Roadmap to enable 5G deployment in The Bahamas

Consultation Document

ECS 73/2024

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1 Introduction

The Utilities Regulation and Competition Authority ("URCA") is the independent regulator and competition body for the Electronic Communications Sector (ECS) in The Bahamas, which includes fixed and mobile telecommunications services, broadcasting, and the management of spectrum and numbering resources.

URCA is charged with the responsibility, *inter alia*, of promoting the main objectives of the Electronic Communications Policy ("EC Policy") set out in section 4 of the Communications Act, 2009 ("Comms Act"). These objectives include, amongst other things, to further "*the interests of persons in The Bahamas in relation to the electronic communications sector by promoting affordable access to high-quality networks and carriage services in all regions of The Bahamas*". To achieve this, URCA is required to:

(i) "*promote investment and innovation in electronic communications networks and services*";

(ii) "*promote the optimal use of radio spectrum*"; and

(iii) "*to enhance the efficiency of the Bahamian electronic communications sector and the productivity of the Bahamian economy*".

URCA recognizes that reliable, high-speed broadband connectivity and technological advancements like the Fifth Generation of International Mobile Communications technology (IMT-5G, hereinafter referred to as "5G") are catalysts for innovation and future development in The Bahamas and that 5G can therefore play a crucial role in achieving the EC Policy objectives. To this end, and in accordance with its respective Annual Plans 2022 and 2023, URCA has engaged with stakeholders to assess demand for 5G and develop the roadmap to enable the provision of 5G services in The Bahamas. In summary:

- In a first step, URCA conducted a consultation[1] in late 2023 to better understand and develop an evidence base for the current and expected demand for enhanced internet connectivity and 5G-enabled services in The Bahamas. This revealed that end users are primarily focused on receiving reliable internet access at decent speeds, with the main future demand use cases being tourism and national security/law enforcement. Additionally, operators view 5G as a natural evolution to improve network capacity, but they emphasize the need for a supportive regulatory and policy environment to facilitate its rollout in due time.

- In a second step URCA is now working closely with the Government of The Bahamas and industry stakeholders to identify and address any outstanding regulatory and policy issues, in order to develop a roadmap to enable 5G deployment in The Bahamas. This

[1] Public Consultation on the Demand for Enhanced Internet Connectivity and 5G in The Bahamas, statement of Results and next steps, 1 September 2023

phase will include stakeholder meetings, consultations on the draft framework, and finalization of the framework.

URCA has developed a draft Roadmap to enable 5G deployment in The Bahamas, set out in the remainder of this document. The purpose of this consultation is to invite comments from interested persons on URCA's draft Roadmap. When completed, this roadmap will identify any outstanding regulatory and policy issues which need to be addressed to enable 5G in The Bahamas.

1.1 Context to this Consultation

Given the importance of this matter, URCA considers that it is essential to engage with a wide range of stakeholders and therefore has, in this instance, adopted a more extensive approach than the standard process for its public consultations. URCA wishes to thank again all stakeholders for their participation and contributions over recent months and looks forward to continuing this dialogue with all interested parties.

1.1.1 Phase I – Demand for 5G

In 2022 and 2023, URCA conducted an extensive public engagement exercise on the demand for 5G-enabled services in The Bahamas (Phase I). This phase involved a consumer survey, industry focus groups, a call for input from operators, a public consultation and interviews with the Government and operators.

Generally, URCA noted the following observations on the current demand for enhanced connectivity and 5G from Phase I:

- **Increased connectivity needs**: There is demand for robust connectivity (especially since the Covid pandemic) driven by remote working, online learning, telehealth services, and e-commerce. New use cases could also emerge building on increased capacity, latency and network slicing. However, there remains uncertainty on these in the medium term.

- **Inclusion needs:** There remains scope for improvement in the availability of reliable internet services in remote areas and the Family Islands. Without reliable, and affordable internet connectivity, there is a risk that segments of the population may be excluded from effectively participating in the digital economy.

- **Support for Digital Ecosystem and Economy**: There is a need to ensure that demand from the tourism sector and digital nomads can be satisfied and to support digital transformation of public and private organization to foster competitiveness and economic growth.

- **Uncertainty on end users' willingness to pay for enhanced connectivity services**: There remains uncertainty to mobile operators on whether the increased demand for existing or new connectivity services will enable them to generate incremental revenues. This

uncertainty adversely impacts their willingness to invest in 5G technology and other network upgrades.

1.1.2 Phase II – Supply-side considerations

In Phase II of its work, URCA is now seeking to develop a roadmap to enable the deployment of 5G in The Bahamas, covering key regulatory measures and supply-side considerations to enable a market-led provision of 5G services. This includes a discussion on spectrum needs and suitable assignment procedure as well as practical considerations which need to be addressed to facilitate the deployment of 5G in The Bahamas.

URCA has engaged with both Mobile Network Operators ("MNOs") providing service in The Bahamas to gain insights into their perspectives on the commercial viability of 5G deployment, both generally and across various regions of the country, as well as any technical, regulatory, and policy considerations necessary to facilitate 5G deployment in The Bahamas.

URCA also met with key government stakeholders, including the Ministry of Economic Affairs, the Office of the Attorney General, the Ministry of Works, and the Civil Aviation Authority Bahamas ("CAAB"), to understand their views on policy actions they each can take to facilitate 5G deployment and to address any concerns they may have.

1.2 Consultation process

URCA invites responses to this Consultation Document from all stakeholders and interested persons. Please note that responses to this Consultation Document must be submitted to URCA on or before 5:00 p.m. on Thursday, 7 October 2024.

Written responses or comments on this Consultation Document should be sent to URCA's Director of Electronic Communications (or designate), either:

- by mail to P.O. Box N 4860, Nassau, The Bahamas; or
- by email, to info@urcabahamas.bs.

URCA advises that its **office will be inaccessible during this consultation process** due to ongoing renovations. As such, URCA is unable to receive responses by hand, and respondents are encouraged to submit their responses as requested above. URCA apologizes for any inconvenience caused in this regard. Persons may obtain copies of this Consultation Document by downloading it from the URCA website at www.urcabahamas.bs.

When submitting responses, respondents are required to provide supporting explanations/reasons for each of their submissions. All responses must clearly indicate the reference to the Consultation Document and the questions addressed for each of the responses provided.

URCA will then review the responses received and publish a Statement of Results on the

consultation along with URCA's Next Steps in this regard.

URCA reserves the right to make all responses available to the public by posting responses on its website at www.urcabahamas.bs. Responses marked 'confidential' should provide supporting reasons to simplify URCA's evaluation of the request for confidentiality. URCA may, in its sole discretion, choose whether to publish any confidential document or submission. Further information on URCA's procedure for handling information marked 'confidential' submitted by consultation respondents and URCA's consultation procedures in general can be found in URCA's Consultation Procedure Guidelines[2].

Please take note that any response to this Consultation Document that does not comply with the requirements set out herein may not be considered by URCA.

1.3 Legal Framework

This subsection sets out the legal framework that governs URCA's power to conduct this consultation process.

Section 4 of the Comms Act provides, inter alia, that the electronic communications policy has as one of its main objectives, to further the interest of persons in The Bahamas in relation to the ECS by promoting affordable access to high quality networks and carriage services in all regions of The Bahamas.

Section 5 of the Comms Act provides that all regulatory measures shall be made with a view to implementing the electronic communications policy objectives. Regulatory measures, inter alia, should be efficient and proportionate to their purpose and in traduced in a manner that is transparent, fair and non-discriminatory.

Section 11 of the Comms Act requires URCA to allow persons with sufficient interest a reasonable opportunity to comment on a proposed regulatory measure which, in the opinion of URCA:

(i) is of public significance; or
(ii) whose rights or interests may be materially adversely affected or prejudiced by the proposed regulatory measure. URCA must also give due consideration to those comments prior to introducing the regulatory measure.

Section 13 of the Comms Act establishes that a regulatory measure is likely to be of public significance if it relates to a regulated sector and can lead to:

(i) a major change in the activities carried on by URCA under the Comms Act or any other enactment;
(ii) a significant impact on persons carrying on activities in a regulated sector; and/or
(iii) significant impact on the general public in The Bahamas or in a part of The Bahamas.

[2] URCA 04/2017 available at https://urcabahamas.bs/wp-content/uploads/2017/07/URCA-042017-URCA-Consultation-Procedure-Guidelines.pdf

URCA therefore considers that the cumulative effect of the foregoing statutory provisions requires URCA to conduct this consultation process regarding the ongoing public consultation/engagement process on enhanced internet connectivity/5G and any potential decision URCA issues in relation thereto.

1.4 Structure of the Remainder of this Document

The remainder of this document is structured as follows:

Section 2: Outlines the opportunities and challenges of rolling out 5G in The Bahamas

Section 3: Sets out the possible options for spectrum assignments to enable 5G in The Bahamas

Section 4: Discusses other practical considerations which need to be addressed to facilitate the deployment of 5G in The Bahamas

Section 5: Sets out the proposed next steps.

2 Opportunities and challenges of rolling out 5G in The Bahamas

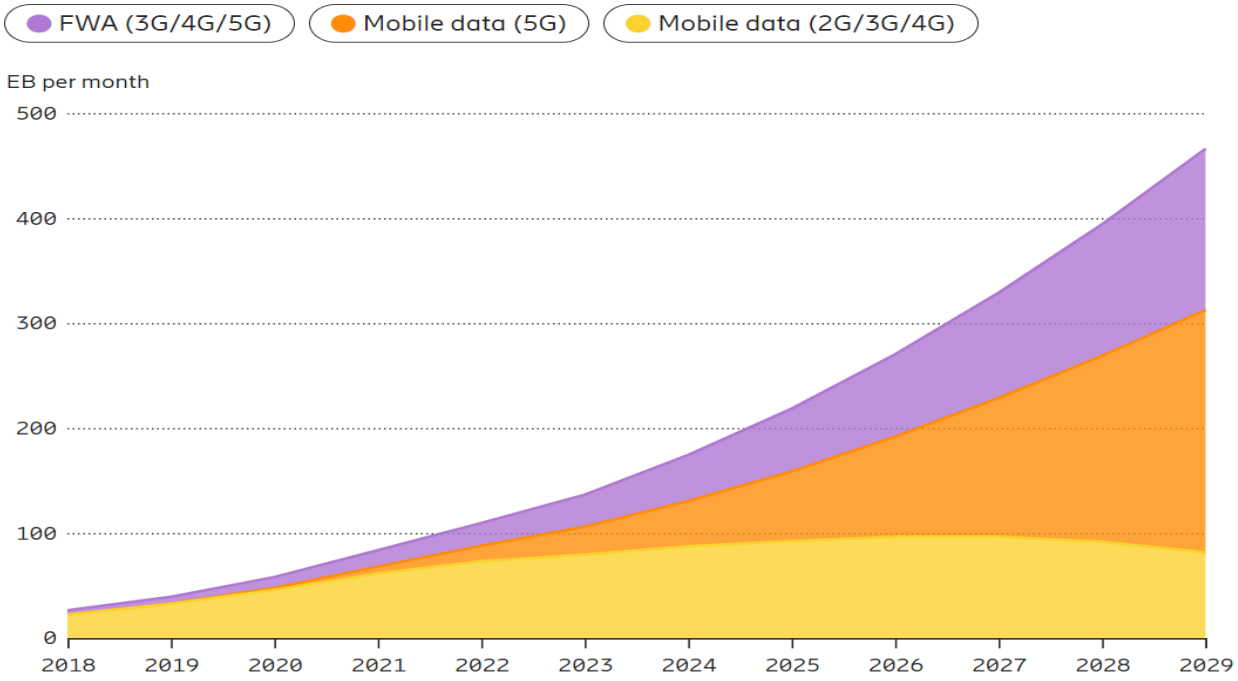
Within this section URCA provides the context to 5G deployment in The Bahamas, by setting out key features and benefits of 5G in general (Section 2.1), followed by an overview of why 5G is important for The Bahamas (Section 2.2), and expected challenges in deploying 5G in The Bahamas (Section 2.3).
In doing so, this section aims to contextualize the remainder of this document which discussed the key considerations to facilitate 5G deployment in The Bahamas, in terms of spectrum related matters (Section 3) and other practical considerations (Section 4).

2.1 Key features and benefits of 5G

In recent years demand for internet services and usage of mobile data services has been growing significantly in The Bahamas and worldwide. This trend is likely to continue going forward, as more devices are connected, and more data-intensive services become available.

