



***UGANDA COMMUNICATIONS COMMISSION***

***RADIO FREQUENCY SPECTRUM MASTER PLAN***

***2021/22 To 2025/26***

**OCTOBER 2021**

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## LIST OF ABBREVIATIONS

3GPP:	Third Generation Partnership Project
ATU:	Africa Telecommunications Union
FWFA:	Broadband Fixed Wireless Access
DAB:	Digital Audio Broadcasting
DVB-T:	Digital Video Broadcasting-Terrestrial
EIRP:	Effective Isotropic Radiated Power
FWA:	Fixed Wireless Access
GE84:	Geneva 1984
HAPS:	High Altitude Platform Stations
HIBS:	High-altitude platform stations as IMT base stations
IEEE:	Institute of Electrical and Electronics Engineers
IMT:	International Mobile Telecommunications
IoT:	Internet of Thing
ISM:	Industry Science and Medical
ISP:	Internet Service Provider
ITU:	International Telecommunications Union
LAN:	Local Area Networks
LTE:	Long Term Evolution
M2M:	Machine to Machine
NBP:	National Broadband Policy
NB-IoT:	Narrow Band Internet of Things
NR-U:	New Radio (5G) in Unlicensed Bands
NTFA:	National Table of Frequency Allocation
PPDR:	Public Protection and Disaster Relief
QoS:	Quality of Service
RLAN:	Radio Local Area Networks
SRD:	Short Range Devices
UCC:	Uganda Communications Commission
UWB:	Ultra-Wide Band
WAN:	Wide Area Networks
WB-IoT:	Wideband Internet of Things
WRC:	World Radiocommunications Conference
WLAN:	Wireless Local Area Networks

## **1. INTRODUCTION**

Radio spectrum is a unique and finite infrastructure resource to integral all wireless telecommunication systems. Evolution in technology and new use cases has led to the introduction of new wireless services and applications, the convergence of several communication platforms, and high-speed data connections all requiring more spectrum. This has continued to place constraints on the available radio frequency spectrum, thus necessitating a review of existing allocations and identification of new allocations.

Uganda Communications Commission (UCC) has thus developed a five (5) year spectrum Master Plan to, among others, facilitate the availability of radio spectrum to address the needs of spectrum users and unlock the potential of radiocommunications in the transformation of Uganda into a digital society. These aspirations are in line with the Uganda Vision 2040, the third National Development Plan, and the National Broadband Policy (NBP) 2018.

The authority to develop this radio spectrum Master Plan is derived from among others, Sections 5(1)(c) and 25 of the Uganda Communications Act, 2013 (the “Act 2013”), the Uganda Communications (Licensing) Regulations concerning radio communication services and installation and operation of radio communications services’ equipment.

## **2. AMENDMENT**

This Master Plan shall be subjected to review during the period 2021/22 to 2025/26 to ensure continued relevance, by inclusion of any key developments due to the evolution of the communications industry, changes in policies and regulations, as well as emergent international best practices.

## **3. OBJECTIVE**

The objectives of this radio spectrum Master Plan are to;

- i)* promote certainty and encourage investment through the anticipation and interventions to meet the needs of spectrum users;
- ii)* facilitate national stakeholders by ensuring that spectrum management decisions respond to market demands;
- iii)* proactively seek opportunities to optimize the benefit of spectrum for its users, maximizing its value to society.

## **4. INTERPRETATIONS**

The terminologies used in this radio spectrum Master Plan shall carry the interpretation of the Act 2013 and regulations issued thereunder unless otherwise defined below.

“**ESIMS**” means Earth Stations in Motion (under satellite service);

**“IoT”** The Internet of Things (IoT) refers to a system of interrelated, computing devices and internet-connected objects that are able to collect and transfer data over a network without human interaction.

