PUBLIC CONSULTATION DOCUMENT

ON

DRAFT NATIONAL 5G STRATEGY

Draft 1.0

18 September 2023
National Communications Authority
Federal Republic of Somalia

Table of Contents

Consultation Guideline

NCA invites Stakeholders and interested parties to provide valuable input and perspectives on the questions raised in **section 11 of this consultation document**. The NCA's board of directors approved on 24 September 2022, the spectrum plan for the 2G, 3G, and 4G (https://nca.gov.so/wp-content/uploads/2022/10/Radio-Spectrum-Assignment-Plan-for-Mobile-and-Fixed-Communication-Networks_Approved_2022.pdf), instructing the NCA to develop a unique strategy for the 5G Spectrum allocations.

As a result, NCA invites the stakeholders to share their opinions and comments on any aspect of the consultation document. When responding, it is requested that interested parties provide relevant background information, context, and supporting materials while explicitly referencing the corresponding paragraph or question number. This approach will enable the regulatory authority to understand the reasons behind the respondents' viewpoints and effectively consider them during decision-making.

The regulatory authority will thoroughly review and carefully consider each response received about this consultation.

To ensure transparency and accountability, the NCA will publish the public responses to this consultation on its official website, www.nca.gov.so, unless the answers are marked confidential.

Kindly send all your responses and comments to this email: **consultation@nca.gov.so**

The deadline to submit responses is 2 November 2023

1. Executive Summary

The National Communications Authority of Somalia (NCA) has developed a draft National 5G Strategy to drive transformative changes in Somalia by establishing comprehensive connectivity, stimulating economic growth and innovation, developing effective regulatory frameworks, fostering research leadership, and delivering societal benefits. The strategy focuses on the nationwide deployment of 5G infrastructure to achieve comprehensive connectivity, ensuring access to affordable high-speed internet and advanced communication services across all regions. The strategy seeks to create equal opportunities for citizens and promote inclusivity by bridging the digital divide.

On September 24, 2022, the Board of Directors of the National Communications Authority (NCA) directed the NCA management to formulate a unique strategy for allocating the 5G spectrum and developing its infrastructure. The decision was part of the spectrum plan of the 2G, 3G, and 4G approved by the NCA's board of directors (https://nca.gov.so/wp-content/uploads/2022/10/Radio-Spectrum-Assignment-Plan-for-Mobile-and-Fixed-Communication-Networks_Approved_2022.pdf). The NCA will conduct a comprehensive stakeholder consultation regarding the proposed methods for the 5G implementation in Somalia.

The strategy recognizes the potential of 5G technology to fuel economic growth and foster innovation. It aims to attract investments and facilitate industry transformation through technological advancements, enhancing productivity, competitiveness, and job creation. By fostering an enabling environment for 5G deployment, the strategy positions Somalia as a hub for innovation and supports the growth of local technology companies. Effective regulation and policy frameworks are vital to the success of 5G implementation. The strategy emphasizes the development of robust regulatory frameworks that ensure fair competition, consumer protection, and adherence to spectrum management, data security, and privacy regulations. The strategy promotes a stable and secure 5G ecosystem by providing clear guidelines and standards.

The strategy also acknowledges the significance of research and development in driving 5G innovation. It aims to foster collaboration in research and position Somalia as a leader in 5G advancements. By encouraging research partnerships and supporting local technology companies, the strategy harnesses the full potential of 5G technology to drive technological growth and socio-economic progress. The strategy's key focus is the societal benefits derived from 5G deployment. It highlights the transformative potential of 5G in sectors such as healthcare, public safety, energy, and urban development. By leveraging 5G technology for advanced healthcare services, improved public safety measures, sustainable energy initiatives, and innovative city applications, the strategy aims to enhance the overall quality of life for the people of Somalia.

The strategy also addresses the critical aspect of spectrum requirements for 5G deployment. Based on the provisions of the National Communication Law, the plan outlines the need for a substantial amount of harmonized spectrum, both in the mid-bands and high-bands, to support 5G services. It emphasizes the importance of ecosystem maturity, including user devices and network equipment readiness, to ensure the country's booming and timely deployment of 5G.

To facilitate the development and deployment of innovative 5G technologies, services, and applications, the strategy explores the establishment of 5G regulatory sandboxes. These controlled environments enable testing, experimentation, and collaboration among the National Communication Authority (NCA), industry players, and technology providers. The sandboxes aim to identify technical challenges, address regulatory gaps, and facilitate the smooth adoption of 5G technology.

Furthermore, the strategy considers various options for 5G infrastructure deployment, including leveraging the networks and services of existing telecom operators, implementing public-private partnerships, or forming consortia among operators. The strategy acknowledges the need for flexibility in infrastructure deployment to meet diverse requirements and ensure efficient and reliable connectivity.

The National Communications Authority of Somalia undertakes a consultative approach to establish the National 5G Strategy, which provides a comprehensive framework to unlock the potential of 5G technology in Somalia. The strategy paves the way for the nation's transformative and inclusive digital future by addressing connectivity, economic growth, regulation, research, and societal benefits.

2. Introduction

The National Communications Authority (NCA) of Somalia, established under the Communications Act of 2017, is the regulatory body responsible for overseeing the communications sector in the country's implementation of the National Communications law and the Ministry of Communications and Technology policies. With a mandate to regulate various aspects of the industry, including telecommunications, Internet, broadcasting, Information and Communications Technology (ICT), and e-commerce services, the NCA aims to foster the development of the ICT industry, promote fair competition, ensure transparency, protect consumer interests, and maintain its role as an independent regulator. In line with its commitment to managing spectrum resources and facilitating the countrywide development of 5G infrastructure, the NCA has formulated a comprehensive 5G strategy for Somalia. This strategy is designed to leverage the potential of the fourth industrial revolution, commonly known as Industry 4.0. By harnessing the capabilities of 5G technology, the NCA aims to support and enhance the advancements associated with Industry 4.0.

