster relief efforts with innovative services only possible on mobile broadband networks"[189].

Although most devices support multiband, the 410-430 MHz ecosystem is less mature compared to the 450-470 MHz ecosystem.

11.4. Current usage and constraints

[187] *ibid*

[188] https://450alliance.org/wp-content/uploads/2021/10/450Alliance-annual-device-update-P-rev-Final.pdf

[189] https://450alliance.org/nokia-and-nordic-telecom-launch-the-worlds-first-mission-critical-communication-ready-lte-network-in-the-410-430-mhz-band/

The current allocation for 410-430 MHz band is for Government services, Mobile Data and Trunking. The Authority's intention is to reserve this band for Digital Trunking only. To implement this, all other users i.e., mobile data, ESKOM, Government Services need to migrate out of the band or use the band for digital trunking.

Frequency Band (MHz)	WRC	Res. / Rec.	Footnote	Resolution/ Footnote
406.1-410 MHz	15	205	5.265	17. Protection of the systems operating in the mobile satellite service in the frequency band 406-406.1 MHz
410-420 MHz	15		5.268	18. Use of the frequency band 410-420 MHz by the space research service is limited to space-to-space communication links with an orbiting, manned space vehicle.

Table 43: Current constraints in this band[190]

Footnote 5.149 also applies to the band 73.0-74.6 MHz; b) that the radio astronomy service in the frequency range 406.1-410 MHz, and radiolocation systems in the frequency range 420-430 MHz which are deployed and protected at a national level, may require protection zones in some countries, if the frequency range 410-430 MHz is used by broadband land mobile systems

11.5. Scenario plans

Potential scenarios:

- Allocation of trunk services in the band as THE AUTHORITY has proposed since 2013
- Given the current trends, consider the introduction and allocation of BB PPDR in the band. This would need in-band migration of some existing trunking services depending on their location within the band.

11.6. Economic feasibility analysis

This band is currently used for government services, mobile data services and public trunking. The City of Cape Town (CoCT) uses this band for voice based

[190] ICASA. 2019. Radio Frequency Migration Plan 2019

PPDR.[191] The two scenarios for the band are explained above, and the costs and benefits of each are explained next:

Costs of implementing scenario 1: The Authority's intention is to use this band exclusively for digital public trunking with all other services being migrated out of the band.[192]This means using the band for terrestrial trunked radio (TETRA), including by PPDR users. Non-trunked radio users will have to migrate out of the band, and the cost of this will depend on whether any equipment currently in use will have to be replaced. Interruption to services should also be considered, as downtime in PPDR networks can be extremely costly in terms of property lost, crimes committed and disaster response.[193]

Benefits of implementing scenario 1: One of the options suggested in the RFSAP for the 450-470 MHz band was to migrate Transnet from the 450 MHz band into 410-413/420-423 MHz or alternatively, there are 2 × 4 MHz and 2 × 3 MHz for TETRA available in 406-426 MHz. The TETRA frequencies are beneficial for Transnet's business critical operations of ensuring freight safety. While the migration will come at a cost to Transnet and the migration is estimated to take around 7 years to complete, the benefits arising from this scenario are that the 450-470 MHz band will be cleared for IMT.

Benefits and costs of implementing scenario 2: As explained above, there is a possibility to use this band for broadband PPDR. There is a growing need for emergency services users to access live video communications, in addition to their dedicated voice communications needs. This network needs to be separate from commercial mobile broadband services providers in the same way that PPDR TETRA networks, for example, are separate to mobile services, since in emergency situations the latter can become congested or switched off entirely for security reasons, as the City of Cape Town explained in its submission on the Authority's NRFP 2021.[194] The benefits of this would be improved emergency services and therefore better protection of lives and property. Nonetheless, there may be substantial costs associated with deploying BB-PPDR services, and it is not clear, given the costs and delays with the migration of Government Services to the 380-400 MHz band described above, for example, that public resources are available for a BB-PPDR network.

[191] City of Cape Town. 2021. Response to invitation to comment on the Draft National Radio Frequency Plan 2021. Available: https://www.icasa.org.za/uploads/files/CoCT_Submission-on-the-Draft-National-Radio-Frequency-Plan-2021.pdf

[192] ICASA. 2013. Frequency Migration Regulation and Frequency Migration Plan.

[193] City of Cape Town. 2021. Response to invitation to comment on the Draft National Radio Frequency Plan 2021. Available: https://www.icasa.org.za/uploads/files/CoCT_Submission-on-the-Draft-National-Radio-Frequency-Plan-2021.pdf

[194] Submission from City of Cape Town on NRFP 2021, dated 24 August 2021.

Summary: Stakeholders are requested to provide any information on the costs and benefits of using this band for alternative uses, including for exclusive public trunking, or for BB-PPDR use.

11.7. Summary proposals arriving out of feasibility study

In light of emerging trends, the Authority plans to make the band available for other potential emerging applications such as broadband PPDR and IoT, in addition to digital public trunking. The Authority plans that all other Radio communications for specific services migrate out of the band[195] and proceed to a RFSAP for the band.

[195] ICASA. 2013. Frequency Migration Regulation and Frequency Migration Plan.

12. Annex 12: 440 - 450 MHz band: Implementation of the Radio Frequency Migration Plan 2013 and 2019

This feasibility study concerning the 440-450 MHz band is mandated by the 2019[196] Radio Frequency migration plans.

12.1. Introduction

The latest National Radio Frequency Plan 2021 aligns the allocation of this frequency band with the ITU table with primary allocation to fixed and mobile. In the 2021 National Radio Frequency Plan, there is an additional primary allocation for SPACE OPERATION (Earth-to-space) and SPACE RESEARCH (Earth-to-space) in South Africa.