**“IMT2020”** International Mobile Telecommunication 2020 (and beyond);

**“M2M”** Means Machine to Machine, that is, communication among machines without (or limited) human interventions.

## **5. APPLICABLE LEGISLATION AND REGULATIONS**

This spectrum masterplan shall be implemented subject to the relevant provisions of the following;

- i) the Uganda Communications Act 2013.
- ii) the UCC Radio Spectrum Planning Framework 2019,
- iii) the UCC Radio Spectrum Authorisation Framework 2019,
- iv) the UCC Spectrum management guidelines in force,
- v) directives issued by the Commission

## **6. SCOPE**

The Master Plan is developed in respect to section 25 of the Act 2013, highlighting the areas of focus for UCC in the period 2021/22 – 2025/26 to address the radio frequency spectrum demands during the period.

## **7. APPLICABILITY**

The Master Plan applies to all spectrum as allocated in the National Table of Frequency Allocation (NTFA).

## **8. THE MASTER PLAN**

### **8.1 Sector status review**

Over the years, UCC has allocated radio frequency spectrum in the Low, and Medium radio frequency spectrum bands (see figure 1 below) to support various categories of communication services requirements under both licensed<sup>1</sup> and unlicensed<sup>2</sup> frameworks.

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<sup>1</sup> Requiring prior authorisation that grants permission to access and utilize specified radio frequency spectrum resources

<sup>2</sup> Group or class authorisation granting any person permission to access and utilize particular radio frequency spectrum subject to complying with the specified technical conditions.

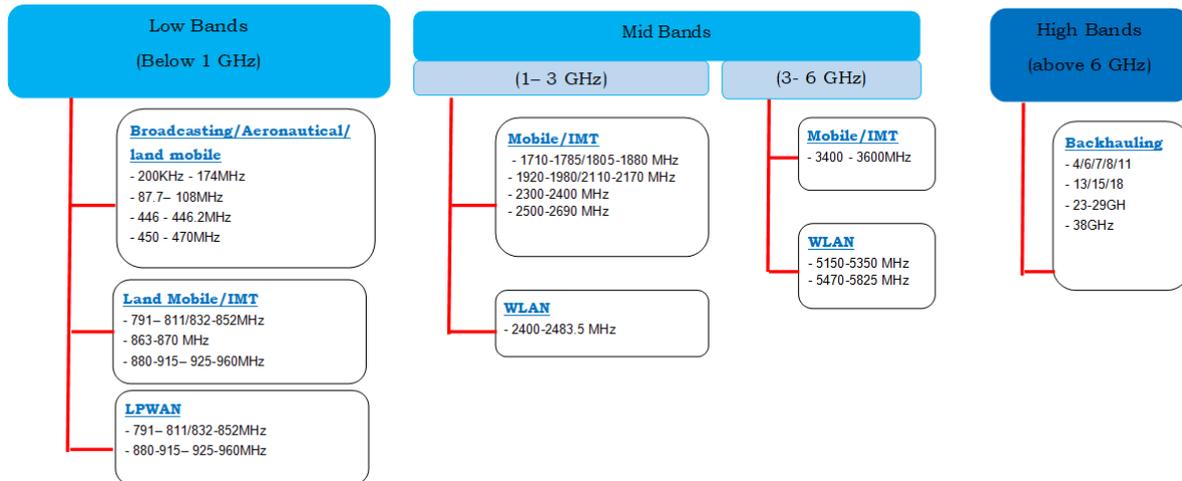


Figure 1: spectrum allocated and authorized for commercial use

Within this Master Plan’s cycle and in alignment with regional and international best practices, UCC will continue repurposing spectrum in this range and also consider radio frequency spectrum in bands higher than 6GHz (high bands) to ably meet the noted demand.

## 8.2 Spectrum uses

In addressing requirements for different spectrum uses, UCC has taken into consideration existing and emerging technologies, regional and international industrial developments/trends that have notably driven the demand for radio frequency spectrum, and the demand as established from consultations with the different stakeholders.