"On September 24, 2022, the Board of Directors at the National Communications Authority (NCA) took a significant step by instructing NCA management to craft a dedicated strategy. This strategy is designed to oversee the allocation of the 5G spectrum and the subsequent development of its supporting infrastructure. This directive forms an integral part of the broader spectrum plan endorsed by the NCA Board for the 2G, 3G, and 4G, available for reference at [https://nca.gov.so/wp-content/uploads/2022/10/Radio-Spectrum-Assignment-Plan-for-Mobile-and-Fixed-Communication-Networks_Approved_2022.pdf]

5G, the fifth generation of wireless technology for cellular networks, represents a significant leap forward compared to its predecessors. It substantially improves data transfer speed, latency, capacity, and connectivity. By enabling faster and more reliable wireless connections, 5G facilitates seamless communication between devices, machines, and systems, crucial for the efficient functioning of various Industry 4.0 technologies that rely on real-time data exchange and collaboration. Furthermore, 5G provides the necessary infrastructure to accommodate the anticipated proliferation of IoT devices in the Fourth Industrial Revolution. With its high capacity and low latency, 5G enables seamless connectivity and communication among many IoT devices, promoting advanced automation and intelligent decision-making.

The high-speed and low-latency capabilities of 5G also enable real-time data collection, transmission, and analysis. This empowers businesses to gather and process real-time data from sensors, machines, and other connected devices. The availability of real-time data facilitates predictive analytics, machine learning, and AI applications, driving optimized operations, improved efficiency, and better decision-making. Moreover, 5G networks facilitate the deployment of edge computing infrastructure, which brings data processing and storage closer to the network's

edge. By reducing latency and enabling faster response times, edge computing combined with 5G becomes critical for time-sensitive applications such as autonomous vehicles, smart grids, and remote healthcare. It allows for data processing and analysis at the network's edge, minimizing the need to transmit large volumes of data to centralized cloud servers.

The NCA's 5G strategy aligns with the National Communications Law, the spectrum policy of the Ministry of Communications and Technology, spectrum regulations, and the NCA's strategic plan for 2023-2027. By implementing this strategy, Somalia aims to capitalize on the transformative potential of 5G technology, supporting the country's technological development and embracing the opportunities presented by the Fourth Industrial Revolution.

3. Strategic Goals

The 5G strategy will achieve the following goals:

a) Comprehensive Connectivity: Establish countrywide 5G infrastructure, ensuring access in all areas and bridging the digital divide for affordable high-speed internet and advanced communication services.
b) Economic Growth and Innovation: Leverage 5G to stimulate economic growth, attract investments, and transform industries through innovation, enhancing productivity, competitiveness, and job creation.
c) Effective Regulation and Policy: Develop robust regulatory frameworks and policies that support 5G deployment, ensuring fair competition, consumer protection, and adherence to spectrum management, data security, and privacy regulations.
d) Research Leadership: Foster collaboration in research and development to position Somalia as a 5G innovation leader, driving technological advancements and supporting the growth of local technology companies.
e) Societal Benefits and Quality of Life: Harness 5G's potential to deliver societal benefits, such as advanced healthcare, improved public safety, sustainable energy initiatives, and innovative city applications, enhancing the overall quality of life for citizens.

4. 5G The Network of the Future and Its Socio-economic Impact

We are currently experiencing the Fourth Industrial Revolution, characterized by transformative technologies that have the potential to enhance global competitiveness, drive economic growth, achieve sustainable development goals, and reshape social behavior. Disruptive technologies such as the Internet of Things, artificial intelligence, data analytics, automation, robotics, cloud computing, virtual and augmented reality, 3D printing, and drones play a pivotal role in this industrial and social revolution.

However, the true power of these technologies lies in hyperconnectivity—a seamless, secure, and reliable network that enables continuous, high-capacity, high-speed connections between individuals and machines. The fifth generation of mobile technologies, 5G, is a crucial catalyst for this transformation. By delivering wireless broadband services at gigabit speeds, facilitating Internet of Things connections, and offering software virtualization for versatile applications, 5G empowers industrial advancements and fosters innovative business models.

5G applications can be classified into 16 vertical groups, which are listed below:

Agriculture	Automobiles and road transport	Drones	Education
Health	Energy	Fixed wireless access	4.0 Industry
Media and entertainment	Public safety	Smart buildings	Smart Cities
Smart public services	Tourism	Transport	Virtual Reality

Each corresponds to a sector of activity or socio-economic sphere that will undergo fundamental transformative changes thanks to access to 5G services and technologies. In these sectors, 5G will positively impact aspects such as the improvement of competitiveness, productivity, efficiency in the use of productive resources, or terms of more excellent quality or performance of the products or services generated in these sectors and areas. Among these verticals, this strategy will promote the application of 5G within the vertical sectors in which "National ICT Policy 2019-2024" promotes sectorial digitalization projects (agri-food, mobility, health, and trade).
Thus, in the industrial field, 5G will be the leading enabler of digital transformation and a key enabler in the ecological transition in mobility, manufacturing, health, energy, agroindustry, and entertainment.

5G Use Cases (IMT-2020 is supported by five (5) critical functional drivers, namely**):**

a) **Enhanced Mobile Broadband (eMBB)** for faster data connections, higher throughput, greater capacity (up to 10 Gbps), and extended mobile coverage with the Ability to support a higher number of devices using high amounts of data. This driver addresses the requirements for human-centric use cases requiring access to multimedia Content, services, and data.

b) **Ultra-reliable low latency communication (uRLLC)** for time-sensitive connections providing for reduced latency for data uploaded from a device to reach its target (1ms On 5G compared to 10ms on 4G). This driver requires stringent requirements with respect
of latency, throughput, and availability to enable wireless control of manufacturing processes, remote medical surgery, and automation of electricity distribution amongst Other uses.

c) **Massive machine-type communications (mMTC)** are characterized by many devices connected to the network providing for data-intensive applications transmitting low-volume data. This driver relies on small-cell deployment and spectral efficiency within networks.

d) **Energy efficiency** leading to lower costs is realized on the network via the quantity. of information transmitted to or received from users per unit of energy consumption Of the radio access network. Similarly, energy efficiency on communications devices It is measured based on the quantity of information per power consumption unit. These drivers support smart electricity grids and metering, industrial automation, Smart consumer wearables, to name but a few use cases.