The Authority also resolved that (from the 2019 Radio Frequency Migration Plan):

1. A feasibility study into the possibility to use the band 440 – 450 MHz for PPDR is to be performed.
2. A Radio Frequency Assignment Plan is to be developed.
3. The proposed allocation for this band is Short Range Business Radio and PMR services only. The band should be cleared of all other users. Communal repeaters can be allocated in this band

12.2. Status of ITU, SADC and South African National Frequency Allocation for the band

Table 44 shows the ITU allocations for the 440-450 MHz band. The band is currently allocated to Fixed and Mobile services in Region 1.

Region 1	Region 2	Region 3
440-450	FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271 5.284 5.285 5.286	

Table 44: ITU frequency allocations for the 440-450 MHz band

[196] ICASA. 2019. Radio Frequency Migration Plan 2019. Government Gazette No 42337, 29 March 2019

12.2.1. Status of SADC Frequency Allocation for the band

Table 45 shows the SADC Radio Frequency Spectrum Allocation Plan[197].

440-450 MHz FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271 5.284 5.285 5.286	**440-450 MHz** FIXED MOBILE except aeronautical mobile 5.286	PMR and/or PAMR PPDR PMR446 (446-446.1 MHz) FIXED (telemetry, dual frequency alarm systems)	The use of this band for PPDR to be studied. PMR446-ERC/DEC/(98)25

Table 45: SADC Radio Frequency Spectrum Allocation Plan for the 440-450 MHz band

12.2.2. Status of National Frequency Plan for South Africa

Table 46 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments

[197] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

440-450 MHz	**440-450 MHz**		
FIXED	FIXED	Telemetry / Data BTX (440 – 441 MHz) FIXED (telemetry, dual frequency alarm systems) Agricultural Telemetry Application Roving simplex Application	Paired with MTX (445 – 446 MHz) Channels 440.0125, 440.3625, 445.0125 and 445.3625 MHz are used for Agricultural Telemetry. Channels 440.275 MHz, 440.2875 MHz, 445.2750 MHz, 445.2875 MHz, 440.375 MHz and 445.375 MHz are roving simplex channels.
MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	Simplex Applications Mobile MTX (441.1 – 445 MHz) Single Frequency Mobile (441 – 441.1 MHz) PPDR, PMR and/or PAMR446 (446 – 446.1 MHz)	Channels 440 - 440.100 MHz and 445 – 445.1 MHz are used as simplex. Paired with BTX (446.1 – 450 MHz) 8 channels - PMR446-ERC/DEC/ (98)25 Radio Frequency Spectrum Assignment Plan GG 42230 Notice 74 of 2019 Radio Frequency Spectrum Regulations (Annex B) (GG. No. 38641, 30 March 2015). Further studies Final Frequency Migration Plan 2019 (GG No .42337 Notice 36 of 2019)
Radiolocation 5.269 5.270 5.271 5.284 5.285 5.286	SPACE OPERATION (Earth-to-space) SPACE RESEARCH (Earth-to-space) Radiolocation 5.269 5.270 5.271 5.284 5.285 5.286		

Table 46: National Radio Frequency Plan for South Africa for 440 to 450 MHz band[198]

12.3. International trends with country examples, standardisation status and maturity of the ecosystem

The trends the Authority sees are in line with the trends provided by Ofcom in their strategic review of the UHF bands. The UK Strategic Review of UHF Band 1 and Band 2, 410 to 470 MHz, by Ofcom proposed to increase sharing [ratios] between BR[199] licensees which the stakeholders broadly supported[200]. It also noted the following trends:

[198] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa

[199] BR = Business Radio

[200] Strategic Review of UHF Band 1 and Band 2 410 to 470 MHz, Ofcom Statement 25 May 2017

- moderate overall growth for services currently using the band, with voice remaining the dominant application for BR and some users seeing increasing use
  of data services;
- potential for increased use for IoT / M2M type applications from both new and
  current users;
- some interest in wideband[201] services / private broadband[202] communications
  networks for businesses; and
- Increasing risk of congestion.

In Europe the frequency sub-band 446.0-446.1 MHz has been designated for analogue PMR 446 by ERC/DEC/(98)25 of 23 November 1998[203] and was amended on 1st June 2012 to include some additional features in order to reduce the risk of harmful interference. The frequency band 446.1-446.2 MHz has been designated for digital PMR 446 by ECC/DEC/(05)12 of 28 October 2005[204]. The PMR 446 radio application is intended for radio communications with transmission and reception taking place on the same channel (single frequency, simplex traffic). PMR 446 radio equipment is exempted from individual licensing and anyone can use the radio equipment without any prior individual permission from the administration. The designation of a harmonised band has formed the basis for the free circulation and use of PMR 446 within Europe and has also facilitated the mutual recognition of conformity assessment[205].

WRC-19 Resolution 646 includes this band for Region 1 (380-470 MHz band) and encourages administrations to consider it for PPDR purposes. The market (i.e., standardisation, harmonisation and device ecosystem) is picking up other parts of the band, specifically for sub bands 380-400, 410-430 and 450-470. The Authority so far sees little evidence of similar market trends for PPDR in the 440-450 MHz band[206]. The number of bands considered for PPDR as shown by the 450 MHz

[201] Wideband – channel allocations generally considered to be between 25 kHz and 1 MHz, (although for CDMA this may be 1.25 MHz) supporting data rates of several hundred kilobits per second (e.g., in the range of 384 to 500 kbit/s)

[202] Broadband – channel allocations greater than 1 MHz, enabling new functionality with additional capacity to support higher speed data and higher resolution images.

[203] ERC Decision (98)25 on the harmonised frequency band to be designated for PMR 446

[204] ECC Decision (05)12 on harmonised frequencies, technical characteristics, exemption from individual licensing and free carriage and use of digital PMR 446 applications operating in the frequency band 446.1-446.2 MHz

[205] ECC Decision (15)05, The harmonised frequency range 446.0-446.2 MHz, technical characteristics, exemption from individual licensing and free carriage and use of analogue and digital PMR 446 applications, Approved 3 July 2015, Amended 2 March 2018

[206] Europe Considers Flexible Harmonization for Mission-Critical LTE Spectrum (rrmediagroup.com)

Alliance does not show any licences or trials in 440-450 MHz band[207]. This band is also not a standardised band within 3GPP.