### 8.2.1 Wireless (fixed and mobile) broadband, including 5G

There are several emerging wireless technologies including but not limited to 5G, wide local area networks (WLAN), low power wide area networks (LPWAN) with many overlaps and correlations between these and their use cases. Many more are envisaged to be enabled by the 5G cellular systems, as either proprietary or open standards. International mobile technologies - IMT2020 including 4G, 5G & 6G cellular technologies, vehicle to vehicle (V2V) wireless, wireless sensing, network slicing, Bluetooth & Wi-Fi, high altitude platform systems (HAPS), Zigbee and Lora technologies are envisaged to be the most significant in the period, hence immensely contributing to the demand for radio frequency spectrum in the next five (5) years<sup>3</sup>;

To be able to deliver their broadband capabilities, the above technologies including IMT technologies are anticipated to utilize spectrum across three (3) major radio frequency spectrum band categories, namely;

- i) ‘Low-band range’, covering spectrum below 1 GHz, much of which has been planned or re-purposed to support mobile broadband services and applications,

<sup>3</sup> Gartner Identifies the Top 10 Wireless Technology Trends for 2019 and Beyond, July 23, 2019

- ii) 'Mid-band range', covering the spectrum between 1 and 6 GHz, some of which is already used for both mobile and fixed wireless broadband access as shown in figure 1 above,
- iii) 'High-band range' covering spectrum ranges above 6 GHz.

In addition to opening new frequency bands (bands previously not used for broadband services), UCC will over the next five (5) years re-farm and review band plans/policies for already assigned spectrum in these ranges with the aim of facilitating the use of such bands to support these technologies including 5G.

Further, UCC envisages that the existing technical frameworks that provide for technology neutrality in bands already repurposed will allow spectrum users (licensees) the flexibility to re-farm such spectrum and adopt new technologies. Where appropriate, UCC will revisit some of these frameworks to facilitate the provision of broadband and adoption of other technologies.

The bands under consideration for the period include the 450MHz, 700MHz (digital dividend 2), and 1880 – 1920MHz band, in the low bands; 2300-2400MHz, 3300-3600MHz in the mid-band; and the *mmWaves* bands above 24GHz band including the 71/81GHz bands (E-band) and the 57/71GHz band (V-band).

UCC continues to keep abreast with global developments, participate in regional and international studies, and monitor demand in respect of deployments in the 40GHz, 46GHz, and 47GHz bands following their identification for IMT at 2019 World Radio Conference (WRC-19).

### **8.2.2 Private/Industry vertical networks**

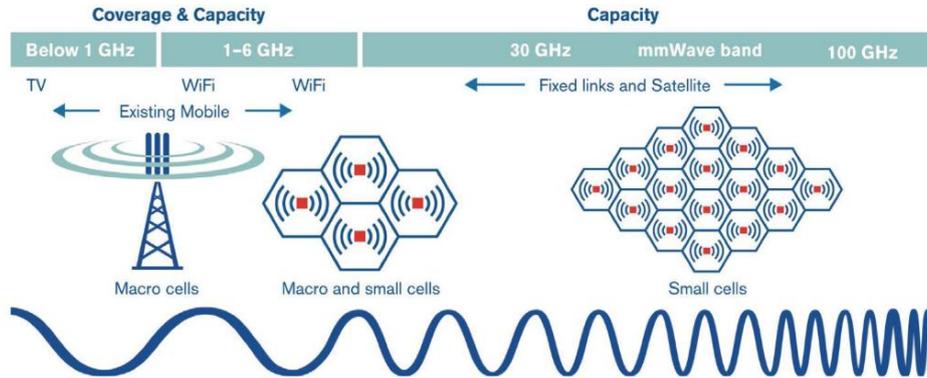
Private and/or integrated networks are increasingly becoming more popular despite the increased availability of long-term evolution (LTE) coverage. Private networks referred to are dedicated networks, acting as local area networks (LAN) that provide secured connectivity and meet specific requirements (*throughputs, latency, security and reliability*) within limited geographic areas.

Private networks have traditionally relied mostly on radio spectrum in the 2.4GHz and 5GHz, largely utilized by the Wi-Fi technology. In the wake of the COVID-19 pandemic, Wi-Fi hotspots around the world have been overloaded, and their demand for higher capacity & data speeds has globally increased significantly among the private organization, regulators, manufacturers, and other potential users. This has spurred the incorporation of private 5G networks that offer higher capacity, data speeds, reliability, and security.