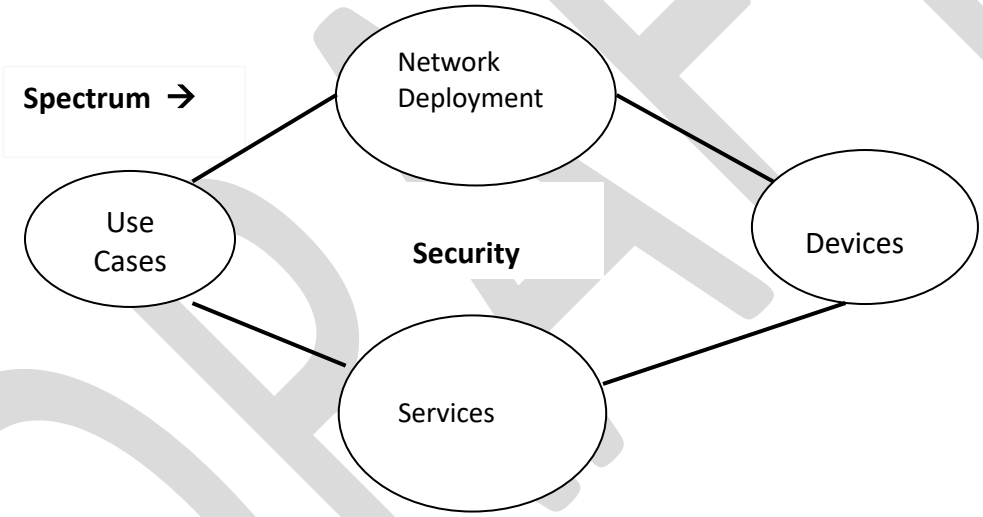
e) **Security** within networks, platforms, and applications leads to high reliability and availability and is a central driver to the adoption of 5G by end users and private and Public institutions.

Table 1: Functional drivers for successful implementation of (5G)

Functional Drivers	Applications
Enhanced Mobile Broadband (eMBB)	Fixed and mobile wireless access services, public protection and disaster response services, massive content streaming services, remote examinations, remote surgery, enhanced in-building broadband services, high-definition cloud gaming, real-time virtual and mixed reality services, etc.
Ultra-reliable Low Latency Communications (uRLLC)	Autonomous vehicles, drones and robotic applications, health monitoring systems /tele health, smart electricity/water grid and metering, factory automation, mission critical security and safety services, high definition real-time gaming, etc.
Security	
Massive Machine-Type Communications (mMTC)	Asset tracking, smart cities and building, e agriculture, energy/utility management, industrial automation, smart consume wearables, environmental managements, intelligent surveillance, smart retail services, smart electricity/water grid and metering, etc.
Power efficiency	

5. Implantation of 5G Technology

Implementation of 5G provides a perpetually increasing number of applications and services to add to the services and applications already provided by current telecommunications networks. While services historically focussed on the mass market, the new capabilities inherent to 5G will offer the ability to develop new applications and services for specific segments within and external to the ICT industry. It is, therefore, necessary to assess the entire 5G ecosystem to ensure sustainable implementation by analyzing the functional drivers to benefit from new technologies and to understand the interdependencies between critical areas of this ecosystem such as spectrum, core and access network deployment, use cases and services, devices, and security.



Source: IMF, 2020

a. 5G Core Network deployment

Different telecommunications service licensees will have different approaches to deploying 5G depending on the existing capabilities of their networks. The 5G network equipment has been designed to interwork existing 4G networks at core and radio access network levels.

The industry has adopted two standardized approaches, namely: -

I) Non-standalone (NSA) 5G network deployment whereby the 5G radio access network connects to and is controlled by the existing 4G core network. Software and hardware within the legacy 4G radio network will need to be upgraded to

support 5G spectrum frequency bands to aggregate processing capacity as required by 5G and to support antenna systems for multiple-input and multiple-output (MIMO). This approach does not require the implementation of a 5G core network, and

II) Standalone (SA) 5G network deployment whereby the 5G radio access network only connects to the 5G core network. The 5G core network integrates with the legacy 4G core network at the network level. The SA 5G network deployment will allow telecommunications service licensees to fully utilize 5G radio equipment and new core network capabilities like network slicing. This approach to network deployment will provide for optimal implementation of 5G technologies.

The features supported by SA deployment of 5G networks will support new services in that: -

A) **Network slicing** allows for creating dedicated virtual networks over a shared physical network infrastructure. This 5G feature allows telecommunications network operators to address specific quality of service requirements of customers depending on the use case, e.g., e-agriculture applications have different needs from e-health and e-educations applications. This network feature will also provide enhanced connectivity for mission-critical services deployed in public safety networks and

B) Virtualization of the network will support faster service provisions and enhance network maintenance in that 5G networks will allow for the division of hardware resources into functions that can be controlled by software. Centralization of control functions enables routing decisions globally to fit specific requirements and provides end-to-end network visibility for establishing and maintaining connectivity.

b. 5G Access Network Deployment

i. **Site Deployment:** Deployment of IMT-2020 (5G) networks may require denser network deployments, potentially increasing the number of base stations and towers. To this end, telecommunications service licenses will be needed to improve 5G site deployment efficiency by sharing resources such as antennas, power, and transmission and minimizing site infrastructure reconstruction.

ii. Backhaul transmission deployment: telecommunications service licensees will face their biggest challenge in providing sufficient backhaul transmission from sites to the core network to support growing mobile data traffic. Suppose backhaul capacity is not provided for during the 5G rollout. In that case, it will result in a bottleneck that may lead to a market failure for 5G. Therefore, the backhaul transmission network is critical in deciding on a 5G implementation model.

A) **Fiber backhaul deployment:** fiber backhaul provides stable connections with very high interference immunity and is suitable for deployment to support

outdoor sites, access networks, and core network implementation. Fibre is considered the preferred backhaul technology for 5G Networks. The cost of fiber deployment may decrease with increasing competition and economies of scale. The relatively high price and period for fiber installation related to trenching, installing ducts, and deployment of physical cables to date means that use will be limited.

B) **Microwave backhaul deployment:** Microwaves can support 5G cell sites at a lower cost within the spectrum bands 7-40GHz, 70/80GHz, 75-110GHz, and 110-170GHz. It is expected that microwave links will be implemented instead of fiber in the whole of Somalia with low fiber penetration due to the cost of implementation.