Anticipated increase in traffic, growth in the number of devices and services, as well as demand for enhanced affordability and user experience will thus likely require enhanced internet connectivity solutions, such as 5G. In this regard, as illustrated below, Ericsson estimates that by the end of 2029 around 75% of all mobile data delivered will be via 5G networks. 5G's share of mobile data traffic was 25% at the end of 2023.

Figure 1: Global mobile network data traffic, by technology



Source: Ericsson, Mobile data traffic outlook.[3]

5G represents a natural evolution from previous generations of mobile technology and is poised to become the global norm. Consequently, the question is not whether to enable or deploy 5G, but rather how and when to do so, as its implementation will inevitably be necessary to keep pace with demand and global technological advancements.

Main benefits associated with 5G include the ability to support ever increasing demand for capacity from existing services and use cases through deployment of advanced technical features.

- **Increased performance**: 5G offers significantly faster speeds, more capacity, and lower latency compared to 4G which allows serving more users simultaneously without compromising performance (up to 1 Gbps).

- **Improved efficiency**: Advanced techniques (such as beamforming and MIMO antennas[4]) enabled by 5G, allow operators to optimize network efficiency and resource utilization.

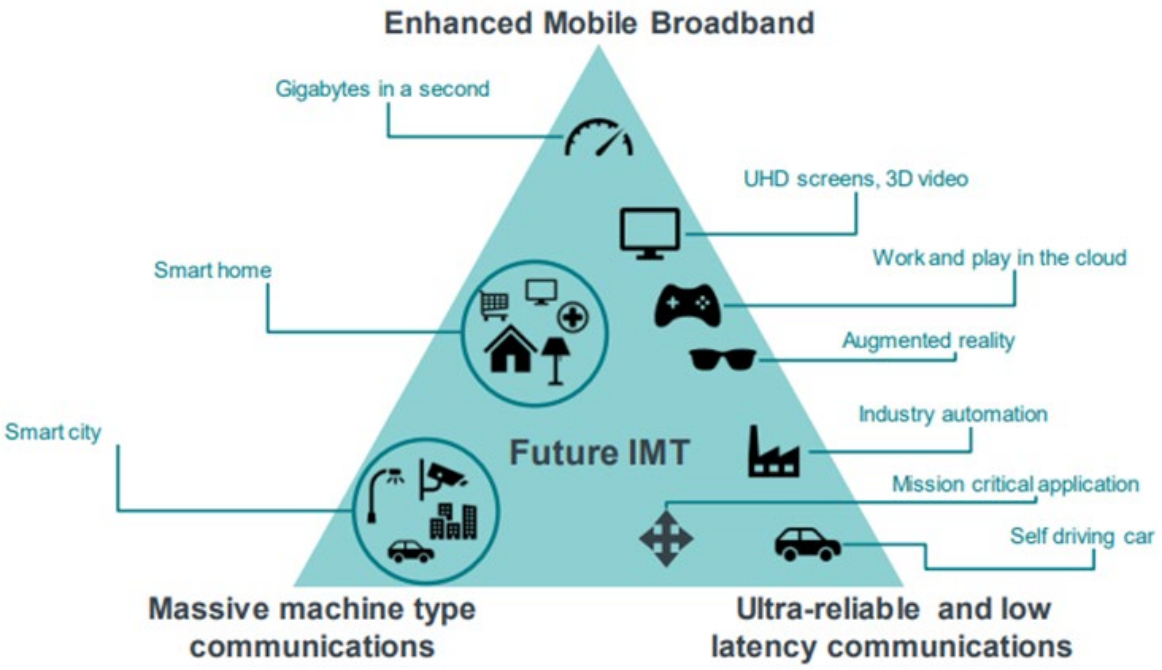
- **Versatility**: 5G also enables greater scope of use cases such as Enhanced Mobile Broadband, Internet of Things ("IoT"), Private Enterprise Networks, and Fixed Wireless Access.

[3] Ericsson (2024). Available at: https://www.ericsson.com/en/reports-and-papers/mobility-report/dataforecasts/mobile-traffic-forecast

[4] Multiple-Input Multiple-Output (MIMO) is a wireless technology that uses multiple transmitters and receivers to transfer more data at the same time. MIMO systems achieve much higher data rates because of a technique used to transmit data simultaneously across multiple antennas. This technique is called spatial multiplexing.

Additionally, 5G networks also enable new use cases and applications in a number of industry sectors worldwide. Figure 2 below illustrates possible new use cases and applications for 5G ranging from augmented/virtual reality to post-disaster communications services.

Figure 2: Possible use cases for 5G

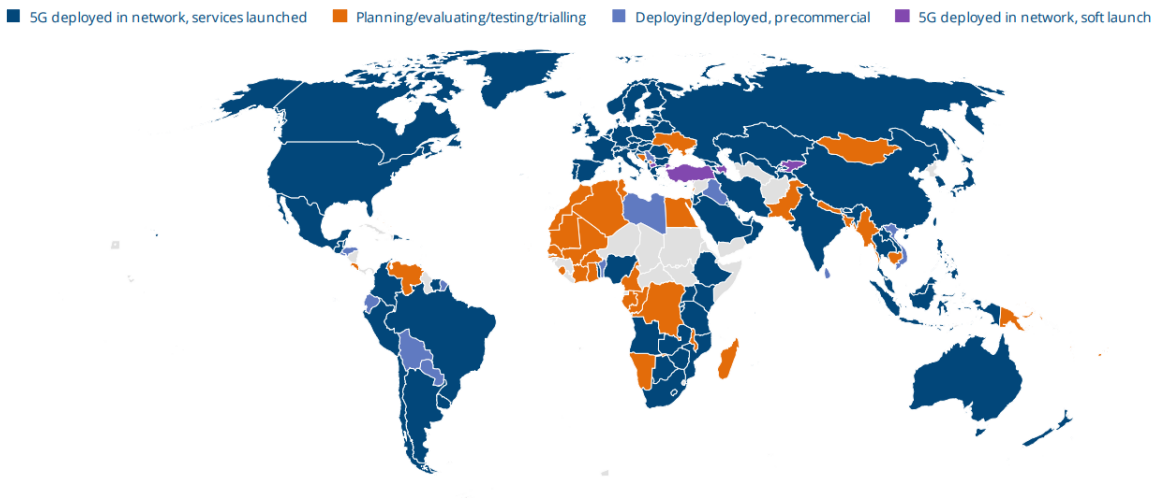


Source: Own elaboration based on information from ITU[5]

Since its initial deployment in late 2018, 5G networks are available in approximately 110 countries as of July 2024.[6] Initially, access to 5G networks was only available in urban areas in certain Asian, European, Northern and Southern American countries. More recently, mobile operators in a few Central American and regional countries have also rolled out 5G networks, namely Bermuda (75% coverage), the Dominican Republic (ca. 55% coverage), Guatemala (partial coverage of all 22 departments), Mexico (ca. 65% coverage), Puerto Rico (ca. 100% coverage), US Virgin Islands (ca. 90% coverage), and most recently the Cayman Islands.[7] Figure 3 below illustrates a world map of countries where 5G is available or being currently deployed as of May 2024.

[5] International Telecommunication Union (2022). Accessible via: https://www.itu.int/en/mediacentre/backgrounders/Pages/5G-fifth-generation-of-mobile-technologies.aspx
[6] According to the Telegeography database consulted in July 2024.
[7] According to the Telegeography database consulted in July 2024.

Figure 3: World map of countries with live or planned 5G networks



Source: GSA[8]

Rollout of 5G technology requires substantial investments across various infrastructure components.

- At the site level, existing radio access network ("RAN") equipment needs to be upgraded or replaced and cell towers may need reinforcements to cope with the added load from 5G antennas and equipment. Typically, 5G relies on a larger number of incremental small(er) cells in the RAN (in addition to existing cell sites)[9], compared to previous mobile networks technologies, which relied on a combination of cell towers and smaller base stations (in urban areas). This implies that with the transition to 5G, the RAN is commonly densified, and network layers must be updated, which in turn requires investment across all network elements.[10]

- At the backhaul level to address the increased data traffic on each cell site and to ensure low latency, enhanced mobile backhaul solutions need to be introduced by means of upgrading microwave links or deploying fiber to cell sites.

- On top of this, there is a need for additional incremental spectrum beyond what is currently allocated to 3G and 4G technologies. In this regard, it is important to note that spectrum allocated for use in older generations of mobile technologies such as 3G may prevent such spectrum from being reassigned for use in providing 5G services at this time. It is likely that MNOs may continue offering 3G services in The Bahamas, for the foreseeable future, to meet the needs of specific customer segments and to ensure service continuity. In light of this, it may not be feasible for spectrum used to provide 3G

[8] GSA 5G Market Snapshot, May 2024, Available at: https://gsacom.com/paper/5g-marketsnapshot-may-2024/
[9] Commonly 5G equipment is added to existing cell sites which is complemented by new small cells in high demand areas.
[10] https://www.gsma.com/solutions-and-impact/technologies/networks/gsma_resources/5g-era-mobile-network-cost-evolution/

services to immediately be reassigned for 5G use. Having regard to the foregoing, a phased transition may be appropriate to mitigate adverse impact on customers.

5G can be deployed in phases, typically involving two main configurations:

- **Non-Standalone ("NSA") 5G.** This initial phase leverages existing 4G LTE infrastructure, using it as an anchor for control functions while providing enhanced 5G speeds and performance (i.e., by introducing 5G RANs that rely on a 4G core network). This allows for a quicker and more cost-effective rollout since it builds on the current 4G LTE network. As of mid-2024, there were around 300 NSA 5G networks across 111 countries.[11]

- **Standalone ("SA") 5G**. In this phase, 5G operates independently of the 4G LTE network. It utilizes a new 5G core network. This new 5G core is designed as a service-based architecture, where network functions are decomposed into services that can be accessed via standardized Application Programming Interfaces ("API").[12] This aims to allow for more flexibility, scalability, and modularity. It may also offer advanced network slicing technology to create multiple virtual networks on the same physical infrastructure, each optimized for different use cases. As of mid-2024, there were only 63 SA 5G networks across 33 countries.[13]

In addition to technological phases, 5G is typically deployed in geographical phases, starting with densely populated areas where there is high demand for increased capacity and then moving to more remote areas.

Consequently, URCA acknowledges that instead of an immediate change in network configuration, mobile operators are likely to follow a gradual transition to 5G. This means that they may, over time, transition to deploying 5G, for example, by installing the smaller cells needed in targeted (urban) areas or by relying on NSA 5G roll-out initially. This will allow devices to access both 4G and 5G networks simultaneously using the same spectrum.

This gradual transition to 5G may permit mobile operators to spread investment costs over a longer period of time, allowing operators to assess how the demand for 5G evolves over time.

However, URCA recognizes that the implementation of 5G in The Bahamas will require time, and a non-trivial amount of investment by the mobile network operators to upgrade their existing mobile networks and infrastructures.

[11] According to the Telegeography database consulted in July 2024.
[12] Network APIs (Application Programming Interfaces) allow software/application developers to easily access advanced 5G network capabilities such as differentiated connectivity, location, security/authentication and network insights to enhance existing applications and develop new ones.
[13] According to the Telegeography database consulted in July 2024.

***Question 1**:*

Do you have any comments on the key features and benefits of 5G technology?

If so, please provide a detailed explanation of these observations, including supporting evidence where available.

2.2 Why 5G is important for The Bahamas?

As recognized in Section 2.1 above, in line with the continuous evolution of wireless communications technology, 5G will become the global norm for mobile wireless technology at some point in the near future, including in The Bahamas. Consequently, enabling and implementing 5G in The Bahamas will become inevitable to keep pace with demand and global technological advancements.

Irrespective of this, 5G will also contribute to the implementation of the Government's policy for the Electronic Communications Sector in multiple ways, including:

- **Tourism**: 5G can cater to the expectations of tourists and businesses accustomed to 5G services in their home countries.
- **Provision of broadband to remote islands and disadvantaged communities**: 5G can be used to build Fixed Wireless Access ("FWA") offers to the islands where direct fiber connections to homes and businesses are not economic. While these offers can be provided with existing 4G networks, FWA offers using 5G would likely improve quality and capacity of services in Family Islands. Therefore, the work carried out to facilitate 5G deployment could also contribute to improved connectivity solutions in remote areas irrespective of the technology.
- **Other**: 5G can help to serve the ICT hubs in The Bahamas, e-government initiatives, on-line education, private networks in ports, and the building of resilient communications networks.

