TANZANIA COMMUNICATIONS REGULATORY AUTHORITY

RADIO FREQUENCY BAND PLAN FOR INTERNATIONAL MOBILE TELECOMMUNICATION (IMT) SYSTEM

First Version

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RADIO FREQUENCY BAND PLAN FOR INTERNATIONAL MOBILE TELECOMMUNICATION (IMT) SYSTEM

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PART 1: Acronyms and Abbreviations

For the purpose of this document, the following abbreviation applies: -

2G	Second Generation of Mobile Networks
3G	Third Generation of Mobile Networks
3GPP	3rd Generation Partnership Project
4G	Fourth Generation of Mobile Networks
5G	Fifth Generation of Mobile Networks
ARFCN	Absolute Radio Frequency Channel Number
BS	Base Station
DL	Downlink
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
EARFCN	E-UTRA Absolute Radio Frequency Channel Number
FDD	Frequency Division Duplex
GSM	Global System for Mobile Communications
HSPA	High Speed Packet Access
IMT	International Mobile Telecommunications
ITU	International Telecommunication Union
LTE	Long Term Evolution
NR	New Radio
OFDMA	Orthogonal Frequency Division Multiple Access
SMS	Short Messaging Services
TCRA	Tanzania Communications Regulatory Authority
TDD	Time Division Duplex
WCDMA	Wideband Code Division Multiple Access
WRC	World Radio Conference
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunications System
UTRA	Universal Terrestrial Radio Access
UARFCN	UTRA Absolute Radio Frequency Channel Number

PART 2: Definition of Terms

Centre gap	The frequency separation between the upper edge of the lower band and the lower edge of the upper band in an FDD paired frequency arrangement.
Duplex band frequency separation	The frequency separation between a reference point in the lower band and the corresponding point in the upper band of an FDD arrangement.
Duplex channel frequency separation	The frequency separation between a specific channel carrier in the lower band and its paired channel carrier in the upper band of an FDD arrangement.
Conventional duplex arrangement	Duplex arrangement with mobile terminal transmit within the lower band and base station transmit within the upper band.
Reverse duplex arrangement	Duplex arrangement with the mobile terminal transmit within the upper band and base station transmit within the lower band.
Frequency Division Duplexing	Duplex technique where the traffic in each direction of a two-way telecommunications link is carried on two different carrier frequencies, each dedicated to the traffic in one direction.
Time Division Duplexing	Transmission scheme that allows an asymmetric flow for uplink and downlink transmission which is more suited to data transmission. In a Time, Division Duplex system, a common carrier is shared between the uplink and downlink, the resource being switched in time. Users are allocated one or more timeslots for uplink and downlink transmission.

PART 3: Introduction

The Tanzania Communications Regulatory Authority (TCRA) Act of 2003, and Electronic and Postal Communications Act of 2010, mandate TCRA to manage, assign and promote the efficient use of the radio frequency spectrum resource in the United Republic of Tanzania.

The radio frequency spectrum is part of electromagnetic waves propagated in space and used as a communication medium for all wireless systems. The radio frequency spectrum is a valuable, scarce public resource and thus subject to transparent, predictable and coherent governing policies, legislations and regulations. It requires proper and timely management in order to accommodate the current and future emerging technologies.

According to the ITU, International Mobile Telecommunications (IMT) systems are mobile systems that provide access to a wide range of telecommunication services including advanced mobile services, supported by mobile and fixed networks, which are increasingly packet-based.

The term “IMT” is the name that collectively applies to “IMT-2000”, “IMT-Advanced”, “IMT-2020” and “IMT-2030”.

IMT-2000 (3G)

UMTS is an umbrella term for the third generation radio technologies developed by the 3GPP as part of IMT-2000. UMTS specifies a complete network system, for which the radio access component, known as UTRAN, uses WCDMA technology to offer greater spectral efficiency and bandwidth to mobile network operators. The system also includes the Core Network; the entity that interfaces to external networks including the public phone network and other cellular telecommunications networks.

IMT-Advanced (4G)

4G LTE (Long Term Evolution) or the E-UTRAN (Evolved Universal Terrestrial Access Network), introduced in 3GPP Rel. 8, is the radio access component of the Evolved Packet System (EPS) - a purely IP based mobile network standard. As an evolution to 3G UMTS, 4G LTE shares many similarities, such as harmonised frequency bands, but also many substantial technological advancements. LTE is based on OFDMA (Orthogonal Frequency

Division Multiple Access) and in combination with higher order modulation, large bandwidths, and spatial multiplexing (MIMO) techniques very high data rates can be achieved.