   Microwave (Fixed wireless) backhaul networks can be deployed to support outdoor sites and the 5G access network depending on the spectrum band it provides for backhaul solutions ranging from less than one (1) km to more than thirty (30) km. Fixed wireless backhaul offers a lower-cost alternative to fiber backhaul networks. This can be reduced further through point-to-multipoint deployment and daisy-chaining of multiple small cells to a fiber-connected cell. Such deployment will serve to shorten the time to market.

C) **Satellite backhaul:** satellite can be a viable solution for backhaul transmission for remote sites within the 5G network.

c. Use cases:

Implementing 5G and associated technologies within the IMT-2020 family provides an opportunity to offer more services over the telecommunications network than just voice, SMS, and broadband data to the mass market. The deployment of IMT-2020 networks provides impactful industrial advances in many industries utilizing ICT. These advances will be attained through enhancing operational effectiveness, improving the safety of workers and the workplace, enabling faster and more effective assembly of products, and using artificial intelligence and robotics, to name a few. The ICT sector will provide the necessary support and underlying networks through:
-

A) **Continuity of voice services**: given the importance of voice services to date and the fact the licensees may re-farm spectrum previously used for 2G and 3G, this will necessitate the deployment of voice services. To ensure continuity of voice services when customers move within areas with different access technologies, it is foreseen that operators will deploy VoLTE and VoNR to continue providing voice services to their customers.

B) **eMBB products and services:** IMT -2020 networks will provide bigger capacity, lower latency, and lower cost/bit offered by telecommunications service licensees trending to deliver unlimited data bundles. Low latency of up to 1 milliseconds supports use cases in online gaming requiring real-time feedback, content streaming, and critical communications, e.g., remote visual monitoring of patients, remote control of devices, and industrial automation.

C) **Enterprise products and services:** IMT-2020 networks will be a crucial enabler of the 4th Industrial Revolution because they provide network slicing and quality of service differentiation. These network features offer the capability and flexibility to serve the needs of different enterprise customers.

With the deployment of this network, IoT applications will be able to make use of new IMT-2020 functionality such as ultra-reliable low latency communications and time-sensitive networking required of time-critical manufacturing processes, interpretation of data from diverse assets, production lines, and machine-to-machine interaction, allowing for risk-mitigation and infrastructure management, e.g., smart grids, smart metering, factory automation, etc.

The deployment of these services opens the market for private 5G networks and small licensees, creating an opportunity for smaller licensees to provide applications and services tailor-made to niche markets while leasing the network from 5G network owners wholesale. The scenario fosters entrepreneurship and creates new employment opportunities, contributing to economic and social well-being.

Examples of various use cases identified as relevant to Africa are shown in Table 2 below.
Table 2: Selected 5G use pertinent circumstances to Africa

Implementing the use cases will necessitate the National Communications Authority (NCA) to not only provide for spectrum awards but also to consider licensed shared access to spectrum resources dependent on business cases presented to the authority when considering applications for spectrum licenses.

6. Spectrum Requirements for 5G

Section 6, Article 35, 36 (5), 37, 38, 39, 40 of National Communication Law mandates the NCA with the planning, monitoring, and awarding of spectrum in "**Consideration and planning the currently existing and future expected needs or any other issues deemed necessary."** Like the existing 4G network, 5G carriers' information wirelessly through an electromagnetic spectrum, precisely, certain frequency bands in the radio spectrum. It stands to reason that range is one of the most critical elements in ensuring the successful and timely deployment of 5G in Somalia. The

NCA team outlines recommendations for implementing spectrum requirements for 5G deployment in Somalia based on the two fundamental principles below:

a) A significant amount of new harmonized spectrum across different countries in the region.
   - Near 100 MHz contiguous for 5G mid-bands (between 1GHz to 6GHz) and around 1GHz contiguous spectrum for 5G high-bands (>6GHz).
b) Ecosystem maturity, including user devices and network equipment readiness.

The ITU World Radio Conference 2019 (WRC-19) held in Egypt concluded on the spectrum. band to be allocated for the implementation of IMT-2020 (5G) and published the resolutions In the WRC-19 Final Acts on 31 March 2020. This document carries international treaty status and binds Somalia as an ITU member state to the provisions for spectrum allocation contained Therein.

The following spectrum bands (referred to as millimeter wave bands) were allocated for IMT-2020 (5G) subject to the WRC-19 Resolutions and radio regulations: -

24.25 – 27.5 GHz	**37.0 – 43.5 GHz**
47.2 – 48.2 GHz	**66.0 – 71.0 GHz**

a. Identified Bands for 5G in Somalia

To support a wide range of use cases and requirements, successful 5G implementation in Somalia must rely on both new and existing IMT 5G spectrums that have been harmonized globally and consist of a multi-layer spectrum within the following three key frequency ranges:

I) Low-band (<1GHz): For widespread coverage and to support the Internet of Things (IoT)
Services.

II) Mid-band (1GHz to 6GHz): Its large contiguous bandwidth forms the first layer of 5G with the balance between capacity and coverage.

III) High-band (>6GHz): For ultra-high broadband speeds envisioned for 5G.

Based on the analysis conducted on global 5G commercial launch and ecosystem readiness, Priority 1, Priority 2, and Priority 3 spectrum for Somalia's 5G deployment have been identified.

i. Low-band (below 1GHz) 700 MHz – Priority 1

The 700 MHz spectrum band is earmarked for implementation of 5G services and applications, as well as public protection and disaster relief services (when required) In rural areas. The 800 MHz spectrum band is currently utilized for 4G services but maybe utilized for future 5G services based on dynamic spectrum sharing between 4G and 5G services.

5G	
694	790

Figure 1: 694 – 790 MHz Band

ii. Mid-band spectrum – Priority 1

Mid-band spectrum refers to the 3300-4200 MHz (C-band) spectrum bands and is suited for urban and rural IMT-2020 network rollout. The spectrum band 3400-3800 MHz has emerged as a primary band for IMT-2020 deployed in that it is near-globally harmonised and allows for assignment of large (80-100 MHz) contiguous blocks of the spectrum as per the frequency channeling arrangements Contained in ITU-R M.1036-6. The further harmonization of this spectrum band for IMT-2020 will allow for economies of scale concerning equipment availability.