These are believed to grow exponentially with the increasing 5G deployments and are expected to support various industry verticals such as automated guided vehicles (AGVs), drones, sensor technology in manufacturing, media,

energy, eHealth, public safety, heavy machinery automation, robotics, smart cities and homes/communities etc.

With the increasing demand for capacity, a noted limitation of the 2.4GHz and 5GHz bands, these networks have been observed crossing into 5G candidate bands (figure 2 below) that provide diversity in supporting the various verticals' requirements.



(Source: GSMA) Figure 2: 5G spectrum ranges to support private networks

Private 5G networks, deployed either as industrial or cellular internet of things (IoTs) connections, are anticipated to provide the above vertical industries with high-performance networks. These industry verticals have notably increased demand for 5G private networks.

In noting the evolution of the private /vertical industries networks, associated requirements, and the need to support use cases as applicable, UCC;

- a) is reviewing the guidelines on the usage of the 2.4GHz and 5GHz bands to among others align with outcomes of the WRC-19, and update the technical and regulatory provisions to support anticipated requirements;
- b) shall seek to facilitate the 5G platform to act as local area networks (LAN) providing connectivity within limited geographical areas towards the vertical sectors' private or dedicated networks requirements and growth. In this regard, UCC shall adopt a dual option approach in which;
  - i. licensed operators having access to adequate 5G radio frequency spectrum and with wide territorial coverage can build and support such private or dedicated networks,
  - ii. unlicensed spectrum (see table 1) can be utilized to deploy 5G private New Radio Unlicensed (NR-U) networks to support the vertical sector requirements.
- c) shall consider the adoption of the lower 6GHz band to support WiFi-6;
- d) continue following ITU-R WRC-23 studies on Agenda Item 1.2 related to the introduction of IMT in the upper 6GHz (6 425-7 025) MHz band.

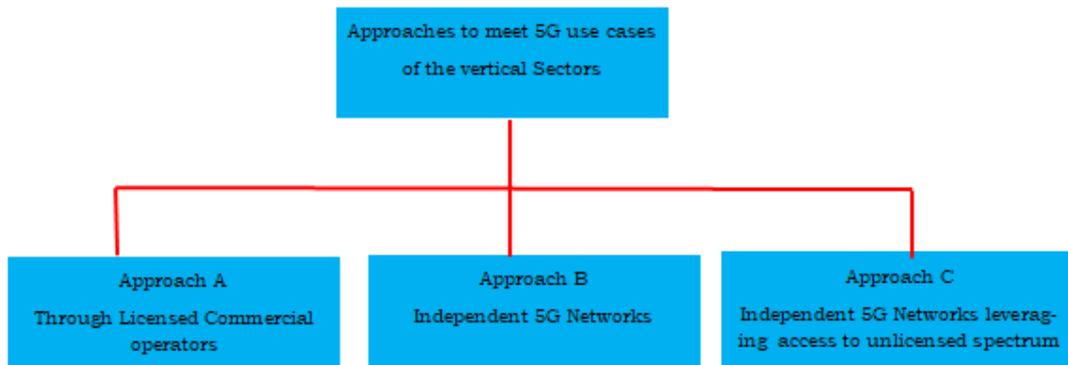


Figure 3: Approaches to meeting 5G vertical sector demands

### 8.2.3 Machine-to-Machine (M2M) Communication

The IoT/machine to machine (M2M) type communications are also anticipated to continue growing exponentially over the next five years. The expeditious global growth of M2M communications is attributed to the increased proliferation and growth of IoTs, that require low power for their efficient operation. M2M communication is increasingly becoming critical to private networks facilitating automation of processes through IoTs that are not restricted to any technology platform, thus making it easier to deploy and run M2M systems.

The current trends though indicate broadband IoT powered by 4G and 5G will overtake 2G and 3G powered IoTs over the next five years (see figure 4 below).