12.4. Current usage and constraints

The typical applications of this band in South Africa include agriculture telemetry, short range business radio, dual frequency alarm systems and PMR. Additional allocations include space operation (Earth-to-space) and space research (Earth-to-space).[208]

There is an existing RFSAP for the band 440-441 MHz which aims to:[209]:

- Enable the assignment of Low Power Spread Spectrum Wide Area Networks for the sole use of burglar alarms and security related telemetry signals.
- Maximise efficiency in the use of the Frequency Band.
- Facilitate the release of VHF and Mid-band spectrum currently used by (Burglar alarms, telemetry etc.).

According to the Radio Frequency Migration Plan 2019, the Applicable Frequency Allocation and Band information for 440-450 MHz band are:

Pairings

FIXED BTX: 440 to 441.1 MHz paired with MTX 445 to 446.1 MHz
Mobile BTX 441.1 – 445 MHz paired with MTX 446.1 to 450 MHz

Single Frequency Mobile Allocations

Channels 440.0125, 440.3625, 445.0125 and 445.3625 MHz are used for Agriculture Telemetry

Channels 440 to 440.1 and 445 to 445.1 are used for simplex applications.

Channels 440.275, 440.2875, 445.2750, 445.2875, 440.375 and 445.375 MHz are roving

Simplex Channels

The Authority also resolved that (from the 2019 Radio Frequency Migration Plan):

1. A feasibility study into the possibility to use the band 440 – 450 MHz for PPDR is to be performed.
2. A Radio Frequency Assignment Plan is to be developed.
3. The proposed allocations for this band are Short Range Business Radio and PMR services only. The band should be cleared of all other users. Communal repeaters can be allocated in this band

[207] https://450alliance.org/wp-content/uploads/2021/10/450Alliance-annual-device-update-P-rev-Final.pdf
[208] National Radio Frequency Plan 2021.
[209] Radio Frequency Spectrum Assignment Plan, Rules for Services operating in the Frequency Band for 440 to 441 MHz, STAATSKOERANT, 15 FEBRUARIE 2019 No. 42230

RESOLUTION 646 (REV. WRC-19), Public protection and disaster relief, also encourages "administrations to also consider parts of the following regionally harmonized frequency ranges for their PPDR applications" in Region 1 covering the 380-470 MHz"[210].

12.5. Scenario plans

The main scenario plan in this band from the Authority's resolutions above pertains to the possibility of the use for PPDR, i.e. Item 1 of the list above which also is in line with Resolution 646 of WRC-19.

Although WRC-19 Resolution 646 includes this band for Region 1 (380-470 MHz band) and encourages administrations to consider for PPDR purposes, the market, (i.e., standardisation, harmonisation and device ecosystem) is picking up other parts of the band, specifically for sub bands 380-400, 410-430 and 450-470. The Authority so far sees little evidence of similar market trends for PPDR in the 440-450 MHz band.

12.6. Economic feasibility analysis

Given the key scenario here is one of conducting a feasibility study for PPDR in this band, the Authority has concluded that there is no evidence of this band emerging as one of the Resolution 646 (WRC) PPDR bands for Region 1.

Furthermore, the costs of migrating out non-PPDR services will have to be investigated as this varies from agriculture telemetry to space operations and research. Agriculture telemetry is important for farmers as it can be used to monitor and assess weather and soil data in order to make better decisions around irrigation and crop protection. Despite agriculture only constituting 3% of South Africa's GDP, it has a higher share of total employment, at around 5%.[211] In addition, South Africa's agricultural sector plays an important role in the country's food security. There may therefore be significant costs to the economy if the agricultural sector is disrupted as a result of migration. Incumbents may also need to incur significant costs in order to operate in a new band. There may also be burglar alarm services and security-related telemetry services in the band.[212] As explained above, these services play an important role in South Africa, given the

[210] RESOLUTION 646 (REV.WRC-19), Public protection and disaster relief, The World Radiocommunication Conference (Sharm el-Sheikh, 2019) https://www.itu.int/dms_pub/itu-r/oth/0C/0A/R0C0A00000F00133PDFE.pdf

[211] Statistics South Africa. 2021. Gross Domestic Product 1st quarter 2021. Available: http://www.statssa.gov.za/publications/P0441/GDP%202021%20Q1%20(Media%20presentation).pdf

[212] Government Gazette 42230 notice 74 of 2019.

high rates of crime. There may be similar disruptions to these services or costs involved with buying new equipment in the event of migration.

Summary: The Authority concludes that its thinking on this band at this stage is that there is a high risk of leading to a more inefficient use of this spectrum band if it proceeds with a PPDR allocation and subsequent PPDR-based RFSAP. The Authority will closely watch the activities happening in 446-446.2 MHz on Analogue and Digital PMR to make any further decisions given developments in Europe.

Stakeholders are invited to comment on this point.

12.7. Summary proposals arriving out of feasibility study

The Authority concludes that its thinking on this band at this stage is that there is a high risk of leading to a more inefficient use of this spectrum band if it proceeds with a PPDR allocation and subsequent PPDR-based RFSAP.

Given no evidence of PPDR emerging in this band, there is a strong case for largely maintaining the *status quo* and taking a longer-term outlook watching brief (i.e. > 3 years) for the band.

The Authority will also closely watch the activities happening in 446-446.2 MHz on Analogue and Digital PMR to make any further decisions given developments in Europe.

In summary, it would be helpful for stakeholders to comment on the optimal use of this band.

13. Annex 13: 825 to 830 MHz and 870 to 875 MHz band: Implementation of the Radio Frequency Migration Plan 2013 and 2019

This feasibility study constitutes the feasibility study for the 825-830 and 870-875 MHz band. This frequency band falls within the frequency range 790 – 960 MHz, which has been identified for IMT services in the ITU-R regulations. This study was mandated by the 2013[213] and 2019[214] Radio Frequency migration plans.