***Question 2**:*

Do you have any other comments on the importance of 5G for The Bahamas?

If so, please provide a detailed explanation of these observations, including supporting evidence where available.

2.3 MNO Representations: Implementation challenges

During URCA's ongoing stakeholder engagement, MNOs in The Bahamas represented to URCA that they face numerous challenges when planning their 5G rollout. These representations are summarized below:

- **Incremental spectrum needs**. MNOs can repurpose some of their existing spectrum for 5G deployment. However, they will also require additional spectrum to fully implement 5G on their mobile sites. This is discussed in more detail in Section 3 below.

- **Need for sufficient energy and backhaul capacity.** MNOs have expressed to URCA that unreliable power supply is an issue that has affected mobile networks in The Bahamas for several years and that outside of densely populated areas there are bottlenecks on current backhaul capacities (i.e., carrying traffic from the mobile sites to the core network, as well as transmission capacity between islands in The Bahamas).

- **Scalability of existing mobile sites**. As discussed in previous sections, 5G is commonly deployed incrementally, using existing mobile sites where existing antennas are replaced by 5G-enabled antennas. However, 5G antennas are significantly larger in size (similar to the size of a door) and also heavier. As such, consideration needs to be given to whether the existing mobile towers can cope with the extra weight and wind load from the 5G equipment. Deploying new or re-enforcing existing mobile towers will impact the timing and costs of deploying 5G in The Bahamas.

- **Financial viability of 5G deployments**: According to MNOs, the business case for the rollout of 5G throughout the entire Bahamas is difficult. 5G will likely initially serve specific customers or hotspot locations where demand is high, and lessons from other jurisdictions show that there is limited willingness to pay for this new technology among existing customers. In rural areas such as the Family Islands it is very likely that MNOs will be able to roll-out 5G without cooperation/mutualization.

- **Availability and affordability of end user devices**. 5G can only be used by end user equipped with compatible handsets. This means that customers using legacy handsets will not be able to access 5G functionalities. The availability of affordable devices is crucial to ensuring that consumers benefit from 5G services in The Bahamas.

- **Societal acceptability of 5G**: In some jurisdictions there are public concerns over allegations about the effects on health of radio waves from mobile towers and about the impact of the energy consumption of data intensive networks on climate change.

- **Need for certainty on the regulatory framework governing 5G.** Without a clear and stable regulatory environment, MNOs will not be able to plan and invest in 5G with confidence, as they would be unaware of the rules and guidelines they must follow. Uncertainty increases risks and slows network deployments. Given this, the main purpose

of this consultation process is to develop a regulatory roadmap for 5G in The Bahamas.

The remainder of this document will discuss several of the above issues in more detail. In particular, Section 3 sets out the planned spectrum assignments to enable 5G deployment and Section 4 discusses non-spectrum related implementation considerations.

***Question 3**:*

Do you have any comments on the likely challenges in deploying 5G in The Bahamas set out above?

If so, please provide a detailed explanation of these observations, including supporting evidence where available.

3 Spectrum assignments to enable 5G

Spectrum is an essential requirement for the provision of any mobile wireless service, including 5G. Further, to enable the full potential of 5G technology MNOs require access to additional spectrum to that already made available to them for 2G, 3G and/or 4G mobile wireless services. In this section, URCA sets out the amount of spectrum that needs to be released to facilitate 5G deployments in The Bahamas, as well as the proposed 5G spectrum license terms and conditions, and the assignment procedure, considering the Government's objectives for the release of 5G spectrum, as summarized in Section 3.1 below.

3.1 Government's objectives with regards to 5G and its resulting objectives for any spectrum release

In alignment with global technological trends, the Government of The Bahamas recognizes the importance of advancing the electronic communications infrastructure deployed throughout The Bahamas. The demand for 5G technology, though limited at present, is particularly significant in the tourism sector, which is vital to the nation's economy. The Government also recognizes the significant time and investment needed to deploy 5G technology as well as the importance of planning certainty. Acknowledging the necessity for additional spectrum for mobile services which is classified as "Premium Spectrum" in the National Spectrum Plan (NSP)[14], the Government fully supports URCA's 5G roadmap. It therefore intends to facilitate MNOs' planning efforts by providing clear information on the availability and terms of Premium Spectrum for 5G deployment.

However, the Government's overarching goal remains the provision of fast and reliable internet access to all end users across The Bahamas. This objective is crucial for economic development, social inclusion, and overall quality of life. It can be achieved by building on both MNOs' current coverage obligations and quality of service requirements and by providing sufficient spectrum and the ability to utilize this spectrum with the most recent and efficient technologies available.

Acknowledging the finite nature of spectrum as a public resource, the Government is mindful of the opportunity costs associated with its allocation. Spectrum must be utilized efficiently to maximize its value, given that once assigned, it cannot be allocated to other uses during the license period. The Government considers 5G is an efficient way to use Premium Spectrum[15] to provide fast and reliable internet access throughout The Bahamas.

To support the deployment of 5G, the Government is therefore prepared to release the necessary incremental Premium Spectrum and has asked URCA to design and administrate the spectrum release. In doing so, the Government does not seek to maximize revenue from this

[14] ECS 0/2020 available at https://urcabahamas.bs/decisions/ecs-02-2020-the-national-spectrum-plan-2020-2023/

[15] The Comms Act grants URCA the exclusive right to manage, allocate and assign all frequencies in the radio spectrum in The Bahamas. In recognition of the differences in value and strategic significance, spectrum is categorized into Premium Spectrum and non-premium spectrum in URCA's National Spectrum Plan, excepting that the Minister shall decide the method of allocating frequencies in the Premium Spectrum bands.

release but rather aims:

- to recover the costs associated with the assignment and award process;[16] and
- to obtain commitments from Licensees to improve the quality of their services throughout The Bahamas to ensure everyone has access to reliable and fast internet, regardless of the specific technology used.

With this approach, the Government believes it can foster an inclusive digital environment that supports national development and keeps pace with global technological advancements.

3.2 Release of suitable spectrum for 5G

Given the Government's stated desire to support the deployment of 5G by releasing additional Premium Spectrum, URCA sets out below further details on the specific spectrum bands that could be released, URCA's understanding of the likely amount of additional spectrum that is needed by mobile operators to deploy 5G in The Bahamas, and the main technical considerations related to the use of these spectrum bands.

3.2.1 Spectrum bands currently classified for the provisioning of mobile services

The Comms Act charges URCA with the responsibility for implementing the EC Policy and grants URCA the exclusive right to manage, allocate and assign all frequencies in the radio spectrum in The Bahamas except for Premium Spectrum where the Minister with responsibility for the electronic communications sector decides the method of allocating frequencies.[17]

As part of this function, URCA develops the NSP, which address the regulatory, technical, financial and geographical elements that must be taken into consideration to effectively allocate, plan, price, authorize, and monitor and enforce the use of radio spectrum in The Bahamas, in accordance with the policy objectives of the Comms Act. The current NSP is available on URCA's website.[18]

The NSP covers all spectrum bands, including Premium Spectrum and spectrum not considered Premium Spectrum ("Standard Spectrum"), allocated to all services that require spectrum (including electronic communications services). The NSP sets out, amongst other things, which spectrum bands can be used for mobile wireless services (see table below) and what conditions may lead to the reallocation of spectrum bands (re-farming). The spectrum bands stated in the Table 1 below are all defined by 3GPP[19] for 5G use as part of Frequency Range 1.[20] In Annex A all 3GPP 5G frequency bands are shown.

[16] Ongoing spectrum management costs are commonly recovered through annual spectrum license fees. URCA notes that this is currently not the case in The Bahamas.
[17] See section 30 of the Comms Act.
[18] ECS 02/2020, available at: https://urcabahamas.bs/decisions/ecs-02-2020-the-national-spectrum-plan-2020-2023/
[19] 3GPP is the 3rd Generation Partnership Project. This organization defines 4G and 5G frequency bands.
[20] Source: 3GPP TS 38.104 V18.5.0 (2024-03); https://www.3gpp.org/ftp/Specs/archive/38_series/38.104/

Table 1: List of Spectrum Bands for currently assigned to the provision of mobile services (also classified as "Premium Bands")

Lower Limit	Upper Limit	NSP band name
470 MHz	698 MHz	Sub-700 MHz band
698 MHz	806 MHz	700 MHz Band
824 MHz	849 MHz	850 MHz Band Uplink
869 MHz	894 MHz	850 MHz Band Downlink
1350 MHz	1400 MHz	L-Band
1427 MHz	1518 MHz	L-Band
1710 MHz	1785 MHz	1700 MHz Band
1850 MHz	1915 MHz	1900 MHz Band Uplink
1930 MHz	1995 MHz	1900 MHz Band Downlink
2110 MHz	2185 MHz	2100 MHz Band
2305 MHz	2320 MHz	2300 MHz Band Uplink
2345 MHz	2360 MHz	2300 MHz Band Downlink
2500 MHz	2690 MHz	2600 MHz Band
3400 MHz	4200 MHz	C-Band

Source: URCA's National Spectrum Plan 2020-2023, Table 6

Table 2 sets out 5G bands that are located within the range of the Premium Bands stated in Table 1 above.

Table 2: List of the 3GPP 5G bands within the range of Premium Bands

3GPP NR operating band	Uplink (UL) operating band	Downlink (DL) operating band	Duplex mode	NSP band name
n71	663 MHz – 698 MHz	617 MHz – 652 MHz	FDD	Sub-700 MHz band
n12	699 MHz – 716 MHz	729 MHz – 746 MHz	FDD	700 MHz Band
n28	703 MHz – 748 MHz	758 MHz – 803 MHz	FDD	
n5	824 MHz – 849 MHz	869 MHz – 894 MHz	FDD	850 MHz Band UL 850 MHz Band DL
Future 5G band	Not defined yet		SDL	L-Band
n74	1427 MHz – 1470 MHz	1475 MHz – 1518 MHz	FDD	L-Band
n66	1710 MHz – 1780 MHz	2110 MHz – 2200 MHz	FDD	1700 MHz Band; 2100 MHz Band
n2	1850 MHz – 1910 MHz	1930 MHz – 1990 MHz	FDD	1900 MHz Band UL 1900 MHz Band DL
n40	2300 MHz – 2400 MHz	2300 MHz – 2400 MHz	TDD	2300 MHz Band UL 2300 MHz Band DL
n41	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	TDD	2600 MHz Band
n77	3300 MHz – 4200 MHz	3300 MHz – 4200 MHz	TDD	C-Band
n78	3300 MHz – 3800 MHz	3300 MHz – 3800 MHz	TDD	

Of the 3PP 5G bands stated in Table 2 above, some have been assigned for other use in The Bahamas and are therefore currently not available. Table 3 below therefore summarizes the current availability of 5G spectrum within each of these bands in The Bahamas.