IMT-2020 (5G)

IMT-2020 systems are mobile systems that include the new capabilities of IMT that go beyond those of IMT-Advanced. IMT-2020 systems support low to high mobility applications and a wide range of data rates in accordance with user and service demands in multiple user environments. The key design principles are flexibility and diversity to serve many different use cases summarized in three usage scenarios.

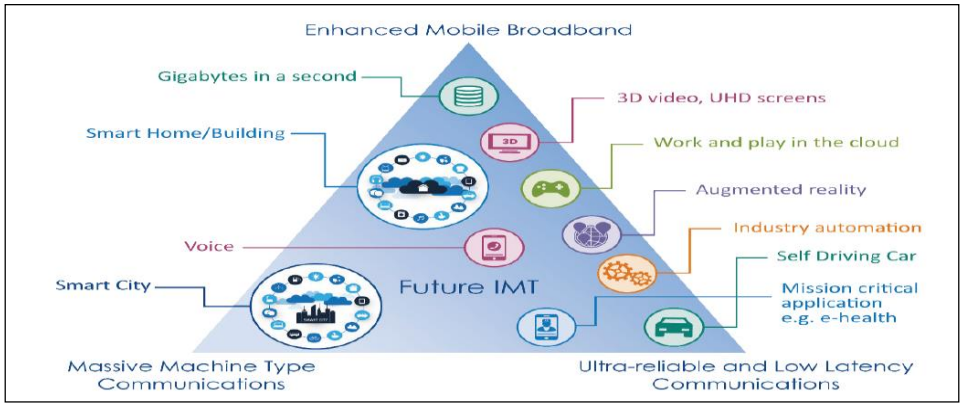


Figure 1 : IMT-2030 (5G) Usage Scenario

IMT-2030 (6G)

IMT-2030 systems are mobile systems that include the new capabilities of IMT that go beyond those of IMT-2020. The IMT-2030 extends three (3) usage scenarios for IMT-2020 and add three (3) usage scenarios

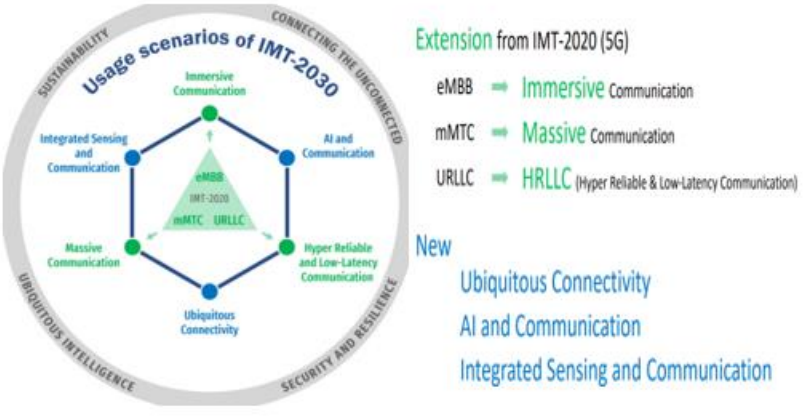


Figure 2 : IMT-2030 Usage Scenario

The radio frequency band plan for IMT is in line with allocations under the National Frequency Allocation Plan (NFAP), International Telecommunication Union (ITU) Region 1 and most

adopted frequency channelization plan as a results of harmonising the spectrum. Harmonization of spectrum for IMT lead to commonality of equipment and is desirable for achieving economies of scale and affordability of equipment.