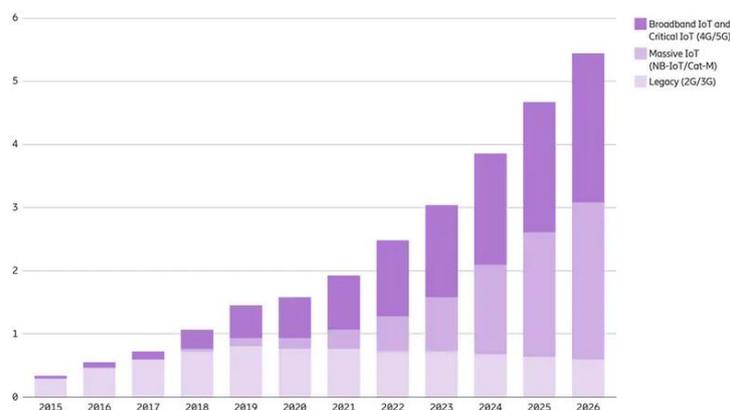


Figure 4: Cellular IoT connections by segment and technology (billion) (Source: Ericsson outlook)

In this respect, UCC has observed that devices providing industrial metering, switching, and/or control (including smart infrastructure) are a subset of IoT communication technologies that have seen most substantial deployments in recent years. Such devices require very low data rates and/or very low duty cycles and operate in low-power wide-area networks (LPWAN). Some of the most common Low power technologies are categorized as either proprietary (e.g., LoRa, Sigfox, Ingenu, Symphony), standard cellular (e.g., Narrow-Band

(NB)-IoT and LTE-Mobile), and/or many other standards/open protocols such as the IEEE standards (Wi-Fi and Wi-Fi6) operable in the unlicensed spectrum.

Further, it has been noted that given the unique capabilities of satellite systems in terms of their wide coverage, several companies are delivering or pursuing new space-based IoT services, with some enabled through new small-satellite technology.

In preparation and response to the demands attributed to the steadily growing proliferation of M2M applications, powered by either terrestrial IoT networks or space based IoTs, UCC will in the period;

- i). review the 2GHz band to make spectrum available to support space based IoTs applications under the NFTA
- ii). in line with the development of a conducive regulatory environment to support emerging technologies, UCC is developing a framework for satellite regulation to foster the growth of the satellite industry.
- iii). cognizant of IoT/M2M systems requirements the spectrum highlighted in table 1 below shall continue to facilitate both Narrowband and wideband IoT systems as well as industry science and medical (ISM) use requirements over the next five years,
- iv). facilitate the adoption of some of the provisions highlighted in the African Telecommunications Union ATU-R recommendation 005-0 on emerging technologies.

**Table 1:** Spectrum to support IoT/M2M operations

Frequency Band (GHz)	Frequency range (MHz)	Application and Max permissible emission limits (EIRP)
2.4GHz	2400– 2483.5	UCC guidelines on the utilization of the 2.4GHz band
5.0GHz	5150–5250	UCC guidelines on the utilization of the 5.0GHz band
	5250–5350	
	5470–5600	
	5650–5725	
	5725–5850	
0.9GHz <sup>4</sup>	915–925	Frequency hopping & digitally modulated transmitters (maximum power 1Watt)

### 8.2.4 Satellite Communication technologies

Satellite technology continues to play a significant role in connecting people especially in the underserved and unserved areas to various communication services. Globally, Satellite communications is undergoing a significant technological innovation and disruption in the provision and delivery of

<sup>4</sup> All operation in this 900MHz band range are subject to neither causing interference nor claiming protection from the incumbent licensed services.

communications and other space-based services leading to a compound annual growth rate (CAGR) projection for the period 2021-2026 of 6.9%<sup>5</sup>, due largely to growth of data communication (see figure 5). This projection is supported by the noted increase in subscriptions and service development to support various requirements including global efforts to fight the COVID-19 pandemic.