5G	
3300	**4200**

Figure 2: 3.3 – 4.2 GHz Band

The spectrum mentioned above bands were not historically allocated to mobile services on a primary basis. Thus, the available range is shared with fixed satellite and fixed services (point-to-point links and WiMax).

It is, therefore, necessary that the Authority considers the following options going. forward before consideration of the spectrum band 3300-4200 MHz for IMT-2020: -

iii. Mid-band spectrum (1 GHz) – Priority 2

The L-band is an excellent complimentary band to combine with sub 1 GHz (e.g. 700 MHz). The band provides a good combination of capacity and coverage. The ecosystem is developed in Europe for its use by supplemental downlink (SDL), which could lead to benefits from economies of scale. A total of 90 MHz of spectrum is available on a TDD basis.

5G	
1427	**1518**

Figure 4. 1427 – 1518 MHz Band

iv. Mid-band spectrum (4-5 GHz) – Priority 2

The band is identified for IMT in Somalia and some countries through a footnote in ITU Radio Regulations. WRC-23 will review the conditions of use of the band for IMT. The ecosystem for the band is still under development and has yet to mature. The band could be considered to be released to the market after the decisions of WRC-23.

5G	
4800	**4990**

Figure 5. 4.8 GHz Band

v. High-band / mmWave (24.25-29.5 GHz) – Priority 2

The 26GHz and 28GHz bands (mmWave, from 24.25GHz – 29.5GHz) frequency range is being considered internationally to supplement 3.5GHz for fiber-like, ultra-high throughput at 5G hotspots and potential for low latency communications. mmWave is unsuitable for wide-area coverage as it has a limited coverage range. Line-of-sight is needed, even though it has a mature ecosystem and adoption from Telcos globally. Given that, coexistence between FSS and 5G is possible with the following recommendations:

a) **24.25GHz – 27.0GHz** (total bandwidth of 2.75GHz) to be allocated to 5G with resolutions depending on coexistence with Earth Exploration Satellite Service (EESS) in WRC-19; and
b) **27.0GHz – 29.5GHz** (total bandwidth of 2.5GHz) to be allocated to 5G with appropriate interference mitigation (5G Base Station is recommended to be set at this range to avoid interference from FSS earth stations).

vi. High-band / mmWave (37-43.5 GHz) – Priority 3

The 40 GHz band is harmonized globally for the deployment of IMT. It is a promising band for the early deployment of 5G millimeter wave systems. It provides extreme bandwidths for ultra-high broadband speeds. Verticals may use it for private 5G networks, though the ecosystem has yet to develop and mature.

vii. High-band / mmWave (40/50 GHz) - Priority 3

The 40/50 GHz bands include the 47.2-48.2 GHz frequency band. The band is identified for deployment of IMT in a few countries. It provides extreme bandwidths for ultra-high broadband speeds. Verticals may use it for private 5G networks, though the ecosystem has yet to develop and mature.

viii. High-band / mmWave (66 – 71 GHz) - Priority 3

The 66 - 71 GHz band is identified for IMT for flexible use for 5G systems, enabling both IMT and non-IMT technologies and sharing with WiGig systems. The band provides extreme bandwidths for ultra-high broadband speeds.

Summary of 5G frequency Bands

Priorities	Range	Band	Status
Priority 1	694-790	700 MHz	Current utilization: 4G
Priority 1	3300-3800	3.5 GHz	Current utilization: 4G
Priority 2	4800-4990	4.8 GHz	FSS and Fixed wireless access (FWA)
Priority 2	1427 – 1518	1.4 GHz	Radio astronomy And satellite services
Priority 3	24.25-29.5 GHz	26 GHz	Current utilization: Microwave
Priority 3	37-43.5 GHz	37 GHz	Current utilization: Microwave
Priority 3	40/50 GHz	40/50 GHz	Fixed point-to-point microwave links And satellite communications
Priority 3	66 – 71 GHz	66 GHz	Microwave

7. Regulatory Options for 5G Infrastructure Deployment

The deployment of 5G in Somalia faces several significant challenges that must be addressed to ensure a successful rollout of this advanced technology. Firstly, limited 4G coverage is a considerable obstacle. Currently, 4G networks are only available in big cities, while most people still rely on 3G or 2G networks. This infrastructure gap hampers the seamless transition to 5G, requiring a solid foundation of advanced connectivity. Another challenge is the reluctance of operators to share infrastructure. Collaboration among operators is essential to minimize costs and accelerate the rollout of 5G networks. However, the necessary investment becomes a significant barrier without cooperation in infrastructure sharing. Overcoming this challenge necessitates promoting a collaborative approach and developing regulatory frameworks that incentivize infrastructure sharing.

Additionally, telecom operators are not interested in investing in infrastructure outside major cities, impacting digital inclusion. The focus on big cities means that rural and underserved areas may not receive the necessary infrastructure upgrades, hindering the equitable deployment of 5G technology. Addressing this challenge requires incentivizing operators to invest in rural areas through public-private partnerships, tax incentives, or regulatory mechanisms.

These challenges highlight the need for concerted efforts from stakeholders to overcome the barriers and ensure a successful deployment of 5G in Somalia. Coverage obligations, promoting

infrastructure sharing, and incentivizing investment in rural areas are crucial steps to address these challenges. Additionally, raising public awareness about the benefits and potential of 5G technology can help generate support and enthusiasm for infrastructure development. By tackling these challenges, Somalia can pave the way for the widespread adoption of 5G, ensuring equitable access to advanced communication services and embracing the opportunities offered by this transformative technology.

The National Communications Authority (NCA) identified three options for deploying the 5G infrastructure to achieve a rapid country-wide deployment. The three options are:

a) Existing Telecom operators deploy the 5G infrastructure.

The deployment of 5G infrastructure through existing telecom operators, with appropriate regulatory obligations and spectrum awarding requirements, presents an opportunity to ensure a successful and efficient rollout of this transformative technology in the country. In addition to the critical considerations of countrywide coverage, quality of service, security, and support for industry vertical operators, other regulatory obligations can be incorporated to promote competition and affordability.