13.1. Introduction

Historically, there have been some CDMA 850 assignments and deployment in this band. The lower part i.e., 825-830 MHz, now falls in the guard band of Region 1 800 MHz band plan (i.e., 832–862/791–821 MHz). The CDMA 850 licensee has been allowed to operate in the band up until the conclusion of analogue to digital switchover. In practice, the licensee has noted severe limitations in operating in this band due to the interference from the short range devices in the upper part of the band i.e., 870-875 MHz, lack of devices and not being in the Region 1 band plan. They have requested to be migrated elsewhere.

13.2. Status of ITU, SADC and South African National Frequency Allocation for the band

13.2.1. Status of ITU Frequency Allocation for the band

Table 47 shows the ITU allocations for the 825-830/870-875 MHz band. This band is allocated for Aeronautical and space research services on a primary basis within Region 1.

[213] Frequency Migration regulation and Radio Frequency Migration Plan March 2013, Government Gazette No 36334, 3 April 2013

[214] ICASA. 2019. Radio Frequency Migration Plan 2019. Government Gazette No 42337, 29 March 2019

Region 1	Region 2	Region 3
5.149 5.291A 5.294 5.296 5.300 5.304 5.306 5.312		**610-890** FIXED MOBILE 5.296A 5.313A 5.317A BROADCASTING
694-790 MOBILE except aeronautical mobile 5.312A 5.317A BROADCASTING 5.300 5.312	**614-698** BROADCASTING Fixed Mobile 5.293 5.308 5.308A 5.309	
790-862 FIXED MOBILE except aeronautical mobile 5.316B 5.317A BROADCASTING 5.312 5.319	**698-806** MOBILE 5.317A BROADCASTING Fixed 5.293 5.309	
862-890 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322 5.319 5.323	**806-890** FIXED MOBILE 5.317A BROADCASTING 5.317 5.318	5.149 5.305 5.306 5.307 5.320

Table 47: ITU frequency allocations for the bands include 825-830/870-875 MHz band

13.2.2. Status of SADC Frequency Allocation for the band

Table 48 shows the SADC Radio Frequency Spectrum Allocation Plan[215].

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	
790-862 MHz FIXED MOBILE except aeronautical mobile 5.316B 5.317A BROADCASTING 5.312 5.319	**790-862 MHz** MOBILE except aeronautical mobile 5.316B 5.317A SADC13	IMT	Res. 224 (REV. WRC-19) applies IMT Radio Frequency Channel arrangement according to ITU-R M.1036

Table 48: SADC Radio Frequency Spectrum Allocation Plan for 825 to 830 MHz band

[215] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

13.2.3. Status of National Frequency Plan for South Africa

Table 49 shows the National Radio Frequency Allocation Plan for South Africa

ITU Region 1 allocations and footnotes	**South African allocations and footnotes**	**Typical Applications**	**Notes and Comments**
790-862 MHz FIXED MOBILE except aeronautical mobile 5.316B 5.317A BROADCASTING	790-862 MHz FIXED MOBILE except aeronautical mobile 5.316B 5.317A NF9	Fixed Links (856 – 864.1 MHz) Wireless Access (827.775 – 832.695 MHz) IMT800 MTX (832 - 862 MHz) IMT850 MTX (825 – 830 MHz)	Paired with 868.1 – 876 MHz Paired with 827.775- 832.695 MHz Paired with BTX (791 – 821 MHz) Paired with BTX (870 – 875 MHz) International Mobile Telecommunication Roadmap (GG No. 42829 Notice 600 of 2019). Radio Frequency Spectrum Assignment Plan (GG 38640 Notice 271 and 272 of 2015) as amended IMT in accordance with ITU-R Recommendation ITU-R M.2090 latest version and Resolution **760 (WRC-15**) applies Recommendation ITU-R M.1036-6 Consideration of the future spectrum needs of Broadband Public Protection and Disaster Relief (PPDR) in the range 694-790 MHz as described in the most recent ITU-R M.2015, while taking into account studies called for by Resolution 646 (WRC15) for technical and operational measures. Band IV/V analogue television is to be migrated to digital television and ensure harmonisation with SADC. WRC-07, WRC-12 and WRC-15 allocated this band to Mobile service except aeronautical mobile and identified it for IMT. Fixed links operating in this band will have to be migrated in order to accommodate IMT.

5.312 5.319	5.312A 5317A		Radio Frequency Spectrum Assignment Plan GG 42337 Notice 165 of 2019 Radio Frequency Spectrum Assignment Plan (GG 38640 Notice 273 of 2015) as amended Radio Frequency Spectrum Assignment Plan GG 41082 Notice 648 of 2017
862-890 MHz FIXED MOBILE except aeronautical mobile 5.317A BROADCAST ING 5.322 5.319 5.323	**862-890 MHz** FIXED MOBILE except aeronautical mobile 5.317A NF10	Fixed Links (856 – 864.1 MHz) Wireless Access (872.775 877.695 MHz) GSM-R MTX (877.695 – 880 MHz) NF10 IMT900 MTX (880-915 MHz) IMT850 BTX (870-875 MHz) Wireless Audio systems and Wireless microphones (863 – 865 MHz) CT2 cordless phones (864.1 – 868.1 MHz) FWA (864.1 – 868.1 MHz) RFID (865 – 868 MHz) Non-specific SRD and RFID (869.4 – 869.65 MHz) Non-Specific SRDs (868 – 868.6 MHz, 868.7 – 869.2 MHz, 869.4 – 869.65 MHz, 869.7 – 870.0 MHz)	Paired with 868.1 – 876 MHz Paired with 827.775 – 832.695 MHz Paired with 921 – 925 MHz Paired with BTX (925 – 960 MHz) Paired with MTX (825-830 MHz) Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015). Recommendation ITU-R M.1036-6 Radio Frequency Spectrum Assignment Plan GG 42337 Notice 165 of 2019 Radio Frequency Spectrum Assignment Plan (GG 38640 Notice 275 of 2015) as amended International Mobile Telecommunication Roadmap GG No. 42829 Notice 600 of 2019).