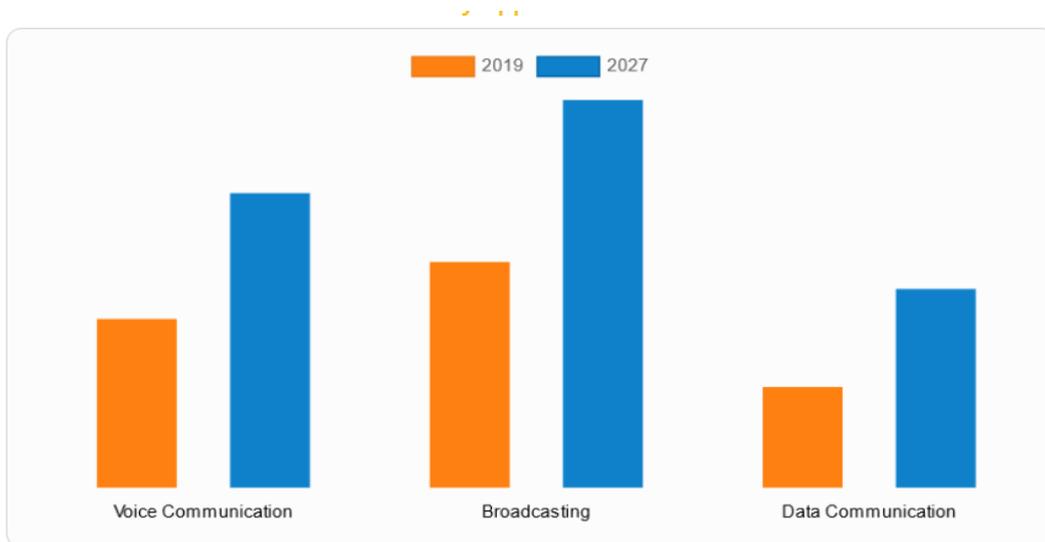


Figure 5: satellite communication market by application, growth projection for the period 2019-2027 (Source Mordor Intelligence)

The CAGR projection is attributed to two factors, namely;

- i). advancement in satellite technology and
- ii). increased interest to invest in satellite communications.

These have greatly facilitated the development and deployment of nanosatellites (lightweight  $\leq 10\text{Kg}$ ) that have gained popularity due to their various capabilities, hence enabling the launching of several constellations and a resultant reduction in the relative cost of connectivity.

UCC has noted that collectively, market and technology changes in respect to satellite communications have led to an increase in local preference of satellite communications to support high throughput systems (HTS) and very high throughput systems (VHTS) of various end-user vertical sectors including but not limited to industry, government, transportation and logistics, media and education (e-learning), especially during the COVID-19 pandemic. These are noted to be driving several spectrum managements challenges, many of which are being addressed, at the international level given the nature of satellite systems.

Further, in support of emerging technologies, satellite communications are envisaged to play an enabling role in the deployment and adoption of 5G in

<sup>5</sup> Source: Global Satellite Communication (SATCOM) Market - Growth, Trends, Forecasts (2021-2026)

ways similar to how they have enabled increased adoption of IoTs by various industries particularly automobile, defense, agriculture and healthcare.

Therefore, in addressing the spectrum demand attributed to the increased utilization of satellite communications as a complement or alternative to terrestrial fixed and mobile networks, UCC in alignment with the ITU-R Resolutions 156 (WRC-15), 559 (WRC-19) and 169 (WRC-19) will;

- i).* continue monitoring regional and international industry trends in respect to satellite communications to facilitate the development of an enabling regulatory environment and adoption of various WRC outcomes,
- ii).* develop a framework for satellite communications in Uganda to promote the growth of satellite communication technologies and services in Uganda,
- iii).* continue to work collaboratively with other government agencies and ministries associated with development of satellite services in Uganda and support the National Space agency project being pioneered by the Ministry of Science Technology and Innovation.

### **8.2.5 Broadcasting services**

Terrestrial sound and television broadcasting remain the most predominant means of mass information dissemination in Uganda and globally. Broadcasting also notably occupies a large share of the satellite communications supported services (figure 5 above). Accordingly, UCC continues to make considerations to facilitate the provision of broadcasting services and shall in the period focus on the interventions highlighted below.

#### ***i) FM Sound broadcasting***

Despite the limited terrestrial FM sound broadcasting resources allocated under the ITU Geneva 1984 (GE84) Plan in Uganda and elsewhere in Africa, the demand for broadcasting services continues to grow with many regions and markets opting to adopt digital sound/audio broadcasting.