Competition is vital to the telecommunications industry as it fosters innovation, improves service quality, and drives down consumer prices. The National Communications Authority (NCA) should include regulatory obligations in the spectrum awarding requirements that encourage competition among telecom operators. This can be achieved by promoting infrastructure sharing, ensuring fair access to critical network resources, and implementing transparent interconnection policies. By fostering a competitive environment, multiple operators can invest in 5G infrastructure, leading to enhanced service offerings and more affordable pricing plans.

Affordability is another crucial consideration in the deployment of 5G. While the benefits of this advanced technology are vast, it is essential to ensure that the services remain accessible to a broad range of users, including individuals and businesses of varying sizes. The NCA should impose regulatory obligations on operators to provide affordable 5G plans and pricing structures. This can be achieved through tariff regulation, cost-based pricing, and promoting the availability of cheap data packages. By prioritizing affordability, the NCA can prevent the digital divide from widening and ensure that all segments can benefit from the advantages of 5G technology. NCA should set clear guidelines for operators regarding pricing practices and the provision of affordable plans. This can involve assessing operators' cost structures, monitoring price levels, and ensuring pricing remains reasonable and competitive. Additionally, the NCA can collaborate with operators to develop targeted programs that promote digital inclusion and affordability, such as subsidized plans for low-income individuals or incentives for operators to invest in

underserved areas. Implementing such measures allows the NCA to create an environment where 5G services are accessible and affordable, contributing to a more inclusive and connected society.

To address competition and affordability concerns effectively, the NCA can implement a comprehensive regulatory framework encompassing various telecommunications industry aspects. This framework should include provisions for fair competition, consumer protection, quality of service, and investment incentives. Regulatory obligations related to competition can consist of rules to prevent anti-competitive behavior, promote equal opportunities for all operators, and ensure transparent and non-discriminatory access to network infrastructure. The NCA can also establish mechanisms for monitoring and enforcing compliance with these obligations, such as regular audits, reporting requirements, and dispute resolution processes.

Moreover, the regulatory framework can include network resilience and reliability obligations. As 5G technology becomes increasingly integrated into critical infrastructure and supports mission-critical applications, ensuring robustness and continuity of services is paramount. The NCA can set minimum requirements for operators to implement redundancy measures, backup power systems, and disaster recovery plans to maintain uninterrupted service in case of network failures or emergencies. These obligations can contribute to a resilient telecommunications infrastructure that supports the evolving needs of industries and society.

Another crucial regulatory aspect is data protection and privacy. With the proliferation of connected devices and the massive amounts of data generated and transmitted through 5G networks, it is crucial to safeguard the privacy and security of users' personal information. The NCA can incorporate obligations related to data protection in the spectrum awarding requirements, requiring operators to adhere to stringent data privacy regulations, implement robust security measures, and obtain explicit consent for data collection and usage. By prioritizing data protection, the NCA can instill trust and confidence among users, fostering the adoption of 5G services and applications. In addition to these regulatory obligations, the NCA should establish a framework for ongoing monitoring, evaluation, and enforcement of compliance with these requirements. Regular audits, performance assessments, and reporting mechanisms can ensure that operators adhere to their obligations and provide the desired service quality, competition, affordability, and data protection. The NCA can also engage in continuous dialogue with operators, industry stakeholders, and consumer groups to gather feedback, address concerns, and make necessary adjustments to the regulatory framework as the technology evolves.

Since the current operators hold technology-neutral licenses, the pricing for 5G spectrum can follow either of the following scenarios:

- The existing spectrum fee structure is already in place for other frequencies.
- A specially negotiated spectrum fee specifically designed for allocating 5G frequencies.

Relying on existing telecom operators to deploy 5G infrastructure may encounter several problems and disadvantages. Firstly, Somalia's lack of a robust 4G infrastructure presents a significant challenge. This deficiency has resulted in low 4G penetration rates throughout the country. Without a solid foundation in 4G technology, the seamless transition to 5G becomes more complex and may hinder the overall effectiveness and efficiency of the deployment.

Another issue arises with operators' reluctance to engage in infrastructure sharing. Sharing infrastructure is essential for optimizing resource utilization and avoiding unnecessary duplication of efforts. However, the potential reluctance of operators to engage in collaborative efforts can result in suboptimal resource utilization and inefficiencies during the deployment of 5G infrastructure. This reluctance could stem from concerns over competition, financial considerations, or other factors inhibiting the efficient deployment of 5G infrastructure throughout the country.

b) Public Private Partnership Model for Infrastructure Deployment

The second option involves a partnership between the public and private sectors to invest in 5G infrastructure. This approach aims to achieve widespread deployment of the infrastructure across the country by encouraging operators to share the infrastructure in collaboration with the government. By collaborating with the government, operators can benefit from the facilitation and support provided in deploying the infrastructure. The government's contribution of essential public resources and infrastructure is instrumental in achieving policy objectives to narrow the digital divide and enhance nationwide connectivity.

Under this model, private operators lead in rolling out the 5G infrastructure through a partnership with the government, established by creating a particular purpose entity. To facilitate the deployment of the infrastructure, the entity will acquire a special spectrum award, with modified awarding requirements specifically tailored to the deployment of the 5G infrastructure. The core principles underlying this model revolve around cost recovery, open and equitable access, avoiding unnecessary infrastructure duplication, and the optimal utilization of scarce resources such as the spectrum. This ensures that operators have a fair opportunity to access wholesale 5G services at regulated prices, promoting competition and affordability in the market.

The government, recognizing the importance of rapidly deploying the 5G infrastructure, will play a vital role in facilitating the availability of the required spectrum in a highly incentivized manner. This proactive approach aims to overcome potential spectrum constraints and streamline the process, enabling operators to expedite the deployment of 5G infrastructure and unlock the benefits of this advanced technology.

The implementation of this model will be conducted in two phases to ensure a systematic and efficient rollout. The initial phase will focus on creating demand for 5G services, preparing for coverage expansion, facilitating infrastructure sharing, and consolidating existing resources. This phase will continue until the desired coverage targets are achieved. The second phase will build upon the lessons learned from the first phase, focusing on diversifying the network and allowing operators to provide innovative 5G solutions based on the experience and studies known and the growth of the demand for 5G solutions and applications. By adopting this comprehensive approach, Somalia can lay the foundation for a robust and inclusive 5G ecosystem. The partnership between the public and private sectors, along with the active involvement of the government, will contribute to bridging the digital divide, improving connectivity, and fostering economic growth and innovation throughout the country.