Table 3: List of available 5G spectrum currently available in The Bahamas

3GPP NR operating band	Uplink (UL) operating band	Downlink (DL) operating band	Available	Remarks
71	663 MHz – 698 MHz	617 MHz – 652 MHz	2 x 25 MHz	
12	699 MHz – 716 MHz	729 MHz – 746 MHz	0 MHz	Fully assigned
28	703 MHz – 748 MHz	758 MHz – 803 MHz	2 x 18 MHz	
5	824 MHz – 849 MHz	869 MHz – 894 MHz	0 MHz	Fully assigned
74	1427 MHz – 1470 MHz	1475 MHz – 1518 MHz	2 x 43 MHz	Not usable yet because of lack of devices
66	1710 MHz – 1780 MHz	2110 MHz – 2200 MHz	2 x 45 MHz plus 2 x 20 MHz	2 x 20 MHz is the AWS-4 band (2180-2200 MHz DL combined with 2000 - 2020 MHz UL)
2	1850 MHz – 1910 MHz	1930 MHz – 1990 MHz	2 x 20 MHz	
40	2300 MHz – 2400 MHz	2300 MHz – 2400 MHz	100 MHz	
41	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	194 MHz	Currently assigned[21]
77	3300 MHz – 4200 MHz	3300 MHz – 4200 MHz	400 MHz At a later stage 500 MHz	Bands 77 and 78 are overlapping (3300 MHz – 3800 MHz). 100 MHz of the overlapping part is currently

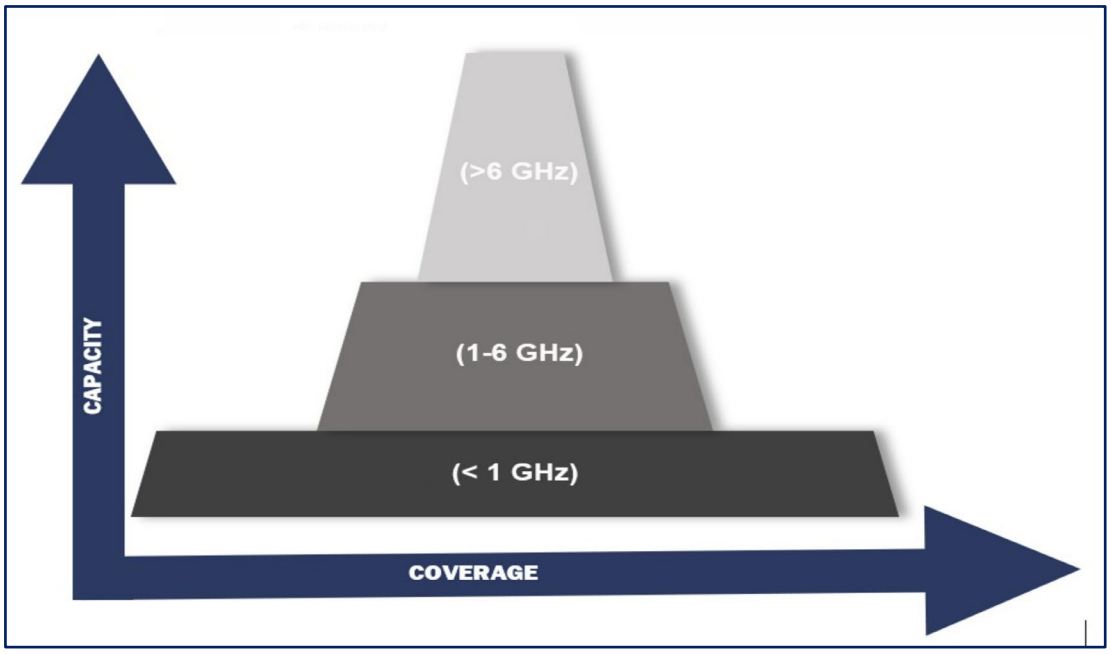
[21] 2500 – 2690 MHz is assigned to Systems Resources Group (SRG) Ltd, a subsidiary of the Cable Bahamas Limited (CBL) Group in New Providence, Abaco and Grand Bahama. BTC currently holds spectrum in the 2590 – 2630 MHz band in Acklins, Bimini, Crooked Island, Exuma and Mayaguana.

78	3300 MHz – 3800 MHz	3300 MHz – 3800 MHz	(100 MHz + 400 MHz) may become available	assigned,[22] the remaining 400 MHz are available. As further discussed in Section 3.2.5 below, the non-overlapping part of band 77 (3800 MHz – 4200 MHz) is overlapping with the C-band (satellite) and adjacent to the band for radio altimeters (4200 MHz – 4400 MHz). For this reason, URCA will not make this part of band 77 available for 5G at this stage.

As discussed in more detail below, mobile operators require a mix of spectrum to deploy 5G, referred to as low-band, mid-band and high-band spectrum. Figure 4 below shows the three main categories of 5G spectrum and their suitability for providing network coverage and network capacity:

- low-band 5G spectrum (< 1 GHz) is best suitable for coverage;
- mid-band 5G spectrum (between 1 GHz and 6 GHz) for a combination of lesser coverage but higher capacity than low-band; and
- high-band 5G spectrum (> 6 GHz) is mainly suitable for providing network capacity.

Figure 4: Overview of Low, Mid and High-band 5G spectrum and the related coverage and capacity characteristics



Source: *https*://www.5gamericas.org/5g-can-help-the-united-states-recover-but-needs-mid-band-spectrum/

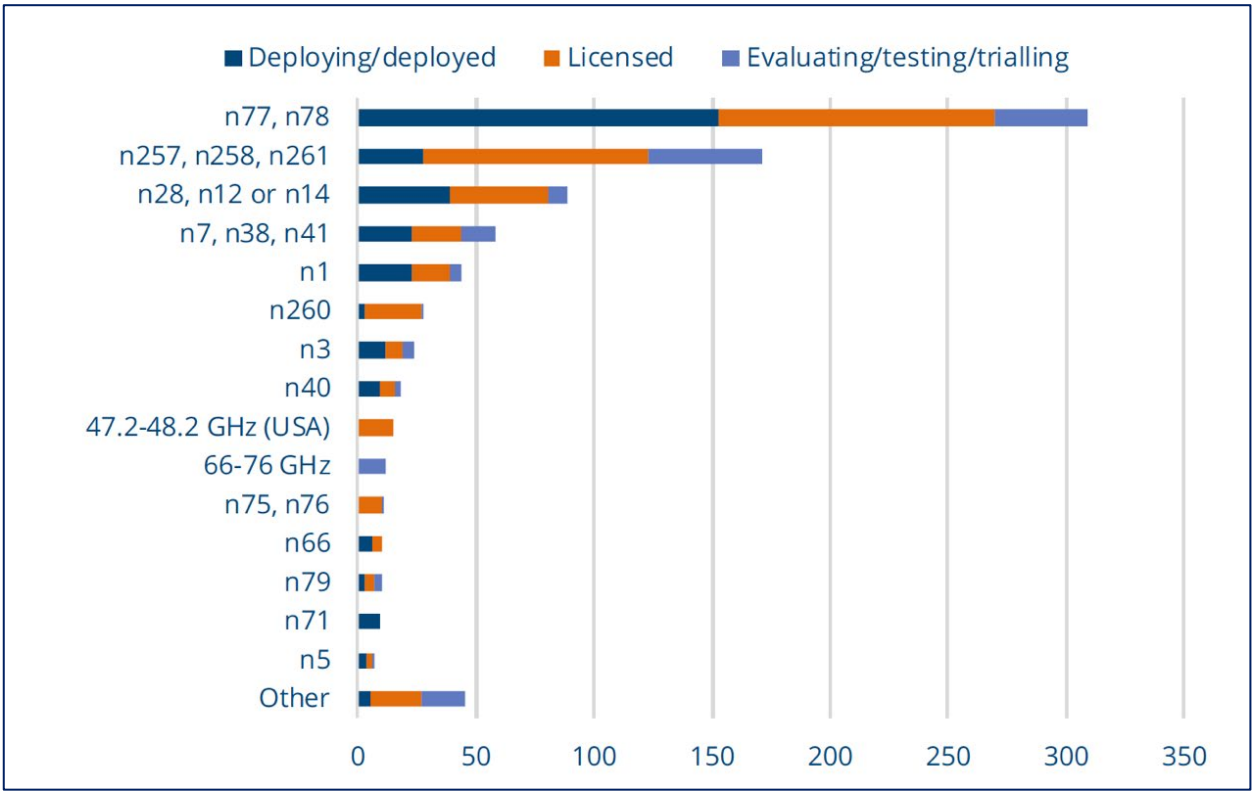
[22] 3400 – 3450 MHz and 3500 – 3550 MHz is currently assigned to BTC for CCTV and WiMAX (Bimini and Cat Cay).

Table 3 above only contains low-band 5G Spectrum (i.e., bands 71 and 28 being currently available for 5G release) and mid-band 5G Spectrum (i.e., bands 2, 66, 40, and 77/78 being currently available for 5G release). This is because only low-band and mid-band spectrum has to date been classified as Premium Spectrum in the NSP in The Bahamas and can therefore be considered for 5G release at this stage.

Further, in most instances, high-band spectrum is not required during the initial stage of 5G deployment, as carrier aggregation will be sufficient to provide the capacity need (see Section 3.2.3 below). However, in future, URCA, in close coordination with Government, will consider including high-band (mmWave) spectrum (e.g., 24 GHz, 28 GHz, 37 GHz and 47 GHz bands) in the table of Premium Spectrum.

Figure 5 below provides an overview of the frequency of each 3GPP 5G band being used in 5G networks around the world by mid-2024 (either actual deployment, licensed or being tested). The available low-band spectrum (bands 28 and 71) is in use in a number of 5G networks, of which band 71 has been used in the US since 2017, especially at a large scale by T-Mobile.[23] Of the available mid-band spectrum, bands 77/78 are currently the most frequently used bands.

Figure 5: Overview of 5G networks and the 3GPP Frequency Bands used



Source: https://gsacom.com/paper/5g-marketsnapshot-may-2024/

To allow taking into account of global technological developments, local market trends, and updates in international spectrum coordination efforts led by the International

[23] Source: https://www.rvmobileinternet.com/fccs-600mhz-auction-concludes-t-mobile-wins-big-nationwide

Telecommunications Union's World Radiocommunication Conferences (ITU WRC),[24] regulatory authorities update their NSPs on a regular basis.

To ensure that NSP remains up to date with global and local developments, URCA is in the process of revising its current NSP and will consult on its draft National Spectrum Plan 2024-27 in the coming months. This will build on the results coming from the latest ITU WRC held in 2023 (WRC-23). In summary, these results were:

- WRC-23 identified additional IMT spectrum[25], which will be crucial for further expanding broadband connectivity and developing mobile services. This new spectrum includes the 3300-3400 MHz, 3600-3800 MHz, 4800-4990 MHz and 6425-7125 MHz frequency bands.[26]

- WRC-23 also defined the use of more low-band spectrum for IMT in the 470-694 MHz band in the Europe, Middle East, and Africa EMEA region (EMEA), identified the 2 GHz and 2.6 GHz bands for using high-altitude platform stations as IMT base stations (HIBS), and established regulations for their operations. This technology offers a new platform for mobile broadband with minimal infrastructure using the same frequencies and devices as IMT mobile networks. HIBS can contribute to bridging the digital divide in remote and rural areas and maintain connectivity during disasters.

- For non-geostationary fixed-satellite service Earth Stations in Motion (ESIMs), WRC-23 defined new frequencies to deliver high-speed broadband onboard aircraft, vessels, trains, and vehicles.[27]

- Finally, WRC-23 defined the agenda for the next WRC due to take place in 2027 (WRC-27), including considering spectrum bands supporting 6G. WRC-27 will focus on the following bands for IMT: 4 400-4 800 MHz, 7 125-8 400 MHz, and 14.8-15.35 GHz.[28] These bands will be crucial for enabling 6G.

In the revised NSP, URCA will seek to comprehensively address the outcomes of WRC-23 and outline how The Bahamas will allocate, manage and utilize spectrum in alignment with the Final Acts of WRC-23 and any other relevant international agreements and The Bahamas' economic, social, and technological goals. This includes specifying any new allocations or reallocations of spectrum bands for 5G services. Subject to the approval of the Minister with responsibility for the electronic communications sector, in the revised NSP URCA will also set out spectrum pricing and allocation mechanisms in alignment with the Government's policy objectives, including the

[24] Source: https://www.itu.int/en/ITU-R/conferences/wrc/Pages/default.aspx
[25] Source: https://www.itu.int/en/mediacentre/Pages/PR-2023-12-15-WRC23-closing-ceremony.aspx
[26] For a detailed overview of all additional frequency bands identified for IMT and the satellite component, reference is made to Resolutions 223, respectively 225 of the Final Acts of the WRC- Source: https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-WRC.16-2024-PDF-E.pdf.
[27] Source: https://www.itu.int/pub/R-ACT-WRC.16-2024.
[28] Source: Resolution 813 (WRC-23): Agenda for the World Radiocommunication Conference 2027, section 1.7, https://rsgb.org/main/files/2024/04/ITU-WRC-27-Agenda.pdf.

Government specific objectives for Premium Spectrum for 5G services.

3.2.2 Existing Premium Spectrum holdings by MNOs

The Bahamas Telecommunications Company Ltd. (BTC) and Be Aliv Limited (Aliv) each currently operate their respective cellular mobile networks using 2 x 24.5 MHz of low-band spectrum and 2 x 30.0/35.0 MHz in mid-band spectrum, as summarized in the table below.