UCC together with other African administrations are undertaking a project to optimize the existing FM band (87.5MHz – 108MHz) with the view of provisioning additional radio frequency channels and coordinating with the neighboring countries as applicable under the ITU framework.

Additionally, UCC is undertaking studies to explore the feasibility of implementing the digital terrestrial television broadcast standard, DVB-T2 for delivery of digital audio broadcasting in Uganda.

In a bid to relieve the strain on the FM band, UCC in collaboration with interested broadcasters in the applicable region, is undertaking a pilot project to establish the feasibility of introducing digital audio broadcasting (DAB or DAB+) in Uganda as an alternative platform for sound broadcasting and other applications that can be supported.

**ii) Community radio broadcasting**

The growth in demand for local broadcasting facilities has led to the use of open-air megaphones or other public address systems in violation of existing communications and noise pollution regulation.

UCC is thus developing a framework to facilitate localized community broadcasting under a low-power FM broadcasting spectrum.

**8.2.6 Spectrum for Government requirements**

UCC has noted an increase in spectrum demand by government (ministries, departments, and agencies) to support various services including but not limited to SMART services, aviation safety, public safety, and national security.

During the period, UCC will continue to consider and plan for such government radio spectrum needs, interests, and requirements in the different frequency ranges. Spectrum to cover interests related to public protection and disaster relief (PPDR) shall be made available on a case-by-case basis, and such use cases shall be made public. Radio spectrum for national security and defense systems shall however not be disclosed.

**8.2.7 Amateur Radio**

During the COVID-19 pandemic, various communication technologies and/or systems have been utilized to relay information across the globe. Amateur radio continues to be one of these. Amateur services are longstanding users of the radio spectrum, utilizing a wide range of bands across the radio frequency spectrum allocated in the NTFA.

During this planning cycle, UCC will continue to support this category of spectrum users by making available spectrum to support their respective requirements, particularly in line with the outcomes of the WRC-19 as provided under NTFA 2020 footnote 5.169A.

**8.3 Subject radio frequency bands for the period 2021/22 to 2025/26**

All allocations and subsequent release/availing of the spectrum will be preceded by a preparatory process summarized below.

**8.3.1 Preparatory process**

**i). Planning**

All radio frequency spectrum planning activities shall be conducted as per the UCC Spectrum Planning Framework 2019, and in alignment with the NTFA. The planning process, summarized into the four (4) principles highlighted in figure (6) below, will be utilized to prepare subject bands considered for the period 2021/22 – 2025/26. Through these stages and in consultation with stakeholders, UCC aims at maximizing the overall public benefit that can be realized from radio frequency spectrum resources. In preparing the bands for

the introduction of new services or use, consideration shall be made to ensure the protection and accomodation of existing services and/or applications.

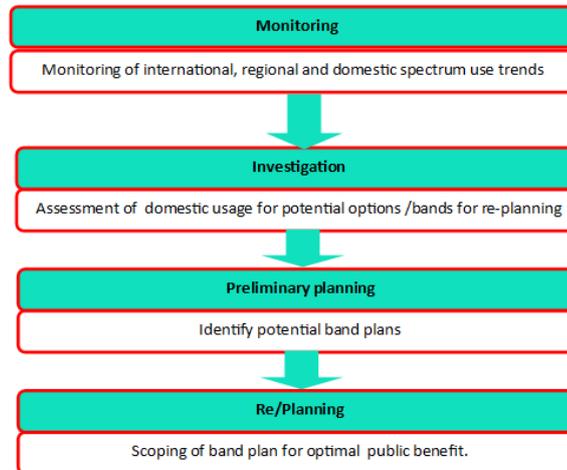


Figure 6: Summary of principles for spectrum planning processes (ref: UCC spectrum-planning framework, 2019).