The PPP option for 5G deployment brings several advantages to Somalia. Firstly, it promotes collaboration between the public and private sectors, allowing operators to benefit from the government's support and facilitation in deploying the infrastructure. This partnership enables using essential public resources and infrastructure, contributing to policy objectives like bridging the digital divide and enhancing nationwide connectivity. Additionally, the model emphasizes cost recovery, equitable access, and optimized resource utilization, ensuring fair competition, affordability, and efficient allocation of scarce resources like the spectrum.

On the other hand, it presents particular challenges. Firstly, coordination among multiple stakeholders, including government agencies and private operators, is required. Moreover, striking a balance between the interests of the public and private sectors poses regulatory challenges, including ensuring fair competition, consumer protection, and compliance with spectrum management and privacy regulations. Overcoming these obstacles necessitates clear governance structures, streamlined processes, and robust regulatory frameworks.

c) Awarding of Two Consortia of Operators for 5G Deployment

The telecommunications market in Somalia is characterized by seven operators, which is considered relatively high compared to other countries. Given the country's small population of approximately 15 million, this number of operators exceeds the optimal

number. Moreover, the substantial number of operators poses a challenge for the NCA in efficiently allocating the spectrum among them.

To address these challenges, the National Communications Authority (NCA) proposes a strategic approach by advocating awarding two consortiums comprising the telecom operators. This collaborative approach aims to streamline the deployment of 5G infrastructure in the country.

The option of awarding two consortia offers several notable advantages. Firstly, it enables the efficient utilization of scarce spectrum resources, ensuring that they are distributed in a manner that maximizes their potential and minimizes wastage. This collaborative framework also fosters the efficient use of other resources, such as infrastructure and expertise, as operators pool their capabilities and resources to accelerate the deployment of 5G networks. Furthermore, awarding two consortiums creates a competitive market environment where participating operators strive to provide the best possible services. This healthy competition can drive innovation, improve service quality, and enhance customer experience. By offering market-driven spectrum pricing based on the consortium's demand and competitive dynamics, a balanced approach can be achieved that promotes fair market conditions and encourages operators to invest and innovate in 5G technologies.

The approach to award two consortiums of telecom operators in Somalia for deploying 5G infrastructure offers compelling advantages. It ensures the efficient utilization of spectrum and other resources while fostering competition among operators to deliver high-quality services. This strategic approach aligns with market demand and promotes the development of a robust and competitive telecommunications sector in the country.

Despite its advantages, awarding two consortiums for 5G deployment in Somalia may present specific challenges. Firstly, coordination among multiple operators within each consortium requires effective governance and coordination mechanisms to ensure smooth collaboration and decision-making. Additionally, the consortium-based approach relies on the willingness of operators to cooperate and share resources, which may pose challenges if there are conflicting interests or a lack of cooperation among participants.

A summary of the regulatory options is presented below:

Regulatory Options for 5G infrastructure Deployment	Advantages	Disadvantages/Challenges
Option 1: Existing Telecom operators deploy the 5G infrastructure	- Utilizes existing operators' infrastructure and expertise. - Easy deployment in big cities	- the lack of a robust 4G infrastructure in Somalia presents a significant challenge. - Reluctance of operators to engage in infrastructure sharing, which leads high cost, inefficient deployment of 5G infrastructure. - Inefficient utilization of scare resources such as the spectrum due to high number of operators
Option 2: Public Private Partnership Model for infrastructure deployment	- Collaboration between public and private sectors - Government support and facilitation in deploying the infrastructure - Use of public resources and infrastructure contributing to policy objectives - Cost recovery, equitable access, and optimized resource utilization	- Coordination challenges among multiple stakeholders - Clear governance structures, streamlined processes, and robust regulatory frameworks are needed
Option 3: Awarding of Two Consortia by Operators for 5G Deployment	- Efficient utilization of spectrum and resources - Fosters competition among operators to deliver high-quality services	- Coordination challenges among multiple operators within each consortium - Reliance on operators' willingness to cooperate and share resources

8. 5G Private Mobile Networks

5G private networks refer to deploying 5G technology specifically for dedicated, personal use by organizations rather than being part of a public telecommunications network. These networks offer several advantages, including high data speeds, low latency, increased capacity, and enhanced

security, making them attractive to manufacturing, logistics, healthcare, transportation, and utilities.

With its ability to handle massive amounts of data quickly and reliably while accommodating a high density of connected devices, 5G promises to transform businesses' operations. It enables enhanced and flexible processes, improved productivity and safety, and seamless integration with artificial intelligence. The benefits of private 5G networks extend across a wide range of industries, including oil and gas, shipping, transportation, manufacturing, retail, sports and entertainment, healthcare, hospitality, and government sectors. By delivering wired performance without physical wires, 5G opens up new possibilities for autonomous or remote operations and introduces advanced functionalities that can significantly enhance operational efficiency and effectiveness. As the adoption of private 5G networks grows, regulatory considerations play a crucial role in ensuring their successful implementation. The regulatory framework should address various aspects, including spectrum allocation, awarding, security, and compliance. Spectrum allocation for private networks requires careful planning to ensure sufficient spectrum resources are available for deployment. Awarding mechanisms must enable organizations to acquire the necessary spectrum and establish and operate private 5G networks efficiently.

The National Communications Authority (NCA) is exploring various options for implementing 5G private mobile networks. One option is to utilize the 5G networks and services existing telecom operators provide. This approach allows enterprises to rely on awarded 5G public service providers for their 5G private mobile networks, freeing up their resources to focus on their core business. However, a drawback of this option is the enterprise's dependence on the performance and coverage capabilities of the 5G public network, which may only partially meet their specific business requirements.