Table 4: Premium Spectrum holdings by BTC and Aliv[29]

Band		BTC	Aliv
Low-band spectrum	700 MHz	2 x 12.0 MHz	2 x 12.0 MHz
	850 MHz	2 x 12.5 MHz	2 x 12.5 MHz
	Sub-total:	***2 x 24.5 MHz***	***2 x 24.5 MHz***
Mid-band spectru	1700 / 2100 MHz	2 x 10.0 MHz	2 x 15.0 MHz
	1900 MHz	2 x 20.0 MHz	2 x 20.0 MHz
	Sub-total:	***2 x 30.0 MHz***	***2 x 35.0 MHz***

Further to the current spectrum holdings of both MNOs set out in Table 4 above, the spectrum holdings in the 2600 MHz band (band 41) and in the C-band (band 77/78) are of importance for determining the spectrum that could be made available for 5G. Currently, band 41 is assigned in some islands for the use of WiMAX (40 MHz) and in other islands for Restricted Mobile Speech Communications Services (190 MHz), and 100 MHz in band 77/78 is assigned for the use of CCTV in New Providence, see also Section 3.2.1 above.

However, the Government/URCA understands that some of these spectrum bands are currently underused and might consider a reclassification of such bands so that these resources are used efficiently.

3.2.3 5G spectrum requirements

To efficiently deploy 5G in The Bahamas, both MNOs require additional spectrum to the spectrum they are currently assigned for 2G, 3G and 4G (see Table 4 above). Given the different properties, MNOs need both low-band spectrum and mid-band spectrum and, once the mid-band spectrum is not sufficient anymore to provide capacity, also high-band spectrum (see Figure 4 above).

Based on URCA's preliminary assessment and taking into account recommendations from the GSM Association amongst others, for an initial 5G deployment in The Bahamas, each MNO will require low and mid-band spectrum to deploy a robust 5G network to ensure wide coverage,

[29] BTC and Aliv (CBL Group) also have been assigned spectrum in non-Premium Bands.

indoor penetration and capacity for high-speed data services.[30]

URCA is cognizant that Licensees require access to adequate spectrum resources to deliver modern and advanced electronic communications services. In recognition of this need and in alignment with industry best practices, URCA will endeavor to allocate and make available sufficient low band and mid-band spectrum to enable Licensees to effectively meet the growing demands of their customers and to support the economic, social and technological policy objectives of the Government.

At a later stage, MNOs are also expected to phase out (sunset) their 2G and 3G, and ultimately also their 4G networks, which will allow them to reuse this spectrum (as set out in Table 4 above) for 5G at that point as well.

URCA is of the view that, for the initial deployment of 5G, no high-band spectrum is needed. The deployment of high-band 5G spectrum typically occurs a few years after the initial deployment of low-band and mid-band spectrum, as the network matures and the demand for higher capacity and speed increases.[31] This position is consistent with the representations made by MNOs to URCA during the URCA's stakeholder engagement meetings.

Question 4:

Do you agree with URCA's assessment that low-band and mid-band spectrum is sufficient for an initial deployment of 5G? If not, please provide a detailed explanation why not and the issues/observations, including supporting evidence where available.

Do you see any need of high-band spectrum in the next few years in the Bahamas? If so, for what type of use case?

In the following sub-section, URCA sets out how these incremental spectrum needs could be met, considering the availability of spectrum in the relevant Premium Bands.

3.2.4 Spectrum bands available for 5G in The Bahamas

Building on Table 3 above, Table 5 below contains a list of the available **low-band spectrum** for the initial deployment of 5G in The Bahamas. This shows that there is ample low-band spectrum available in band 28 and band 71 to offer each MNO low-band spectrum for their initial deployment of 5G. Both bands are commonly used around the world to deploy 5G, but band 28

[30] Sources: GSMA and Nokia (https://www.gsma.com/spectrum/wp-content/uploads/2023/02/Spectrum-Policy-Trends-2023-1.pdf, https://www.gsma.com/connectivity-for-good/spectrum/wp-content/uploads/2022/07/5G-Mid-Band-Spectrum-Needs.pdf and https://www.nokia.com/networks/5g/spectrum/5g-spectrum-bands-explained/.

[31] Source: https://www.gsma.com/spectrum/wp-content/uploads/2021/07/5G-mid-band-spectrum-needs-vision-2030.pdf.

is used more often than band 71 (see Figure 5 above).

Table 5: Available low-band spectrum for the initial deployment of 5G

3GPP NR operating band	Uplink (UL) operating band	Downlink (DL) operating band	Available
71	663 MHz – 698 MHz	617 MHz – 652 MHz	2 x 25 MHz
28	703 MHz – 748 MHz	758 MHz – 803 MHz	2 x 18 MHz

The possible carrier bandwidths in the available low-band 5G spectrum in The Bahamas are shown in Table 6 below.

Table 6: Carrier bandwidths available low-band spectrum

3GPP NR operating band	Minimum Bandwidth	Possible Intermediate Bandwidths	Maximum Bandwidth
71	5 MHz	10 MHz, 15 MHz	20 MHz
28	5 MHz	10 MHz, 15 MHz	20 MHz

Similarly, Table 7 below contains a list of the available **mid-band spectrum** for the initial deployment of 5G in The Bahamas. URCA is of the preliminary view to assign mid-band spectrum in band 77/78 as this is the most common 5G band worldwide (see Figure 5 above). This band also contains significantly more spectrum (500MHz /900 MHz) than band 41 (190 MHz) or any of the other bands set out in Table 6. Assigning band 77/78 would therefore allow catering for future demand of additional spectrum within in the same band.

URCA notes, however, that 100 MHz of band 77/78 is currently assigned for CCTV in New Providence. URCA will therefore examine whether the current spectrum holdings in band 77/78 can be re-farmed to the edges of the C-band to have maximum flexibility in assigning contiguous 5G spectrum blocks in this band in the upcoming 5G spectrum award.

Table 7: Available mid-band spectrum for the initial deployment of 5G

3GPP NR operating band	Uplink (UL) operating band	Downlink (DL) operating band	Available	Remarks
66	1710 MHz – 1780 MHz	2110 MHz – 2200 MHz	2 x 45 MHz plus 2 x 20 MHz	2 x 20 MHz is the AWS-4 band (2180-2200 MHz DL combined with 2000 - 2020 MHz UL)
2	1850 MHz – 1910 MHz	1930 MHz – 1990 MHz	2 x 20 MHz	
40	2300 MHz – 2400 MHz	2300 MHz – 2400 MHz	100 MHz	
41	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	194 MHz	Fully assigned currently.
77	3300 MHz – 4200 MHz	3300 MHz – 4200 MHz	400 MHz At a later stage 500 MHz (100 MHz + 400 MHz) may become available	Bands 77 and 78 are overlapping (3300 MHz – 3800 MHz). 100 MHz of the overlapping part is currently assigned, the remaining 400 MHz is available. As further discussed in Section 3.2.5 below, the non-overlapping part of band 77 (3800 MHz – 4200 MHz) is overlapping with the C-band (satellite) and adjacent to the band for radio altimeters (4200 MHz – 4400 MHz). For this reason, URCA will not make this part of band 77 available for 5G at this stage.]
78	3300 MHz – 3800 MHz	3300 MHz – 3800 MHz		

The possible carrier bandwidths in the available mid-band 5G spectrum in The Bahamas are shown in Table 8 below.

Table 8: Carrier bandwidths available in the mid-band 5G spectrum

bn3GPP NR operating band	Minimum Bandwidth	Possible Intermediate Bandwidths	Maximum Bandwidth
66	5 MHz	10 MHz, 15 MHz	20 MHz
2	5 MHz	10 MHz, 15 MHz	20 MHz
40	5 MHz	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz	100 MHz
41	5 MHz	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz	100 MHz
77	5 MHz	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 90 MHz	100 MHz
78	5 MHz	10 MHz, 15 MHz, 20 MHz, 25 MHz, 30 MHz, 40 MHz, 50 MHz, 60 MHz, 70 MHz, 80 MHz, 90 MHz	100 MHz

Question 5:

Do you have any preference for a specific low-band spectrum band and/or mid-band spectrum band to be assigned to you for the initial deployment of 5G and for a carrier bandwidth? If so, please provide a detailed explanation of your preference(s) and the issues/observations, including supporting evidence where available.

Do you have any preference for a specific carrier bandwidth within the low-band spectrum band and/or mid-band spectrum band to be assigned to you for the initial deployment of 5G? If so, please provide a detailed explanation of your preference(s) and the issues/observations, including supporting evidence where available.

Do you agree with the release of mid-band spectrum in band 77/78 for the initial deployment of 5G? If not, please provide a detailed explanation why not and the issues/observations, including supporting evidence where available.

Do you see merits in refarming spectrum in band 77/78 to freeing up more of those bands for 5G? If not, please provide a detailed explanation why not and the issues/observations, including supporting evidence where available.

3.2.5 Technical considerations of operations

When considering which spectrum bands could be assigned to the Licensees to enable 5G, URCA needs to consider technical compatibility issues from international harmonization under the auspices of the ITU and other users in The Bahamas.

- **International Frequency Coordination agreements to be entered into by The Bahamas and neighboring countries**: URCA needs to ensure that MNOs are not causing harmful cross-border interference and that MNOs in neighboring countries are not causing harmful interference in The Bahamas. These agreements may restrict the use of frequencies in the vicinity of borders, especially low-band 5G spectrum could cause interference over distances over water of 100 – 150 km.[32]

- **Coexistence between Aliv, BTC and other spectrum users:** To coordinate and harmonize the use of the numerous allotments of spectrum, URCA must implement regulatory measures to prevent and mitigate harmful in-band and out-of-band interference to users of the spectrum. In this connection, URCA specifies technical conditions of use, which identify appropriate operating thresholds for the following parameters: Centre frequency, Bandwidth, guard bands, spectral mask and modulation and Time Division Duplex (TDD) synchronization. These technical conditions of use will be aligned with the applicable international standards.

[32] Sources: https://www.fcc.gov/700-mhz-public-safety-spectrum and https://dgtlinfra.com/cell-tower-range-how-far-do-they-reach/.

- **Coexistence with the use of C-band by radio altimeters in the 4.2 – 4.4 GHz band:** This may lead to technical constraints for mobile operators within protection areas around airports, which will be determined by the Civil Aviation Authority Bahamas ('CAAB'). In other countries protection areas around (international) airports are 2100 meters (1.24 miles) from the start and end of the runway and 910 meters (0.56 miles) from the airports center line. Within these areas signal power levels and antenna tilts must be significantly limited to minimize possible interference on radio altimeters.[33]

URCA does not expect the technical considerations set out above to lead to significant limitations for using 5G spectrum, except around airports.

***Question 6**:*

Do you have any comments on the technical considerations that need to be taken into account when determining the relevant spectrum blocks to be made available for 5G in The Bahamas and limitations of its usage? If so, please provide a detailed explanation of these issues/observations, including supporting evidence where available.

3.3 5G Spectrum licenses and assignment procedure

The options described in this section are indicative only, aiming to outline the high-level thinking and key parameters of any license or award process. The exact process design and license terms and conditions will be determined after this process has concluded.

3.3.1 URCA's powers on spectrum

The Comms Act provides that "*URCA has the exclusive right to manage, allocate and assign all frequencies in the radio spectrum in The Bahamas*"[34] and that "*The Minister shall be responsible for deciding the method of allocating frequencies in the premium spectrum band of the spectrum plan*"[35].

The Comms Act also provides that spectrum should be managed and used in a manner that:

> "*(a) is open, objective, transparent and non-discriminatory;*
>
> *(b) is economically efficient and facilitates the evolution of new technologies and electronic communications services whilst taking into account in particular investment in existing equipment configured for specific radio spectrum and the cost of migration to other radio spectrum; and*

[33] Source: https://www.faa.gov/5g
[34] See section 29 of the Comms Act
[35] See section 30 of the Comms Act

(c) meets the needs of government departments and agencies referred to in section 34(1)."[36]

In the current NSP, all low-band and mid-band 5G bands, which have been standardized by IMT 2020 for mobile use are classified as Premium Spectrum.[37] This means that the determination of the method of allocation of spectrum bands for 5G, and the pricing of those bands, are matters to be determined by the Minister with responsibility for the ECS.

As set out in Section 3.1 above, the Government is prepared to release the necessary incremental Premium Spectrum to support the deployment of 5G in The Bahamas and has asked URCA to design and administrate the spectrum release, taking into account the Government's objectives (as summarized in that sub-section of this document).

3.3.2 Spectrum assignment process options

In this sub-section URCA sets out the award process options for assigning the incremental spectrum required for 5G. In particular, URCA considers the merits of allocating the spectrum by means of an auction process or through an administrative procedure. URCA then sets out its preliminary views on the key terms and conditions to be included in the 5G spectrum licenses to be awarded to the Licensees.