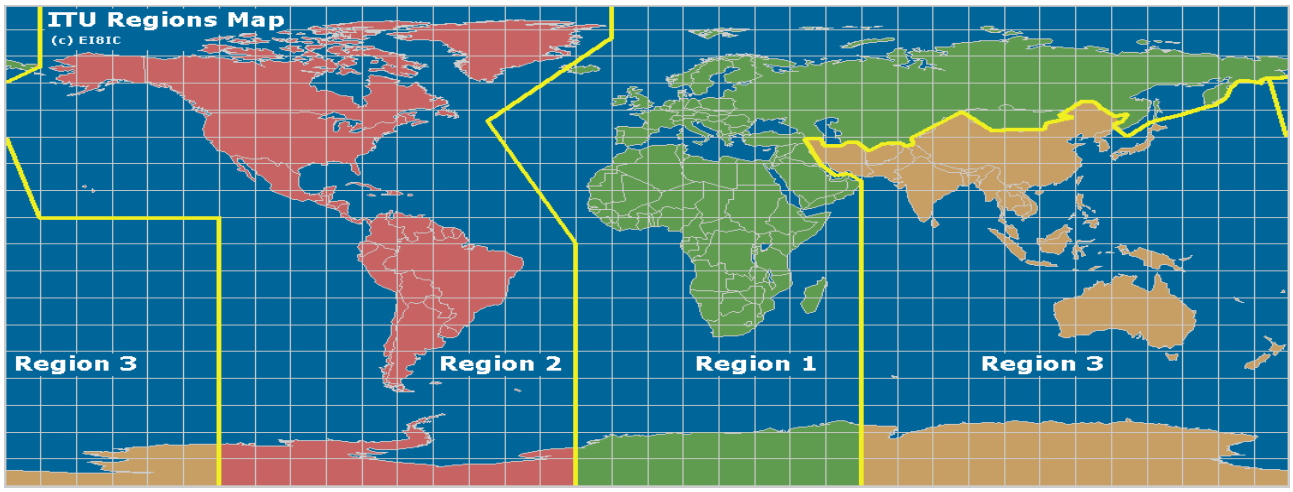


Figure 3 : ITU Regions

The Plan is complemented by ITU-R Recommendations and Reports on IMT that provide additional details on a number of aspects including unwanted emission characteristics for the bands addressed in this plan and radio interface specifications.

PART 4: Scope and Purpose

This document provides radio frequency spectrum plan for terrestrial component of International Mobile Telecommunication (IMT)[11] systems in the United Republic of Tanzania.

The purpose of the plan is to provide assistance to operators and other stakeholders on the use these bands for smooth and interference free operation of in the country.

[1] International Mobile Telecommunications (IMT) encompasses IMT-2000, IMT-Advanced and IMT-2020, as specified in Resolution ITU-R 56-3.

PART 5: ITU Related Recommendations and Reports on IMT

Recommendation ITU-R M.687	International Mobile Telecommunications-2000 (IMT-2000)
Recommendation ITU-R M.816	Framework for services supported on International Mobile Telecommunications-2000 (IMT-2000)
Recommendation ITU-R M.818	Satellite operation within International Mobile Telecommunications-2000 (IMT-2000)
Recommendation ITU-R M.819	International Mobile Telecommunications-2000 (IMT-2000) for developing countries
Recommendation ITU-R M.1033	Technical and operational characteristics of cordless telephones and cordless telecommunication systems
Recommendation ITU-R M.1034	Requirements for the radio interface(s) for International Mobile Telecommunications-2000 (IMT-2000)
Recommendation ITU-R M.1035	Framework for the radio interface(s) and radio sub-system functionality for International Mobile Telecommunications-2000 (IMT-2000)
Recommendation ITU-R M.1073	Digital cellular land mobile telecommunication systems
Recommendation ITU-R M.1167	Framework for the satellite component of International Mobile Telecommunications-2000 (IMT-2000)
Recommendation ITU-R M.1224	Vocabulary of terms for International Mobile Telecommunications (IMT)
Recommendation ITU-R M.1308	Evolution of land mobile systems towards IMT-2000
Recommendation ITU-R M.1390	Methodology for the calculation of IMT-2000 terrestrial spectrum requirements
Recommendation ITU-R M.1457	Detailed specifications of the radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)
Recommendation ITU-R M.1579	Global circulation of IMT terrestrial terminals
Recommendation ITU-R M.1580	Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-2000
Recommendation ITU-R M.1581	Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-2000
Recommendation ITU-R M.1645	Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000
Recommendation ITU-R M.1768	Methodology for calculation of spectrum requirements for the terrestrial component of International Mobile Telecommunications