		Alarms (868.6 – 868.7 MHz, 869.25 – 869.3 MHz, 869.65 – 869.7 MHz)	

Table 49: National Radio Frequency Plan for South Africa for 825 to 830/870 to 875 MHz band[216]

13.3. International trends with country examples, standardisation status and maturity of the ecosystem

This is one of the most important sub 1 GHz bands for IMT deployment in Region 1. 3GPP has standardised this band as Band 20. There is a significantly matured global ecosystem developed for this band.

According to 2018 GSA data[217], 182 operators have commercially launched LTE networks using the 800 MHz Band 20 in 82 countries. At present, Band 20 is the second most popular band used by public telecom operators around the world for LTE. In 2020 GSA also stated[218] that this band is the second-most deployed spectrum band in networks worldwide (used in 199 launched networks). The ecosystem of devices is strong, with 6,838 known supporting LTE devices (40.7% of all devices).

The Authority's view is that sub 1 GHz coverage spectrum like 800 MHz band complements mid band capacity spectrum i.e., 3.5 GHz band, and hence both coverage and capacity spectrum are needed for SA Connect.

The 700 MHz and 800 MHz bands are proving instrumental in delivering widespread LTE services but these bands will only deliver their full potential if the spectrum available is licenced in a way to accommodate large carriers in order to improve network performance and offer greater capacity.

13.4. Current usage and constraints

The current usage constraint is that this band is still subject to analogue to digital switchover. On the 26th of November 2021, the Authority issued temporary licences[219] in the IMT 800 (and IMT 700 MHz) band radio frequency spectrum to six of South Africa's wireless network operators. However, analogue and digital television broadcasting services still occupy parts of the 700 MHz and 800 MHz

[216] National Radio Frequency Plan 2021, (NRFP-21) 8.3 kHz – 3000 GHz, Independent Communications Authority of South Africa
[217] LTE 800 MHz Ecosystem Evolution Report September 2018 - GSA (gsacom.com)
[218] LTE Ecosystem July 2020 - Global Status Report - GSA (gsacom.com)
[219] South Africa's cellular networks get new temporary spectrum (mybroadband.co.za)

radio frequency bands, the Authority urged licensees to share and coordinate usage in these frequency bands.

13.5. Scenario plans

As per the global trend, it is logical for South Africa to migrate this band given that the emerging highest value use of this band is for IMT.

13.6. Economic feasibility analysis

The scenario for this band is to implement IMT. While there is a current licensee in the band, Liquid Telecom, it currently offers campus-wide services in a small number of locations and does not consider there is a business case to deploy a network in the band given the limited number of devices available in South Africa. There is therefore little or no cost involved in migrating Liquid Telecom out of the band. This economic feasibility study first considers the highest value use of the spectrum. This is followed by a discussion on economic aspects of migration.

Highest value use

The highest-value use of the band is for IMT services, and this has been the case for some time. For example, Germany and Sweden were among the first countries in Europe to award 800 MHz spectrum, in 2010 and 2011 respectively.[220] Research prepared for the Belgium Institute for Postal Services and Telecommunications (BIPT) showed an overall welfare impact of using the band for IMT of around €1 056 million, including €692 million (66%) arising from consumer surplus and €364 million (34%) from producer surplus.[221] In particular, assigning the 800 MHz band for IMT results in network cost savings, as it has improved propagation characteristics and requires fewer sites to reach required coverage levels compared to other bands. The award of the 800 MHz band is also expected to encourage faster LTE deployment and broader population coverage leading to faster uptake in (higher value) LTE services, generating additional revenues for operators. Consumers benefit from faster provision of better LTE coverage which increases their willingness to pay for these services.

Therefore, given the sparsely populated rural areas in South Africa and the growing demand for mobile broadband, designating the 800 MHz band for IMT and migrating non-IMT users out of the band will result in the highest value use of this band.

[220] GSMA. 2015. The socio-economic benefits of greater spectrum policy harmonisation in the EU. Available: https://www.gsma.com/spectrum/wp-content/uploads/2015/12/Socioeconomic-benefits-of-harmonisation1.pdf

[221] Aetha. 2013. Economic benefits from use of the 790-862MHz band for DTT and mobile broadband. Available: https://www.bipt.be/file/cc73d96153bbd5448a56f19d925d05b1379c7f21/27cb9c45cfefdfc810b9fce8da5df1add5a3e9ea/02-aetha_consulting_-_report_on_the_economic_benefits.pdf

Economic aspects of frequency spectrum migration

The current use of the 850 MHz band is limited in South Africa. Nonetheless, Liquid Telecom historically had a significant number of customers using CDMA services using predominantly fixed wireless equipment for voice and Internet access services. There is a question as to where Liquid Telecom could be migrated in order for them to achieve a similar outcome. This is similar to considering where Transnet and the Government Services, for example, need to migrate to in order to allow the 450-470 MHz band to migrate to its highest value use, while allowing Transnet and Government Services to achieve the equivalent service levels for their critical business applications and PPDR needs respectively. This is a difficult question to answer at this stage, given that it is not clear what band might be suitable for this purpose, and how much spectrum would be needed. Stakeholders are encouraged to make submissions on this question.

Summary

It is clear that the highest-value use of this band is for IMT purposes, given the number of devices available for IMT in this band in South Africa, and in light of the very high estimates of consumer and producer surplus for IMT use estimated in other countries. There is also a very low cost of migration for the incumbent in the band, Liquid Telecom, which has very few services in this band. Nonetheless, there is a question as to where Liquid Telecom might migrate in order to make the band available for IMT use, and stakeholders are encouraged to comment on this question.