3.3.2.1 Auction vs. administrative procedure

There are two common procedures for assigning spectrum, both having different advantages and drawbacks depending on the overall objective of the award and the wider market context:

Auctions
In an auction, eligible parties submit financial offers for the spectrum licenses, based on pre-defined rules. Auctions can take various forms, for example covering a single round or multiple rounds. The successful parties are those who place the highest bid (or bids) for the licenses. There may also be a prequalification phase to ensure that only eligible bidders compete for the license (i.e., a hybrid version of the managed assignment process and auction).

Auctions have often been regarded as an efficient and transparent mechanism for awarding spectrum, particularly in situations, where there is: (i) spectrum scarcity, i.e., there being excess demand for the spectrum, (ii) a sufficient number of possible bidders, i.e., there will be competition for the spectrum to be assigned, (iii) the relevant spectrum is of high economic value to the users, and (iii) uncertainty on the most efficient allocation (including when there are several lots of spectrum assigned at the same time).[38] This is to ensure that the party which

[36] See section 32 of the Comms Act
[37] Further, as recognized above, going forward, URCA will also consider including high-band spectrum (mmWave) spectrum the table of Premium Spectrum.
[38] When spectrum licenses are subject to renewal procedures, there is less uncertainty on use because networks are already rolled out. Re-auctioning already assigned spectrum may dampen investment. This is because if operators are not guaranteed that they will be able to win back their existing spectrum holdings, they would delay investment in new equipment/technologies in order to avoid the new equipment being stranded (if their spectrum holding changes post-auction).

values it most (and hence which should put the spectrum to most efficient use) will be assigned the spectrum at a price reflecting the economic value of the spectrum, subject to this assignment not resulting in any distortionary effects on competition in the relevant market. In these circumstances, auctions have enabled many governments to extract substantial revenues from spectrum licenses. Auctions can cater for the award of individual spectrum lots, multiple lots across different bands, and pre-packaged spectrum licenses.

However, spectrum auctions can be complex and time and resource intensive to design and implement/participate in.[39] As such, they are commonly only used when there is excess demand for the spectrum and the relevant spectrum is of high economic value. They may also result in the risk of winner's curse.[40]

Spectrum auctions can at times also conflict with other policy objectives, such as incentivizing investment and ensuring widespread network coverage and affordability. For example, a 2017 study by PolicyTracker[41] for the European Commission showed an association between poorer 4G network availability and higher auction prices, suggesting an impact on investment. It explains that there is a risk that if mobile operators spend too much money on purchasing spectrum licenses, they may not have sufficient funds to build out networks and expand coverage.

Managed assignment process

Managed assignment process (or "Beauty contests") are used in place or in combination with auction procedures to offer a viable alternative for spectrum assignments. This approach involves evaluating applicants based on a set of predefined criteria, such as network coverage commitments, service quality, and business/investment plans, rather than solely on financial bids.[42]

They can be timelier and more efficient in assigning spectrum when there is limited or no competition for the spectrum to be awarded, and revenue maximization is not the key objective of the assignment process (i.e., non-financial aspects /commitments are important).[43]

Having regard to the characteristics and advantages/drawbacks from both assignment procedures discussed above, URCA proposes to adopt a managed assignment process for the upcoming 5G spectrum release. This is for the following reasons:

- The Government's stated objective for the 5G spectrum release (as set out in Section 3.1 above) is not to maximize the proceeds from the spectrum award, but to incentive network rollout in a timely manner, and to obtain commitments from Licensees to

[39] The degree of complexity depends on the auction design and format. For example, a simple sealed bid auction is less complex than multi-round and combinatorial auction formats.
[40] This implies that the winner of the auction pays a price which exceeds its valuation of the spectrum being allocated.
[41] http://www.policytracker.com/blog/press-release-european-commission-publishes-5g-study-based-on-policytracker-research
[42] Although the amount each applicant is willing to pay for the spectrum can also form part of the evaluation criteria. There may also be a fixed or minimum price for each licence set in advance of the assignment process.
[43] In doing so they may not reveal full economic value of the spectrum.

improve their service across the country to ensure everyone has access to reliable and fast internet, regardless of the specific technology used. A managed assignment process is well-suited to take into account non-financial aspects in the spectrum license award, whilst still facilitating an efficient spectrum use as well as generating revenue for government. It also enables URCA to require non-price commitments from applicants in line with the policy objectives for the market (e.g., coverage, speed, quality of service, etc.).

- The assignment process will only be open for the existing MNOs (BTC and Aliv). This is a result of the URCA's recent investigation into the possible further liberalization of the cellular mobile market in The Bahamas which concluded that a third mobile network operator would not be commercially viable at this point.[44] Given this, limited competition is to be expected in the upcoming 5G spectrum award process.

- Designing an auction procedure specifically tailored to contribute to specific policy objectives can be a lengthy and complex task, appears disproportionate for this spectrum release and may delay the issuance of spectrum licenses and subsequent network rollouts. A managed assignment process represents a more efficient process in these circumstances.

***Question 7**:*

Do you have any comments on the proposed spectrum award procedure for 5G spectrum? If so, please provide a detailed explanation of these observations, including supporting evidence where available.

3.3.3 Spectrum assignment process parameters and spectrum license terms

In the below, URCA sets out some of the main considerations it will need to make as part of the design of the upcoming spectrum assignment process as well as the 5G spectrum licenses that will be awarded as part of this process. In doing so, URCA sets out its preliminary views on the key issues to consider as well as some potential options to adopt. URCA has not, at this point, developed concrete proposals for any of these parameters or license terms. These will instead be developed during the upcoming award design process.

3.3.3.1 Non-price terms

When developing the spectrum assignment procedure and designing the 5G spectrum licenses to made available, there will be a number of non-price aspects to consider:

- **License duration**: Spectrum licenses are generally assigned for several years to provide

[44] Electronic communications sector policy, consultation document ECS 11/2023, paragraph 50.

certainty to Licensees and allow sufficient time for them to recoup their investments. This is also the case in The Bahamas, where the Premium Spectrum licenses have been awarded to Aliv and BTC for 15 years. URCA proposes to apply the same license duration to the 5G spectrum licenses, provided that the Licensees continues to hold an Individual License.[45] URCA considers the 15-year license duration represents an adequate period to allow the licensee to earn a reasonable return on investment efficiently incurred, whilst also ensuring that valuable spectrum is not "tied up" in sub-optimal allocations and assignments over a prolonged period of time.

- **Geographic scope of the spectrum license**: Whilst URCA has the ability to award regional and national spectrum licenses, all Premium Spectrum licenses awarded to date have been national in scope, given the objective to ensure that electronic communications services are available on a national basis. Given this, URCA is minded to also award the 5G spectrum license on a national basis.

- **Coverage obligations**: It is common for mobile spectrum licenses to set out minimum geographic coverage requirements and associated timings for achieving these coverage targets. This is also the case in The Bahamas, where Aliv's Individual Spectrum License contains coverage obligations. As such, URCA proposes to also include coverage obligations in the 5G spectrum licenses. Whilst these are likely to contain similar final targets (in terms of population coverage levels), URCA is cognizant of the high costs of deploying 5G in less densely populated areas and may therefore allow Licensees more time to cover the remoter islands.

  The upcoming spectrum award could also involve obligations on Licensees to improve coverage (and quality of service) in specific areas, with these obligations taking the form of target coverage levels or the number of sites, accompanied by various intermediary milestones.[46] Setting such additional and specific coverage obligations would aim to ensure the Government objectives for this spectrum awards, in terms of improving mobile service availability and performance in all parts of The Bahamas, are met.

- **Minimum network performance obligations**: Beyond geographic coverage targets, the spectrum licenses could include obligations for Licensees to improve the performance of their networks in terms of the services delivered to end users. This could take the form an obligation of means (minimum capacity installed per site) or an obligation of results (setting quality of service targets in line with best international practice, regarding for example, average (download) speeds, package loss, fault repair times, and/or latency). Setting such performance obligations would again aim to ensure meeting the Government objectives for this spectrum awards, in terms of ensuring that mobile service

[45] BTC's and Aliv's Individual Licenses expire in November 2024 and May 2032 respectively. All relevant spectrum licenses and operating licenses are issued coterminously and as such will expire at the same time.
[46] This type of non-price term was for instance included in the 2012 spectrum license issued by URCA to BTC for 4G spectrum in the 700 MHz band.

availability and performance is reasonable across the entire country.

- **Network resilience and restoration requirements**: Resilience refers to an operator's ability to restore normal operations of its infrastructure and services as quickly as possible following major network failures that cause damage and service interruptions. Given The Bahamas' vulnerability to hurricanes and the severe impact these storms can have on mobile network infrastructure, it is important to ensure that the spectrum licenses contain clear requirements on network resilience and restoration. For example, a common requirement within the region is to mandate that all mobile sites need to be built to withstand Category 5 hurricanes) or be restored expeditiously, and in any event, no later than five calendar days after any hurricane has passed The Bahamas.

3.3.3.2 Price terms

When developing the spectrum assignment procedure and designing the 5G spectrum licenses to made available, there will be a number of pricing aspects to consider, including:

- **Level and structure of the spectrum license fee**. It is common for Licensees to pay a fee for the right to use the spectrum awarded as part of the spectrum award process. This is in recognition of the economic value of the spectrum rights to the Licensee (in terms of its ability to earn revenues from the services delivered with the help of the spectrum), the opportunity cost to society of the spectrum, and to incentivize efficient use of the spectrum. The spectrum fee is a "pass-through" fee payable to the Government of The Bahamas and only billed and collected by URCA. URCA anticipates that Licensees will again have to pay spectrum license fees for the 5G spectrum licenses. However, in line with the Government's stated objectives for the 5G spectrum award process, URCA does not anticipate the spectrum fees to be set to maximize revenues or to reflect the likely economic value, but mostly in relation to the opportunity cost of the spectrum, incentivizing efficient use of the spectrum and recovering any costs of the award process. Given the likely level of the spectrum license fee, URCA anticipates that any such fee would have to be paid as a one-off charge, rather than being amortized over the license duration.

- **Annual spectrum management fees.** Spectrum management fees are separate to spectrum fees discussed above, as they seek to compensate the regulatory authority for the costs incurred in awarding the spectrum and undertaking its spectrum management activities (in line with the cost causality principle). As such, these fees are commonly determined on an aggregated basis and apply across all types of spectrum license types (however, in recognition of the differences in value of the different license types, the level of the spectrum management fees may also differ across the license types). URCA notes that it has to date not imposed an annual spectrum management fee on Licensees. However, URCA retains the right to introduce such annual spectrum management fees in future, including on the 5G spectrum licensees.

- **Performance bond**. In many spectrum awards it is common for the applicants to submit a performance bond, in the form of a bank guarantee or letter of credit. This aims to provide financial guarantees that the Licensee will meet all coverage and minimum network performance requirements set out in the spectrum license. Assuming the Licensee complies with all of these requirements, the performance bond will be released once the last coverage or minimum performance level requirement milestone is met. This was also the case in The Bahamas, where Aliv had to provide a performance bond at the time of it being awarded its spectrum license.

  Given this, URCA proposes to also request a performance bond from both Licensees as part of the upcoming 5G spectrum award. The level of the performance bond and the process for releasing it will be determined as part of the spectrum award process design. However, URCA will take into account the level of the performance bonds paid by Licensees in the past, as well as the coverage and performance targets to be included in the 5G spectrum licenses.

***Question 8**:*

Do you have any comments on the price and non-price considerations for the 5G spectrum award and licenses set out above? If so, please provide a detailed explanation of these observations, including supporting evidence where available.

4 Non-spectrum related implementation considerations

In this section URCA summarizes key practical considerations to facilitate the deployment of 5G in The Bahamas which URCA has identified as part of its engagement with MNOs and with key government stakeholders.

4.1 Investment incentives for 5G

Given the MNOs' representations to URCA that there is an uncertain business case for 5G in The Bahamas and the high expected investment needs to deploy 5G across The Bahamas, the MNOs have stated a need for financial support from Government to enable 5G in The Bahamas. According to the MNOs a combination of the following initiatives would be needed in general (i.e., beyond the initial deployment in high demand areas), and to facilitate 5G roll-out on the Family Islands. In particular:

(i) Eliminating or reducing customs duties and/or value added tax (VAT) charged on network equipment and on any additional tower sites required for 5G in order to incentivize a fast roll out of 5G;

(ii) Waiving Business License and Communications License fees on any revenues earned from 5G services sold on the Family Islands during the initial years of 5G provisioning; and/or

(iii) Universal Service Funding to be made available to reduce the cost of 5G wireless broadband access to residential and business users on the Family Islands. This could, according to the MNOs, be funded by a levy on telecommunications services or on new commercial developments granted construction permission in the Family Islands.