Recommendation ITU-R M.1797	Vocabulary of terms for the land mobile service
Recommendation ITU-R M.1822	Framework for services supported by IMT
Recommendation ITU-R M.2012	Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (IMT-Advanced)
Recommendation ITU-R M.2015	Frequency arrangements for public protection and disaster relief radiocommunication systems in accordance with Resolution **646 (Rev.WRC-15)**
Recommendation ITU-R M.2070	Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-Advanced
Recommendation ITU-R M.2071	Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-Advanced
Recommendation ITU-R M.2083	IMT Vision – "Framework and overall objectives of the future development of IMT for 2020 and beyond"
Recommendation ITU-R M.2090	Specific unwanted emission limit of IMT mobile stations operating in the frequency band 694-790 MHz to facilitate protection of existing services in Region 1 in the frequency band 470-694 MHz
Recommendation ITU-R M.2150	Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2020 (IMT-2020)
Recommendation ITU-R SM.329	Unwanted emissions in the spurious domain
Report ITU-R M.2030	Coexistence between IMT-2000 time division duplex and frequency division duplex terrestrial radio interface technologies around 2 600 MHz operating in adjacent bands and in the same geographical area
Report ITU-R M.2031	Compatibility between WCDMA 1800 downlink and GSM 1900 uplink
Report ITU-R M.2038	Technology trends
Report ITU-R M.2041	Sharing and adjacent band compatibility in the 2.5 GHz band between the terrestrial and satellite components of IMT-2000
Report ITU-R M.2045	Mitigating techniques to address coexistence between IMT-2000 time division duplex and frequency division duplex radio interface technologies within the frequency range 2 500-2 690 MHz operating in adjacent bands and in the same geographical area
Report ITU-R M.2072	World mobile telecommunication market forecast
Report ITU-R M.2078	Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT-Advanced
Report ITU-R M.2109	Sharing studies between IMT-Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands

Report ITU-R M.2110	Sharing studies between radiocommunication services and IMT systems operating in the 450-470 MHz band
Report ITU-R M.2113:	Report on sharing studies in the 2 500-2 690 MHz band between IMT-2000 and fixed broadband wireless access systems including nomadic applications in the same geographical area
Report ITU-R M.2320	Future technology trends of terrestrial IMT systems
Report ITU-R BT.2337	Sharing and compatibility studies between digital terrestrial television broadcasting and terrestrial mobile broadband applications, including IMT, in the frequency band 470-694/698 MHz
Report ITU-R BT.2339	Co-channel sharing and compatibility studies between digital terrestrial television broadcasting and international mobile telecommunication in the frequency band 694-790 MHz in the GE06 planning area
Report ITU-R S.2368	Sharing studies between International Mobile Telecommunication-Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 MHz and 4 500-4 800 MHz frequency bands in the WRC study cycle leading to WRC-15
Report ITU-R M.2374	Coexistence of two TDD networks in the 2 300-2 400 MHz band
Report ITU-R M.2375	Architecture and topology of IMT networks
Report ITU-R M.2481	In-band and adjacent band coexistence and compatibility studies between IMT systems in 3 300-3 400 MHz and radiolocation systems in 3 100-3 400 MHz

PART 6: IMT Bands and Frequency Arrangements

6.1 700 MHz Band

UPLINK (BS receive, UE transmit)	CENTER GAP	DOWNLINK (BS transmit, UE receive)

703 **733** **758** **788 MHz**

Frequency arrangements details	
Uplink Frequency (MHz)	703 - 733
Downlink Frequency (MHz)	758 - 788
Duplex Separation (MHz)	55
Centre Gap (MHz)	25
UL EARFCN (4G)	27210 - 27659
DL EARFCN (4G)	9210 - 9659
Supported Channel Bandwidth (MHz)	5, 10, 15, 20

The 3GPP lower B28 (700 MHz) LTE band is used by Mobile Network Operators (MNOs) for LTE network deployments, and is excellent for wide area coverage in regional and rural environments, for in-building coverage. MNOs have flexibility to deploy LTE using B28 as a single band or as part of a multi-band network. LTE-A or LTE-Advanced Pro technologies can be deployed using carrier aggregation to combine various bandwidths of B28 with other bands.

6.2 800 MHz Band

DOWNLINK (BS transmit, UE receive)	CENTER GAP	UPLINK (BS receive, UE transmit)

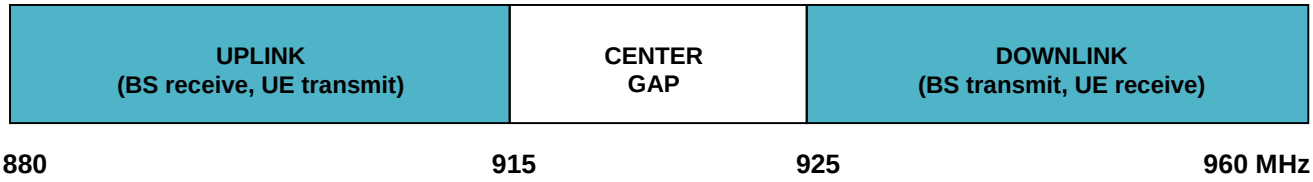
791 **821** **832** **862 MHz**

Frequency arrangements details	
Uplink Frequency (MHz)	832 - 862
Downlink Frequency (MHz)	791 - 821
Duplex Separation (MHz)	41
Centre Gap (MHz)	11
UL EARFCN (4G)	24150 - 24449
DL EARFCN (4G)	6150 - 6449
Supported Channel Bandwidth (MHz)	5, 10, 15, 20

The 3GPP B20 (800 MHz) LTE band is used by mobile network operators for LTE network deployments, and is excellent for wide area coverage in regional and rural environments, for in-building coverage. It is also referred as Digital Dividend Band I (DDBI).