13.7. Summary proposals arriving out of feasibility study

In summary, the Authority plans to use the lower part of this band for IMT use.

14. Annex 14: 1429 – 1452 MHz band: Implementation of the Radio Frequency Migration Plan 2013 and 2019

This feasibility study concerning the 1429-1452 MHz band is mandated by the Frequency Band Migration Regulation and Plan contained in the IMT Roadmap 2014[222] and IMT Roadmap 2019[223].

14.1. Introduction

In 2013, the Authority anticipated a potential WRC-15 decision on the use of this band and suggested a feasibility study post WRC-15. In the 2019 Frequency migration plan, the Authority confirmed that a feasibility study should be conducted. After which, a new RFSAP would be developed taking into consideration study results within ITU-R WP5D and in accordance with the latest version of Recommendation ITU-R 1036[224] in respect of L band.

14.2. Status of ITU, SADC and South African National Frequency Allocation for the band

14.2.1. Status of ITU Frequency Allocation for the band

Table 50 shows the ITU allocations for the 1429-1452 MHz band. This band is allocated for Fixed and Mobile on a primary basis within Region 1.

Region 1	Region 2	Region 3
1 429-1 452 FIXED MOBILE except aeronautical mobile 5.341A 5.338A 5.341 5.342	**1 429-1 452** FIXED MOBILE 5.341B 5.341C 5.343 5.338A 5.341	

Table 50: ITU frequency allocations for 1429-1452 MHz band

[222] Final (Draft) IMT Roadmap 2014, Government Gazette Vol. 593 Pretoria, 14 November 2014 No. 38213
[223] Final (Draft) IMT Roadmap 2019, Government Gazette Vol. 645, 29 March 2019 No. 42361
[224] Recommendation ITU-R M.1036-6 (10/2019), Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications in the bands identified for IMT in the Radio Regulations

14.2.2. Status of SADC Frequency Allocation for the band

Table 51 shows the SADC Radio Frequency Spectrum Allocation Plan[225].

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	
1 429-1 452 MHz FIXED MOBILE except aeronautical mobile 5.341A 5.338A 5.341 5.342	**1 429-1 452 MHz** FIXED MOBILE except aeronautical mobile 5.341A 5.338A 5.341		

Table 51: SADC Radio Frequency Spectrum Allocation Plan for 1429-1452 MHz band

14.2.3. Status of national frequency plan for South Africa

Table 52 shows the national radio frequency allocation plan for South Africa

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
1 429-1 452 MHz FIXED MOBILE except aeronautical mobile 5.341A 5.338A 5.341 5.342	1 429-1 452 MHz FIXED MOBILE except aeronautical mobile 5.341A 5.338A 5.341	Fixed links (duplex) (1 427-1 452 MHz) IMT	Paired with 1 375 – 1 400 MHz) In accordance with Recommendation ITU-R F.1242 Recommendation ITU-R M.1036-6 (International Mobile Telecommunications (IMT)) RFSAPs to be developed Resolution 528 (Rev. WRC-19) Resolution 739 (Rev. WRC-19).

[225] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

Table 52: National Radio Frequency Plan for South Africa for 1429 to 1452 MHz band[226]

14.3. International trends with country examples, standardisation status and maturity of the ecosystem

The international trends in this band are being driven by the activities in Europe (i.e., UK) in the same way as the 1452 to 1492 MHz band.

In Europe, this ECC Decision (17)06[227] "harmonises the use of the 1427-1452 MHz (and 1492-1518 MHz) bands for terrestrial Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL) and it provides the harmonised technical conditions including the least restrictive technical conditions for the deployment of MFCN SDL within CEPT.

As defined in the ECC decision (17)06, An "MFCN SDL is a mobile broadband system, which by means of base station transmitters in the network, uses unpaired spectrum in the downlink to provide a supplemental downlink capacity to carry comprehensive text, audio, images, data, sound and video content in general, in a unicasting, multicasting or broadcasting mode".

Indeed, the CEPT is harmonising both 1427-1452 MHz and 1492–1518 MHz frequency bands for MFCN SDL through this ECC Decision. This is because it is important to enhance the downlink capability of mobile broadband systems and represents a strategic tool to tackle the growing mobile data traffic asymmetry, as has happened between 1452 to 1492 MHz band in Europe. Note that the ECC decision also recognises the band 1429 to 1452 with the same arrangements[228].

At WRC-15, the frequency bands 1427-1452 MHz and 1492-1518 MHz were identified globally for International Mobile Telecommunications (IMT) in accordance with Resolution 223 (Rev. WRC-15)[229].

Therefore, the global trends suggest that this band be considered for IMT use as Europe has done.

[226] NATIONAL RADIO FREQUENCY PLAN 2021, (NRFP-21) 8.3 kHz – 3000 GHz INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA

[227] ECC Decision (17)06, The harmonised use of the frequency bands 1427-1452 MHz and 1492-1518 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL) Approved 17 November 2017 Corrected 2 March 2018

[228] https://docdb.cept.org/document/1016

[229] ITU Radio Regulations Edition of 2016

14.4. Current usage and constraints

This band is currently allocated to low capacity Point-to-Point/Dual Frequency links[230]. Spectrum is subject to coordination.

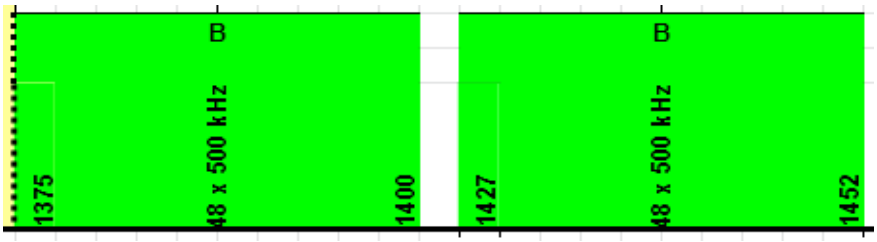


Figure 25: Current usage of the band for fixed links pairs it with 1374 to 1400

Due to the fact that the SA frequency allocation table identifies this band for both Mobile and Fixed on a primary basis, in the 2019 Radio Frequency Migration Plan, the Authority proposed (based on the equipment availability) to:

- maintain existing links where required as they were found to be too expensive to migrate, etc.
- allocation to rural broadband (BFWA) due to good propagation characteristics.