Another option is to establish an independent 5G private mobile network on the enterprise's premises, utilizing infrastructure owned and operated by the enterprise. In this scenario, the NCA can issue spectrum awards to eligible enterprises that intend to deploy and manage their 5G private networks. One advantage of this option is that the enterprise gains full control over network management, including response times for maintenance, repairs, and upgrades. It also allows flexibility in implementing and evolving the network based on emerging needs.

However, a limitation of this option is the high cost of in-house expertise required unless the enterprise chooses to subcontract certain aspects of implementing and managing the 5G private mobile network to a partner. This cost consideration needs to be considered when deciding on this option.

Overall, the NCA is considering these options to provide enterprises with choices for deploying 5G private mobile networks, weighing the advantages and disadvantages of each approach.

9. 5G Regulatory Sandboxes

NCA is also considering establishing 5G regulatory sandboxes to facilitate developing and deploying innovative 5G technologies, services, and applications. These sandboxes can provide a controlled environment for testing, experimentation, and collaboration between NCA, industry players, and technology providers.

Regulatory sandboxes for 5G implementation encompass several vital aspects that must be considered. Firstly, they address spectrum-related challenges by granting participants temporary access to specific 5G frequency bands for testing purposes. This approach allows companies to assess the performance, coverage, and interference issues associated with their 5G solutions without the constraints of traditional awarding requirements. By providing this temporary spectrum access, regulatory sandboxes enable participants to explore and experiment with the capabilities of 5G technology, test their applications, and validate their performance in a controlled environment. This helps identify any technical challenges or limitations and facilitates the development of innovative solutions that can optimize spectrum utilization and improve overall network efficiency.

Secondly, regulatory sandboxes focus on testing various network architectures and deployment models. Participants can experiment with different configurations, such as standalone or hybrid networks, small cells, or network slicing, to evaluate their impact on performance, scalability, and resource allocation. This testing allows for a deeper understanding of the potential benefits and challenges associated with different network architectures and helps identify the most effective approaches for deploying 5G networks. By exploring and testing various network deployment scenarios, regulatory sandboxes provide valuable insights into the technical and operational aspects of 5G implementation, enabling regulators to make informed decisions and develop appropriate guidelines and standards.

Thirdly, regulatory sandboxes encourage the testing of innovative use cases and applications that leverage the unique capabilities of 5G technology. These may include areas such as the Internet of Things (IoT), augmented reality (AR), virtual reality (VR), smart cities, and industrial automation. By providing a controlled environment for testing these use cases, sandboxes facilitate the assessment of their feasibility, scalability, and regulatory implications. Participants can explore these innovative solutions' technical and operational challenges and identify potential regulatory gaps or barriers. This enables regulators to comprehensively understand the opportunities and challenges presented by emerging 5G use cases and develop regulatory frameworks that support their successful deployment while ensuring users' safety, security, and privacy.

NCA believes that 5G regulatory sandboxes are crucial in facilitating the effective implementation of 5G networks and their innovative solutions. By addressing spectrum-related challenges, testing

different network architectures, and encouraging the exploration of innovative use cases, sandboxes create an environment that fosters innovation, collaboration, and knowledge sharing. Through these sandboxes, NCA can gain valuable insights into the technical, operational, and regulatory aspects of 5G deployment, enabling them to develop appropriate policies, guidelines, and standards. By doing so, they can ensure that 5G networks are deployed efficiently, securely, and in a manner that maximizes consumer and industry benefits.

10. Consultation Questions

a) What advantages do each of the three potential regulatory choices covered in Section 7 of this article appeal to you, and what concerns do you have about them?

b) Please indicate your preference among the three options in section 7 of this document and provide a rationale.

c) Which 5G use cases and applications will most likely influence the nation's industries?

d) What awarding approach do you recommend for the allocation of 5G spectrum?

e) What is your stance on the NCA's proposal to offer different options for implementing 5G private mobile networks?

f) Are you in favor of the notion that 5G private networks have the potential to facilitate the adoption of 5G services across diverse industries such as manufacturing, energy, and others?

g) What are your perspectives on the awarding approach for spectrum allocation to enterprises for 5G private mobile networks?

h) What strategies would you propose to guarantee the accessibility, compatibility, and cost-effectiveness of standardized 5G equipment and devices in the market?

i) What steps should the NCA implement to ensure the security and integrity of 5G networks and devices?

j) Do you favor the NCA's proposal to establish 5G regulatory sandboxes to foster innovation in 5G services, allowing for pilot programs and technology testing?

k) What business and other opportunities can be unlocked by deploying 5G technologies within Somalia? Please explain and give reasons for your answer.

l) In your view, which of the two standard network options - stand-alone vs. Non-stand-alone- will impact the rollout of 5G in Somalia, considering issues such as speed of deployment, costs vs. benefits, use case development, etc.? Please explain and give reasons for your answer.

m) How will high-speed, low-latency fifth-generation (5G) networks, enhanced through artificial intelligence (AI) and linking of billions of devices through the Internet of Things (IoT), advance the Fourth Industrial Revolution (4IR)? Please explain and give reasons for your answer.

n) How much contiguous spectrum, at the minimum, do you believe is required in 5G mid-band (between 1 GHz to 6 GHz) to deliver 5G services effectively? Please explain and support your answer.

o) How much contiguous spectrum, at the minimum, do you believe is required in 5G high band (>6 GHz) to deliver 5G services effectively? Please explain and support your answer.

p) What can be done to encourage the participation and contribution of stakeholders in the 5G Consortium? Please explain and support your answer.

q) What role do you see the 5G Consortium playing in advancing the deployment of 5G in Somalia? Please explain and support your answer.

r) What regulatory interventions do you propose to ensure that spectrum license fees for 5G medium and high bands are kept to a reasonable figure? Please explain and support your answer.

s) To what extent is the current 4G network infrastructure adequate for the rollout of 5G technologies and networks? Please explain and give reasons for your answer. (Note - Telecom operators should submit the current 4G coverage, including coverage maps across the country, 4G subscribers, and existing plans for broader 4G coverage).

t) What limitations do you see in the ability of the current 4G infrastructure to support 5G? Please explain and give reasons for your answer.

u) Which frequency bands, if any, can be re-farmed for 5G? Please explain and support your answer.

v) What is your opinion or consultation regarding shutting down 3G services in favor of advanced networks (4G/5G, etc.)? Please explain and support your answer.