Mobile Operators have flexibility to deploy LTE using B20 as a single band or as part of a multi-band network. LTE-A or LTE-Advanced Pro technologies can be deployed using carrier aggregation to combine various bandwidths of B20 with other bands.

6.3 900 MHz Band



Frequency arrangements details	
Uplink Frequency (MHz)	880 - 915
Downlink Frequency (MHz)	925 - 960
Duplex Separation	45
Centre Gap (MHz)	10
UL EARFCN (4G)	21450 - 21799
DL EARFCN (4G)	3450 - 3799
UL UARFCN (3G)	2712 - 2863
DL UARFCN (3G)	2937 - 3088
Supported Channel Bandwidth (MHz)	0.2, 1.4, 3, 5, 10

The 3GPP Band 8 (900 MHz) is used globally for 2G GSM basic services such as voice, SMS and basic data mobile communications. Technology-neutral licensing framework enabled 900 MHz to become a mainstream spectrum of choice for IMT especially 3G and 4G. Using 900 MHz for LTE is gaining traction amongst mobile network operators refarming unused and underutilised spectrum in some geographical areas. Operators are known to have commercially launched LTE mobile broadband service in 900 MHz (band 8) spectrum

(LTE900), either as a single band system, or as part of a multi-band deployment, many of the latter using LTE-Advanced carrier aggregation technology to deliver higher speeds for users.

6.4 1800 MHz Band

UPLINK (BS receive, UE transmit)	CENTER GAP	DOWNLINK (BS transmit, UE receive)

1710 **1785** **1805** **1880 MHz**

Frequency arrangements details	
Uplink Frequency (MHz)	1710 - 1785
Downlink Frequency (MHz)	1805 - 1880
Duplex Separation	95
Centre Gap (MHz)	20
UL EARFCN (4G)	19200 - 19949
DL EARFCN (4G)	1200 - 1949
Supported Channel Bandwidth (MHz)	1.4, 3, 5, 10, 15, 20

Far more LTE networks have been deployed at 1800 MHz (3GPP Band 3) than in any other frequency band. The band has the largest LTE user devices ecosystem.

Mobile Network Operators are re-farming the existing assigned spectrum assets in 1800 MHz, to deploy more efficient LTE technology outdoors and indoors that enables enhanced mobile broadband capabilities to be rolled out faster, and to support more customers with a better user experience.

6.5 2100 MHz Band

1920 **1980** **2110** **2170 MHz**

Frequency arrangements details	
Uplink Frequency (MHz)	1920 - 1980
Downlink Frequency (MHz)	2110 - 2170
Duplex Separation (MHz)	190
Centre Gap (MHz)	20
UL EARFCN (4G)	18000 - 18599
DL EARFCN (4G)	0 - 599
UL UARFCN (3G)	9612 - 9888
DL UARFCN (3G)	10562 - 10838
Supported Channel Bandwidth (MHz)	5, 10, 15, 20

3GPP Band 1, also known as the IMT band, is the world's most popular 3G UMTS frequency band. The 2100 MHz band 1 spectrum provides a good compromise between capacity/density and penetration/range.

Mobile carriers have flexibility to deploy LTE using band 1 as a single band or as part of a multi-band network. LTE-A or LTE-Advanced Pro technologies can be deployed using carrier aggregation to combine various bandwidths of band 1 with other bands.