In the 2013 Radio Frequency Migration Plan, the Authority anticipated a potential WRC-15 decision on the use of this band and suggested a feasibility study post WRC-15.

In the 2019 Frequency migration plan, the Authority confirmed that a feasibility study should be conducted. After which, a new RFSAP would be developed taking into consideration study results within ITU-R WP5D and in accordance with the latest version of 1036 in respect of L band.

14.5. Scenario plans

The logical next step in South Africa is to migrate this band given that emerging highest value use of this band is for IMT. For instance, over the next 3 years, the regulator in the Kingdom of Saudi Arabia, plans to make available exclusive-use licences in the 1427 – 1518 MHz (either TDD or SDL[231]).

As the ecosystem for this band is maturing, similar to the Kingdom of Saudi Arabia intends to exclusively licence to IMT, the Authority should clear the current users.

[230] Final Radio Frequency Migration Plan 2019, Government Gazette No. 42337, 29 March 2019

[231] Spectrum Outlook for Commercial and Innovative Use 2021- 2023 PUBLIC CONSULTATION, Publishing Date: 28 January 2021, 28 February 2021

14.6. Economic feasibility analysis

The scenario for this band being considered by the Authority is to allocate it for IMT use. In order to consider the economic feasibility of this approach, first current users are considered, followed by an assessment of the costs and benefits of the band for IMT use.

Current users

It seems there is currently only limited usage of the band. For example, in the Authority's recent consultation on the National Radio Frequency Plan,[232] the broadcasters did not comment on it, and Telkom (a former user of the band) supported allocating it to IMT.[233] Telkom suggested, nonetheless, that current users of fixed links in the band need to be migrated out, and sharing with broadcasters needs to be considered. Given the current limited usage of the band, it is likely that the costs of allocating it exclusively to IMT will be low.

Benefits of using the band for IMT

In terms of benefits of allocating the band for IMT, Vodacom mentioned in a submission to the Authority's draft 2021 NRFP that the 1427 – 1518 MHz band will allow for better coverage and indoor penetration as compared to IMT1800, as well as additional capacity, with 91 MHz bandwidth available.[234] Additionally, it provides mobile operators with flexibility in deployment, as it can be deployed in a time division duplexing (TDD) or supplemental downlink (SDL) configuration, enabling operators to tailor the configuration based on their network needs.

The value of assigning 40 MHz additional spectrum in the 1.4/1.5 GHz band, over and above the benefit of assigning 40 MHz between 1452-1492 MHz discussed above (USD 40 billion globally), is approximately USD 10 billion globally.[235] This suggests that allocating 23 MHz of spectrum in the range between 1429-1452 MHz will have considerable benefits in South Africa.

Summary

The costs of migrating existing users appear to be relatively low, given the apparent limited usage of the band, and the benefits of allocating the band to IMT

[232] See submission from the National Association of Broadcasters on the NRFP 2021 to the Authority dated 27 August 2021.
[233] See submission from Telkom on the NRFP 2021 dated 27 August 2021.
[234] https://www.icasa.org.za/uploads/files/Vodacom-Submission-on-the-Draft-National-Radio-Frequency-Plan-2021.pdf
[235] Plum Consulting. October 2015. Global momentum and economic impact of the 1.4/1.5 GHz band for IMT. Available: https://www.gsma.com/spectrum/wp-content/uploads/2015/10/1-4-1-5GHz-L-band-for-IMT-OCTOBER-2015.pdf

are likely significant. This suggests that the Authority's proposed approach for the band is economically feasible.

Any incumbent users of the band are encouraged to submit information on their costs of migrating out of the band, or any additional costs that they will incur if the band is allocated exclusively for IMT purposes. It would also be useful for stakeholders to comment on the benefits of using the band for IMT purposes.

14.7. Summary proposals arriving out of feasibility study

In summary, the Authority is proposing that this band would be used for IMT.

CONTINUES ON PAGE 258 OF BOOK 3

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15. Annex 15: 1518 - 1525 MHz band: Implementation of the Radio Frequency Migration Plan 2013 and 2019

This feasibility study concerning the 1518-1525 MHz band is mandated by the Frequency Band Migration Regulation and Plan contained in the IMT Roadmap 2014[236] and IMT Roadmap 2019[237].

15.1. Introduction

The radio frequency migration plan 2013 intended to develop a RFSAP with consideration to the assignment of Studio Transmitter Links (STL) in this band

According to the Radio Frequency Migration Plan 2019, this band was allocated for both single frequency links as well as the IMT satellite component. The authority planned to:

- Assign this band for repeater links for land-mobile radio (LMR) and migrate such links
  into this band.
- Assign for outside-broadcasting links currently operating in 2300 – 2450 MHz
- The Radio Frequency Spectrum Assignment Plan was published for public consultation in Government Gazette Number 41164 (Notice 784 of 2017)"

The 2019 RFSAP also stated that "this Radio Frequency Spectrum Assignment Plan supersedes any previous spectrum assignment arrangements for the same spectrum location". It also seeks to ensure that there is no harmful interference to IMT Satellite Systems and to assign for single frequency links where there is no harmful interference to IMT Satellite services". A feasibility study needs to be conducted in order to implement the requirements of the existing RFSAP 2019.

Since then, the Authority noted that this band is allocated for Mobile, Fixed and Mobile-Satellite services on a primary basis within Region 1.