URCA acknowledges that a nationwide deployment of 5G will require non-trivial investment over time and that the business case for 5G (esp. in Family Islands) remains uncertain.[47]

It is important to note that initiatives (i), (ii) and the non-telecommunications related levies set out in (iii) fall outside of URCA's control. While URCA can advocate for policies that promote investment and innovation, the ultimate decision-making power in these areas rests with the Government. The need to incentivize investment in telecommunications infrastructure has been recognized by the Government, as evidenced by the establishment of its Communications License Fee Reduction Scheme in 2022/23.[48] This scheme allows Licensees to apply to URCA for a reduction in their annual Communications License Fee (of 0.75% relevant turnover in the first year, increasing to 1.5% for every year thereafter), if they invest at least B$100,000 in emerging

[47] Equally, URCA understands that for their initial 5G deployment in high demand areas on New Providence, MNOs do not require new tower sites. Only at a later stage, MNOs are expected to deploy new sites to improve coverage in the mid-band by rolling-out small cells (micro, pico, femto cells) and when high-band spectrum will be deployed also mmWave cells.

[48] http://www.govnet.bs/wps/wcm/connect/d476d4fd-ddde-4b5f-b2ea-e1ba33ae1f73/COMMUNICATIONS%2BACT%2B%28AMENDMENT%2BTO%2BSCHEDULE%2B3%29%2BORDER%2B2022.pdf?MOD=AJPERES

technologies and services or in underserved areas.[49] As 5G constitutes a new service and emerging technology in The Bahamas, investments in 5G infrastructure would also qualify for this reduction, encouraging MNOs to accelerate the deployment of advanced network capabilities. Additionally, URCA notes that the Government stated that duty on telecommunications equipment has been eliminated.[50]

Currently, there is no Universal Service Fund (USF) in place to support the expansion of electronic communications services to underserved areas in The Bahamas. However, URCA is in the process of reviewing the Universal Service Framework with the aim to issue a consultation on its preliminary findings later this year. This may explore the potential benefits and implementation strategies for a USF in The Bahamas, as well as other ways of ensuring the provision of (enhanced) electronic communications services throughout the entire nation.

4.2 Site approval

As discussed in Section 2.1 above, the transition to 5G existing RAN equipment needs to be upgraded or replaced and cell towers may need reinforcements to cope with the added wind load and weight from 5G antennas and RAN equipment. As 5G relies on a larger number of incremental small(er) cells in the RAN (in addition to existing cell sites) especially when mid-band and high-band spectrum will be deployed, the RAN is commonly densified.

- In The Bahamas, any new mobile tower requires pre-approval by URCA and the Ministry of Public Works, as required by the Buildings Regulation (Electronic Communications Tower) Rules 2016 ("Electronic Communications Tower Rules").[51]

- Further, any changes to the equipment installed on existing mobile towers would also require an inspection by URCA and the Ministry of Works to ensure the structural integrity of the tower remains intact. This will also apply to the installation of 5G antennas, given the increased wind load resulting from the larger 5G antennas, compared to 3G and 4G equipment.

- However, small cells can be installed without any pre-approval,[52,53] subject to the electronic equipment having been type approved by URCA, all health and safety requirements are adhered to, and the respective landlord/owner has given permission for the cell to be installed on their building/property. For the purpose of maximizing

[49] https://www.urcabahamas.bs/wp-content/uploads/2023/08/Comms-Fee-Reduction-Guidance-Note-Final-6-02-23_DD_20022023-JM.pdf
[50] See pg. 14 of the FY 2022/2023 Budget Communication available at https://www.bahamas.gov.bs/wps/wcm/connect/8978f30c-6f67-4177-aab1-8c5fecf58342/FY2022-23_Budget_20220525-055026_FINAL.pdf?MOD=AJPERES
[51] https://laws.bahamas.gov.bs/cms/images/LEGISLATION/SUBORDINATE/2016/2016-0020/2016-0020.pdf
[52] Small cells are commonly deployed on lamp posts, traffic lights, street signs, utility poles, and/or building facades, without requiring any structural constructions like towers.
[53] Small antennas, including micro cells and picocells, are excluded from the electronic communications tower definition in the Buildings Regulation (Electronic Communications Tower) Rules 2016, and thus are not subject to the approval process for mobile towers set out in these Rules.

public benefit and minimizing any potential risks, URCA may consider requiring MNOs to notify URCA of any small cell deployment(s) that: (i) exceed certain thresholds (i.e. power output levels), (ii) are within a certain proximity of sensitive areas/premises (i.e., schools, airports, hospitals), and/or (iii) involve the installation and commissioning of a significant number of cells within a specific geographic area.

It should be noted that the said status quo concerning the installation of small cells and any notification procedure regarding the deployment of small cells implemented by URCA does not and would not prejudice URCA's statutory power to implement any regulatory measure(s) that URCA considers necessary to any market failure(s) and/or carry out the main objectives of the EC Policy.

Based on its initial discussions with the MNOs, URCA understands that during the initial 5G deployment stages (focusing on high demand areas in New Providence and touristic areas), the MNOs would rely on their existing towers (i.e., adding 5G equipment to existing towers) which will be complemented by new small cells in those high demand areas. Given this, URCA expects there to be limited impact of the initial 5G deployment on the existing tower approval application procedure and thus, sees no need to engage with the Government of The Bahamas and/or any other relevant Government Ministries/Department to review the Electronic Communication Tower Rules to facilitate 5G deployment.

4.3 Infrastructure sharing

Sharing of telecommunications infrastructure, such as co-location of radio equipment on mobile towers, is already taking place between MNOs in The Bahamas, demonstrating a commitment to efficient resource utilization and reduced environmental impact. In particular, Aliv is currently collocating on BTC's mobile towers in the Family Islands.

To facilitate this practice, in 2015 URCA issued the Infrastructure Sharing Regulations ("Infrastructure Sharing Regulations").[54] These regulations aim to promote cooperation among Licensees, minimize the need for new tower construction, and ensure optimal use of existing passive infrastructure, thereby supporting sustainable network expansion and improved service delivery across the country. URCA notes that the Infrastructure Sharing Regulations concerns passive infrastructure sharing (such as co-location at towers, poles, or buildings, dark fiber and/or duct sharing), not the sharing of active mobile network equipment (such as antennas and radio network controllers).

Globally, there is an increasing trend towards MNOs sharing parts of their active network infrastructure. This growth in the popularity of active network sharing has been driven by several factors. One key factor is, however, the opportunities that network sharing provides MNOs to meet coverage obligations and address congestion issues, at significantly lower costs, compared to a counterfactual of MNOs deploying separate networks (or only engaging in sharing passive

[54] ECS 04/2015. Available at: https://www.urcabahamas.bs/wp-content/uploads/2016/10/035843400.pdf

network infrastructure or a different form of arrangement). This is becoming even more the case with the increased deployment of 5G infrastructure, which requires operators to undertake significant investments at a time when the ability to monetize such investments is not always clear. URCA notes that MNOs have stated an interest in active network sharing arrangements, in particular, in the context of deploying 5G in the Family Islands.

From a regulatory perspective, network sharing can give rise to both positive and negative effects on the market.

- On one hand, such arrangements can lead to significant cost savings for operators who can pass these on to customers in the form of lower prices, better quality services, and expanded coverage.

- On the other hand, the greater co-ordination between competing operators can increase the scope for anti-competitive information sharing and tacit collusion between the sharing parties, at the expense of other competitors in the market, as well as end-users. In particular, as part of its 2022 Mobile Market Review,[55] URCA concluded that the retail mobile services market in The Bahamas was prospectively competitive and thus URCA removed all ex-ante regulation in this market. However, within this market review, URCA also noted the potential increased risk of tacit collusion between both MNOs going forward (as the market may have reached a point of saturation and market shares had fully converged).
  Further, infrastructure sharing reduces network resilience (as it reduces the duplication of network infrastructure available), an important consideration for the management of natural disasters, such as hurricanes.

Given this, URCA seeks to better understand as part of this consultation process, the importance of active and passive network sharing arrangements for MNOs to be able to deploy 5G in The Bahamas in general, and in the Family Islands in particular. This, in turn, will allow URCA to assess the need for developing rules and regulations around active mobile network sharing.

4.4 Power supply

During recent engagements with URCA, the MNOs have repeatedly raised their ongoing issues resulting from unreliable power supply and power failures affecting their network operations and leading to increased incidences of mobile network outages. Unless resolved, these issues would also adversely impact the provision of 5G services to Bahamian end users.

URCA notes the MNOs' concerns and recognizes the importance of reliable power supply for any electronic communications network, including 5G, and the recent challenges experienced by Licensees. URCA wishes to remind the MNOs that it is imperative and the responsibility of all Licensees to ensure that they have access to a stable and reliable power supply for their entire

[55] ECS 15/2022, available here: https://urcabahamas.bs/decisions/ecs-15-2022-statement-of-results-and-final-determination-retail-cellular-mobile-market-review-and-assessment/

network footprint. Particularly, URCA notes the following obligations:

1. **Condition 14.1 of the Individual Operating Licence** – Licensees are required to comply with any relevant compulsory standards and/or specifications published by International Standards Bodies for the provision of their carriage services, technical interfaces and/or network functions in connection with any of their networks or carriage services;

2. **Condition 27.1 of the Individual Operating Licence** - Licensees are required to take all reasonably practicable steps to maintain, to the greatest extent possible:

   (a) the proper and effective functioning of their networks at all times; and

   (b) in the event of Force Majeure, the availability of their carriage services, including uninterrupted access to Emergency Organisations as part of any carriage services offered by it.

3. **Clauses 4.1 of the Outage Reporting and Mitigation Regulations** – Licensees have a duty to implement and comply with relevant industry best practices, standards, specifications, and/or recommendations for the purpose of:

   (a) identifying risks of Outages occurring;

   (b) reducing risks of Outages occurring; and

   (c) preparing for the occurrences of Outages;

Having regard to the foregoing, URCA consider that a core requirement for maintaining a properly functioning network is ensuring that carriage services remain available during power outages using backup power solutions, including generators, battery backups. As part of their business continuity plans, MNOs need to maintain batteries, solar panels and/or generators with an adequate stock of diesel at all their network facilities and cell sites. URCA notes that this is a common requirement imposed on Licensees around the world, including in countries with unreliable power supply. URCA also notes that the cumulative effect of the above conditions requires Licensees to (a) ensure their network sites and equipment are properly maintained, and (b) implement preventative measures to mitigate the effects of unreliable power supply.

4.5 Private 5G networks

The market for private 5G networks is in its nascent stages and has, according to the industry, significant growth potential. While there are promising use cases and early deployments in the industrial sector, the technology, regulatory environment, and market dynamics are still developing.[56]

[56] Source: https://www.gsma.com/solutions-and-impact/industries/connected-manufacturing/gsma_resources/private-5g-industrial-networks-2023/

Common applications of 5G private networks observed elsewhere include industrial automation, smart factories, remote healthcare, smart grids, and coordination. However, as the industry matures, one can expect to see broader adoption, more standardized solutions, and a clearer understanding of the economic benefits of private 5G networks.

URCA recognizes that the development of Private 5G Networks may represent an opportunity for industries, enterprises, public sector organizations, communities in remote areas (that are underserved or uneconomic to serve) and other entities to enhance operational capabilities, bandwidth capacity and improve quality of life through tailored and high-quality connectivity solutions. Such opportunities are aligned with the Government's economic, social, and technological goals for The Bahamas. URCA is aware that there may be use cases in The Bahamas for Private 5G networks, including private resorts and communities, cruise ports, and container ports.

However, URCA notes that currently there is limited information available to URCA on the demand and use cases for Private 5G Networks in The Bahamas. Therefore, URCA is not currently in a position to propose a specific regulatory framework for such networks or opine on whether such a framework is necessary. As URCA contemplates whether the establishment of a regulatory framework for Private 5G Networks is required, it is crucial that URCA receives feedback on key issues concerning the deployment and management of Private 5G Networks to ensure that any proposed Private 5G Regulatory Framework is fit for purpose, and aligned with the Government's economic, social and technological objectives and international best practices, including:

1. **Spectrum Needs for Private 5G Networks** – The spectrum bands that URCA should consider making available for Private 5G Networks, if any.