6.6 2300 MHz Band

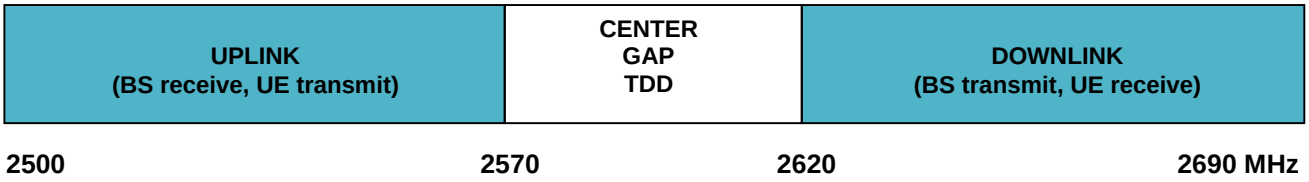
2300 **2400 MHz**

Frequency arrangements details	
Uplink/Downlink Frequency (MHz)	2300 - 2400
UL/DL EARFCN (4G)	38650 - 39649
Supported Channel Bandwidth (MHz)	5, 10, 15, 20

The 3GPP B40 (2300 MHz) TDD LTE band is used by public mobile operators for LTE network deployments, and is typically deployed due to the wide availability of spectrum and its short-range permits deployment dense coverage for maximum capacity.

Mobile network operators have flexibility to deploy LTE using B40 as a single band or as part of a multi-band network. LTE-A or LTE-Advanced Pro technologies can be deployed using carrier aggregation to combine various bandwidths of B40 with other bands.

6.7 2600 MHz Band



Frequency arrangements details	
Uplink Frequency (MHz)	2500 - 2570
Downlink Frequency (MHz)	2620 - 2690
Duplex Separation (MHz)	120
Centre Gap (MHz)	50
UL EARFCN (4G)	20750 - 21449
DL EARFCN (4G)	2750 - 3449
UL/DL EARFCN (4G)	37750 - 38249
Supported Channel Bandwidth (MHz)	5, 10, 15, 20

The 3GPP B7 (2600 MHz) LTE band is used by public mobile operators for LTE network deployments. Mobile network operators have flexibility to deploy LTE using band 7 as a single band or as part of a multi-band network. LTE-A or LTE-Advanced Pro technologies can be deployed using carrier aggregation to combine various bandwidths of B7 with other bands.

6.8 3500 MHz Band

UPLINK / DOWNLINK (BS transmit and receive, UE transmit and receive)

3300 **3600 MHz**

Frequency arrangements details	
Uplink/Downlink Frequency (MHz)	3300 - 3600
UL/DL NR-ARFCN (5G)	620000 - 653333
Supported Channel Bandwidth (MHz)	10 15 20 30 40 50 60 70 80 90 100

The band is considered high priority for 5G (NR) technology. This spectrum has become a cornerstone of 5G in many parts of the world as it offers a good balance between coverage and capacity

6.9 3600 MHz Band

UPLINK / DOWNLINK (BS transmit and receive, UE transmit and receive)

3600 **3800 MHz**

Frequency arrangements details	
Uplink/Downlink Frequency (MHz)	3600 - 3800
UL/DL NR-ARFCN (5G)	620000 - 653333
Supported Channel Bandwidth (MHz)	10 15 20 30 40 50 60 70 80 90 100

6.10 26 GHz Band

UPLINK / DOWNLINK (BS transmit and receive, UE transmit and receive)

24.250 **27.500 GHz**

Frequency arrangements details	
Uplink/Downlink Frequency (GHz)	24.25 – 27.5
UL/DL NR-ARFCN (5G)	2016667 - 2070833
Supported Channel Bandwidth (MHz)	50, 100, 200, 400

6.11 40 GHz Band

UPLINK / DOWNLINK (BS transmit and receive, UE transmit and receive)

37 **43.5 GHz**

Frequency arrangements details	
Uplink/Downlink Frequency (GHz)	37 – 43.5
UL/DL NR-ARFCN (5G)	2229167 - 2279166
Supported Channel Bandwidth (MHz)	50, 100, 200, 400

6.12 66 GHz Band

UPLINK / DOWNLINK (BS transmit and receive, UE transmit and receive)

66 **71 GHz**

Frequency arrangements details	
Uplink/Downlink Frequency (GHz)	66 - 71
UL/DL NR-ARFCN (5G)	
Supported Channel Bandwidth (MHz)	50, 100, 200, 400

PART 7: Document Administration

7.1 Amendment

TCRA may from time-to-time, review, and update or modify this document to ensure its continued service and to meet the international and/or national performance requirements as necessary.

7.2 Compliance

Appropriate provisions of the TCRA Act, 2003, the Electronic and Postal Communications Act, 2010 and the Electronic and Postal Communications (Radiocommunication and

Frequency Spectrum) Regulations, 2018, shall be used for compliance of this document and effective from the date it has been published.

7.3 Publication

This document shall be published on the TCRA website https://www.tcra.go.tz for public information, compliance and reference purposes.

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