15.2. Status of ITU, SADC and South African National Frequency Allocation for the band

[236] Final (Draft) IMT Roadmap 2014, Government Gazette Vol. 593 Pretoria, 14 November 2014 No. 38213
[237] Final (Draft) IMT Roadmap 2019, Government Gazette Vol. 645, 29 March 2019 No. 42361

15.2.1. Status of ITU Frequency Allocation for the band

Table 53 shows the ITU allocations for the 1518-1525 MHz band. The whole band is allocated for Mobile, Fixed and Mobile-Satellite services on a primary basis within Region 1.

Region 1	Region 2	Region 3
1 518-1 525 FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341 5.342	**1 518-1 525** FIXED MOBILE 5.343 MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341 5.344	**1 518-1 525** FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341

Table 53: ITU frequency allocations for the 1518-1525 MHz band

15.2.2. Status of SADC Frequency Allocation for the band

Table 54 shows the SADC Radio Frequency Spectrum Allocation Plan[238].

ITU Region 1 allocations and footnotes	SADC common allocation/s and relevant ITU footnotes	SADC proposed common sub-allocations / utilisation	Additional information
1 518-1 525 MHz FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341 5.342	**1 518-1 525 MHz** FIXED MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341	1518-1525 MHz Fixed links (single frequency)	The band 1518-1559 MHz is identified for satellite component of IMT; Res.225 applies.

Table 54 SADC Radio Frequency Spectrum Allocation Plan for the 1518-1525 MHz band

15.2.3. Status of National Frequency Plan for South Africa.

[238] SADC Radio Frequency Spectrum Allocation Plan (SADC RFSAP) 8.3 kHz – 3000 GHz, Edition 2021, https://assets.website-files.com/5fb8ce4adbd6ad2ccc1423e7/612fe72be15121775ae6a121_2021%20SADC%20RADIO%20FREQUENCY%20SPECTRUM%20ALLOCATION%20PLAN.%20docx%5B1%5D.pdf

Table 55 shows the National Frequency Plan for South Africa.

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
1 518-1 525 MHz FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A 5.341 5.342	1 518-1 525 MHz FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.351A 5.341	IMT Satellite component	The band 1518-1559 MHz is identified for satellite component of IMT; Res. 225 applies. Radio Frequency Spectrum Assignment Plan GG 42286 Notice 125 of 2019 Final Frequency Migration Plan 2019 (GG No. 42337 Notice 36 of 2019)

Table 55: National Radio Frequency Plan for South Africa for 1518 to 1525 MHz band[239]

The recommended frequency arrangements for implementation of IMT in the band 1518-1525 MHz are summarised in Table 56.

Frequency arrangements	Paired arrangements (FDD)				Un-paired arrangements (TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)	
G1	External	–	1 427-1 517	–	None
G2	1 427-1 470	5	1 475-1 518	48	None
G3					1 427-1 517

Table 56: Frequency arrangements in the 1518-1525 MHz band MHz

[239] NATIONAL RADIO FREQUENCY PLAN 2021, (NRFP-21) 8.3 kHz – 3000 GHz INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA

15.3. International trends with country examples, standardisation status and maturity of the ecosystem

In July 2013, Inmarsat launched the "Alphasat" satellite. This is the first satellite to operate in additional L-band spectrum known as the "extended L-band" frequencies (1518-1525 MHz and 1668-1675 MHz)[240].

15.4. Current usage and constraints

The radio frequency migration plan 2013 intended to develop a RFSAP with consideration to the (a) assignment of Studio Transmitter Links (STL) in this band and (b) the concerns of Inmarsat with regard to interference.

According to the Radio Frequency Migration Plan 2019, this band was allocated for both single frequency links as well as the IMT satellite component. "However, this band remains unoccupied and there are views that the IMT (satellite) will have limited usage within South Africa." Due to these factors, the Authority proposes to:

- Assign this band for repeater links for land-mobile radio (LMR) and migrate such links
  into this band.
- Assign for outside-broadcasting links currently operating in 2300 – 2450 MHz

A Radio Frequency Spectrum Assignment Plan was published for public consultation in
Government Gazette Number 41164 (Notice 784 of 2017).

The RFSAP[241] states "the requirements for the utilisation of the frequency band between 1518 MHz and 1525 MHz for the IMT Satellite component and Single Frequency Links (1517–1525 MHz). The RFSAP seeks to ensure that there is no harmful interference to IMT Satellite Systems and to assign for single frequency links where there is no harmful interference to IMT Satellite services".

The 2019 RFSAP also stated that "this Radio Frequency Spectrum Assignment Plan supersedes any previous spectrum assignment arrangements for the same spectrum location".

[240] https://www.ofcom.org.uk/__data/assets/pdf_file/0029/72299/inmarsat_response_sent.pdf

[241] Radio Frequency Spectrum Assignment Plan, Rules for Services operating in the Frequency Band 1518 MHz to 1525 MHz Government Gazette No. 42337 435, 29 March 2019

A feasibility study needs to be conducted in order to implement the requirements of the existing RFSAP 2019.

15.5. Scenario plans

The Authority plans to encourage mixed use of all co-primary users i.e., Fixed, Mobile, and Mobile-Satellite. Given that there is an existing RFSAP, the key scenario here is to ensure its feasibility considering the emerging trends.

15.6. Economic feasibility analysis

This band is currently unoccupied, and the Authority proposes a scenario in which it is shared between all co-primary users. This includes IMT Satellite, which provides users with telecommunication services outside those areas covered by the terrestrial component.[242] While these services may not be widely used currently, there may be greater use for these applications in the future. Since the band is currently unoccupied, there are unlikely to be any costs associated with migrating users out of the band. Stakeholders are encouraged to comment on any costs involved with migrating out of the band, and the benefits of using the band for the services proposed here or any other alternative services.

15.7. Summary proposals arriving out of feasibility study

The Authority plans to encourage mixed use of all co-primary users i.e., Fixed, Mobile, and Mobile-Satellite.

[242] Radio Frequency Spectrum Assignment Plan for the frequency band 1518 to 1525 MHz.