2. **Private 5G Network Operation Models** - The network model(s) that industries and organizations would be interested in deploying (i.e., self-managed networks, or networks operated by existing MNOs and/or other URCA Licensees).

3. **Economic and Strategic Impact of Private 5G Networks** - The anticipated economic and social impact of deploying Private 5G Networks and the use cases for Private 5G Networks in specific industries in The Bahamas.

4.6 Health concerns

There is a consensus among international health organizations, including the World Health Organization (WHO) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP), that there are no known adverse health effects from exposure to Radiofrequency (RF) fields below recommended limits.

The introduction of a new technology using existing or new radio frequencies does not change the characteristics of those frequencies. This means that the ICNIRP guidelines which apply up to 300 GHz, and thus well above the frequencies proposed for 5G, remain valid. Therefore, URCA expects there to be no adverse health effects from 5G, provided that 5G RF exposure levels remain below the ICNIRP guidelines[57] for members of the public.

Nevertheless, URCA sees merits in engaging in public awareness campaigns to explain the above and reassure the general public that 5G is safe. Any such campaigns would be planned and executed by the Ministry of Health, with support and input from URCA, with the aim to run the campaigns in the months prior to any 5G services launch in The Bahamas.

URCA considers a possible further way to address any potential health and environment concerns (discussed in Section 4.7 below) would be to provide the general public with an increased level of transparency on Electromagnetic Field (EMF) measurements. This is, for example, done by regulatory authorities in the UK, Ireland, Germany and France with online portals providing the location of antennas and EMF measurements results to members of the public.
URCA may also consider developing EMF Regulations, as many other regulatory authorities around the world already have done.[58] These regulations would set out, amongst others:

- the RF exposure limits (as determined by ICNIRP) and requirements for Licensees to inform URCA on the safety distances (zones)[59] around sites,
- measures taken to prevent the general public entering safety zones (and thus being exposed to EMF levels above the exposure limits), and
- changes of the equipment in a site that affects the safety zones.

Also, the regulations would require licensees to provide URCA with all relevant technical information in order to enable URCA to check the safety zones determined by the licensees.

4.7 Environment concerns

Citizen or environmental protection organizations might be concerned about the installation of additional infrastructure, the impact of 5G on the carbon emissions of increased data traffic, and higher processing requirements and generation of electronic waste induced by the obsolescence of existing equipment.

As 5G networks require much less energy to transmit the same amount of data as 4G, they are more efficient in the ratio of power consumption to traffic. However, 5G network's higher speed and bandwidth might also increase the number of users or the duration of use (rebound effect).

[57] https://www.icnirp.org/en/activities/news/news-article/rf-guidelines-2020-published.html
[58] See for instance https://www.ofcom.org.uk/siteassets/resources/documents/spectrum/emf/guidance-emf-compliance-enforcement.pdf?v=326016
[59] Outside the safety distance, the EMF levels meet maximum exposure limits are met, inside the EMF levels are too high. Safety distances are horizontal and vertical.

For example, URCA notes that this question was recently studied by the French telecommunications regulatory authority (ARCEP), which found that although there was a temporary decline in energy efficiency following the introduction of 5G in France, the energy efficiency of 5G networks ultimately surpasses that of networks relying solely on 4G technology for accommodating traffic growth.[60] Given this, URCA for now has no *a priori* environmental concerns with the deployment of 5G in The Bahamas. However, it welcomes the views of stakeholders and the general public on any potential environmental concerns which might need to be addressed in this context.

***Question 9**:*

Do you have any comments on these non-spectrum related implementation considerations?

If so, please provide a detailed explanation of these observations, including supporting evidence where available.

[60] https://www.arcep.fr/la-regulation/grands-dossiers-thematiques-transverses/lempreinte-environnementale-du-numerique/consommation-energetique-reseaux-mobiles-etude-comparee.html

5 Next steps

Phase II of the 5G consultation process will provide URCA with a better view on key regulatory measures and supply-side considerations to enable a market-led provision of 5G services in The Bahamas.

After consideration of the responses to this Consultation Document (and assuming there is an ongoing demand for 5G deployment by the MNOs), URCA will:

- Confirm the spectrum to be released for 5G;
- Design a spectrum award process and draft 5G spectrum license conditions;
- Update and/or develop any ECS regulations needed to facilitate the deployment of 5G in The Bahamas;
- Assuming URCA receives adequate feedback and information on Private 5G Networks in The Bahamas, confirm whether a Private 5G Network Regulatory Framework is necessary and if so, what matters should be addressed by such framework; and
- Continue to liaise with the relevant Government Ministries/Department and regulatory bodies on environmental, health and planning issues to facilitate the safe and efficient deployment of 5G in The Bahamas.

Annex A: Frequency bands of the 5G technology according to 3GPP

Table A1 below sets out all frequency bands that are defined by 3GPP for 5G use as part of Frequency Range 1 (as of March 2024).[61]

Table A1 – 3GPP 5G spectrum bands - Frequency Range 1

NR operating band	Uplink (UL) operating band BS receive / UE transmit FUL, low – FUL, high	Downlink (DL) operating band BS transmit / UE receive FDL, low – FDL, high	Duplex mode
1	1920 MHz – 1980 MHz	2110 MHz – 2170 MHz	FDD
2	1850 MHz – 1910 MHz	1930 MHz – 1990 MHz	FDD
3	1710 MHz – 1785 MHz	1805 MHz – 1880 MHz	FDD
5	824 MHz – 849 MHz	869 MHz – 894 MHz	FDD
7	2500 MHz – 2570 MHz	2620 MHz – 2690 MHz	FDD
8	880 MHz – 915 MHz	925 MHz – 960 MHz	FDD
12	699 MHz – 716 MHz	729 MHz – 746 MHz	FDD
13	777 MHz – 787 MHz	746 MHz – 756 MHz	FDD
14	788 MHz – 798 MHz	758 MHz – 768 MHz	FDD
18	815 MHz – 830 MHz	860 MHz – 875 MHz	FDD
20	832 MHz – 862 MHz	791 MHz – 821 MHz	FDD
247	1626.5 MHz – 1660.5 MHz	1525 MHz – 1559 MHz	FDD
25	1850 MHz – 1915 MHz	1930 MHz – 1995 MHz	FDD
26	814 MHz – 849 MHz	859 MHz – 894 MHz	FDD
28	703 MHz – 748 MHz	758 MHz – 803 MHz	FDD
29	N/A	717 MHz – 728 MHz	SDL
30	2305 MHz – 2315 MHz	2350 MHz – 2360 MHz	FDD
34	2010 MHz – 2025 MHz	2010 MHz – 2025 MHz	TDD
38	2570 MHz – 2620 MHz	2570 MHz – 2620 MHz	TDD
39	1880 MHz – 1920 MHz	1880 MHz – 1920 MHz	TDD
40	2300 MHz – 2400 MHz	2300 MHz – 2400 MHz	TDD
41	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	TDD
46	5150 MHz – 5925 MHz	5150 MHz – 5925 MHz	TDD (NOTE 3)
48	3550 MHz – 3700 MHz	3550 MHz – 3700 MHz	TDD
50	1432 MHz – 1517 MHz	1432 MHz – 1517 MHz	TDD
51	1427 MHz – 1432 MHz	1427 MHz – 1432 MHz	TDD
53	2483.5 MHz – 2495 MHz	2483.5 MHz – 2495 MHz	TDD
54	1670 MHz – 1675 MHz	1670 MHz – 1675 MHz	TDD
65	1920 MHz – 2010 MHz	2110 MHz – 2200 MHz	FDD
66	1710 MHz – 1780 MHz	2110 MHz – 2200 MHz	FDD
67	N/A	738 MHz – 758 MHz	SDL
70	1695 MHz – 1710 MHz	1995 MHz – 2020 MHz	FDD
71	663 MHz – 698 MHz	617 MHz – 652 MHz	FDD
74	1427 MHz – 1470 MHz	1475 MHz – 1518 MHz	FDD
75	N/A	1432 MHz – 1517 MHz	SDL
76	N/A	1427 MHz – 1432 MHz	SDL
77	3300 MHz – 4200 MHz	3300 MHz – 4200 MHz	TDD

[61] *Source:* 3GPP TS 38.104 V18.5.0 (2024-03); https://www.3gpp.org/ftp/Specs/archive/38_series/38.104/

NR operating band	Uplink (UL) operating band BS receive / UE transmit FUL, low – FUL, high	Downlink (DL) operating band BS transmit / UE receive FDL, low – FDL, high	Duplex mode
78	3300 MHz – 3800 MHz	3300 MHz – 3800 MHz	TDD
79	4400 MHz – 5000 MHz	4400 MHz – 5000 MHz	TDD
80	1710 MHz – 1785 MHz	N/A	SUL
81	880 MHz – 915 MHz	N/A	SUL
82	832 MHz – 862 MHz	N/A	SUL
83	703 MHz – 748 MHz	N/A	SUL
84	1920 MHz – 1980 MHz	N/A	SUL
85	698 MHz – 716 MHz	728 MHz – 746 MHz	FDD
86	1710 MHz – 1780 MHz	N/A	SUL
89	824 MHz – 849 MHz	N/A	SUL
90	2496 MHz – 2690 MHz	2496 MHz – 2690 MHz	TDD
91	832 MHz – 862 MHz	1427 MHz – 1432 MHz	FDD (NOTE 2)
92	832 MHz – 862 MHz	1432 MHz – 1517 MHz	FDD (NOTE 2)
93	880 MHz – 915 MHz	1427 MHz – 1432 MHz	FDD (NOTE 2)
94	880 MHz – 915 MHz	1432 MHz – 1517 MHz	FDD (NOTE 2)
95 (NOTE 1)	2010 MHz – 2025 MHz	N/A	SUL
96 (NOTE 4)	5925 MHz – 7125 MHz	5925 MHz – 7125 MHz	TDD (NOTE 3)
975	2300 MHz – 2400 MHz	N/A	SUL
985	1880 MHz – 1920 MHz	N/A	SUL
996	1626.5 MHz -1660.5 MHz	N/A	SUL
100	874.4 MHz – 880 MHz	919.4 MHz – 925 MHz	FDD
101	1900 MHz – 1910 MHz	1900 MHz – 1910 MHz	TDD
1024	5925 MHz – 6425 MHz	5925 MHz – 6425 MHz	TDD3
1048	6425 MHz – 7125 MHz	6425 MHz – 7125 MHz	TDD
105	663 MHz – 703 MHz	612 MHz – 652 MHz	FDD
106	896 MHz – 901 MHz	935 MHz – 940 MHz	FDD
109	703MHz – 733 MHz	1432 MHz – 1517 MHz	FDD (NOTE 2)

NOTE 1: This band is applicable in China only.
NOTE 2: Variable duplex operation does not enable dynamic variable duplex configuration by the network and is used such that DL and UL frequency ranges are supported independently in any valid frequency range for the band.
NOTE 3: This band is restricted to operation with shared spectrum channel access as defined in TS 37.213 [20].
NOTE 4: This band is applicable only in countries/regions designating this band for shared-spectrum access use subject to country-specific conditions.
NOTE 5: The requirements for this band are applicable only where no other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area. For scenarios where other NR or E-UTRA TDD operating band(s) are used within the frequency range of this band in the same geographical area, special co-existence requirements may apply that are not covered by the 3GPP specifications.
NOTE 6: UL operation is restricted to 1627.5 – 1637.5 MHz and 1646.5 – 1656.5 MHz per FCC Order DA 20-48.
NOTE 7: DL operation is restricted to 1526-1536 MHz frequency range. UL operation is restricted to 1627.5 – 1637.5 MHz and 1646.5 – 1656.5 MHz per FCC Order 20-51 [24].
NOTE 8: This band is applicable only in countries/regions designating this band for IMT licensed operation in accordance with RCC Recommendation 1/21.

Table A2 below sets out all frequency bands that are defined by 3GPP for 5G use as part of Frequency Range 2 (as of March 2024).

Table A2 – 3GPP 5G spectrum bands - Frequency Range 2

NR operating band	Uplink (UL) and Downlink (DL) operating band BS transmit/receive UE transmit/receive FUL,low – FUL,high FDL,low – FDL,high	Duplex mode
257	26500 MHz – 29500 MHz	TDD
258	24250 MHz – 27500 MHz	TDD
259	39500 MHz – 43500 MHz	TDD
260	37000 MHz – 40000 MHz	TDD
261	27500 MHz – 28350 MHz	TDD
262	47200 MHz – 48200 MHz	TDD
263	57000 MHz – 71000 MHz	TDD