**ii). Towards WRC-2023**

UCC has commenced the implementation of the outcomes of the WRC-19 including but not limited to;

- a) updating of the National Table of Frequency Allocation (NTFA), this will be made available to the public,
- b) reviewing of the guidelines on the utilization of the 5GHz band,
- c) reviewing of the 2.7GHz, 24.25 – 27.5 GHz, 37–43.5 GHz, 45.5–47 GHz, 47.2–48.2 and 66–71 GHz bands in preparation for adoption of IMT2020 technologies including 5G;
- d) implementing the provisions of Resolution 559, under the ITU frameworks to support satellite communications.

UCC shall continue to coordinate the national preparatory activities and engage in various regional and international activities leading to the WRC-23, participate and contribute to various studies including ITU studies with a special interest in study groups four (SG-4) and five (SG-5). Key studies of interest of the WRC-23 agenda include.

- a) Agenda Item 1.1, Resolution 223 (Rev.WRC-19) on the protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories affecting footnote 5.441B of the NTFA,
- b) Agenda item 1.2, Resolution 245 (WRC-19); on identification of the bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications;
- c) Agenda item 1.5, Resolution 235 (WRC-15) – Reviewing the use of spectrum in the frequency band 470-960 MHz in Region 1,

- d) Agenda item 1.6, Resolution 173 (WRC-19) – reviewing the use of the frequency bands 17.7-18.6 GHz and 18.8-19.3 GHz and 19.7-20.2 GHz (space-to-Earth) and 27.5-29.1 GHz and 29.5-30 GHz (Earth-to-space) by earth stations in motion communicating with non-geostationary space stations in the fixed-satellite service;
- e) Agenda item 1.4, Resolution 247 (WRC-19), on the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level.

**8.3.2 Spectrum Release Scheduling**

Table-2 below summarizes the subject radio frequency spectrum releases for public and commercial use as well as the respective release schedules;

**Note:**

For scheduling purposes, in table 2 below;

- a) quarter 1 (Q1) shall imply the period 1<sup>st</sup> January – 31<sup>st</sup> March,
- b) quarter 2 (Q2) shall imply the period 1<sup>st</sup> April – 30<sup>th</sup> June,
- c) quarter 3 (Q3) shall imply the period 1<sup>st</sup> July – 30<sup>th</sup> September,
- d) quarter 4 (Q4) shall imply the period 1<sup>st</sup> October – 31<sup>st</sup> December.

**Table 2:** Schedule for review and opening up of subject bands

<b>Priority band</b>	<b>Proposed period in which invitations to apply (ITA) notice shall be published.</b>	<b>Planned action</b>
450 (350-470 MHz)	Q2 2022	<ul style="list-style-type: none"> <li>- Re-farm the band for the introduction of IMT and fixed wireless access (FWA) systems.</li> <li>- Adopt and implement a new band policy.</li> </ul>
3.3 GHz (3300–3400 MHz)	Q1 2022	<ul style="list-style-type: none"> <li>- Continue monitoring regional and international industrial development relating to the use of the band for IMT</li> <li>- Defragmentation of the band and development of new band policy,</li> <li>- Adoption of the 3.3GHz new band policy</li> </ul>
3600-3800 MHz, 6425–7025 MHz, 7025–7125 MHz and 10.0–10.5 GHz	Q3 - 2024	<ul style="list-style-type: none"> <li>- Continue monitoring regional and international industry developments relating to the use of the bands;</li> <li>- (Bands being studied under WRC-23 Agenda Item 1.2)</li> </ul>
4.2 GHz (3800-4200 MHz)	Q3 - 2024	Continue monitoring regional and international industry developments relating to the use of the bands.
4.5 GHz (4400–4500 MHz)  4.8GHz (4800–4990MHz)	Q4 - 2024	<ul style="list-style-type: none"> <li>- Continue monitoring regional and international industry developments relating to the use of the bands.</li> </ul> <p>(4800–4990MHz Band is being studied under WRC-23 agenda item 1.1)</p>

26 GHz (24.25 – 27.5 GHz)	Q2 - 2023	<ul style="list-style-type: none"> <li>- Continue following regional and international industry developments relating to the use of the bands,</li> <li>- Review the band for the adoption of IMT, including 5G following WRC-19 outcomes</li> </ul>
31-36 GHz	Q2 - 2023	<ul style="list-style-type: none"> <li>- Review band for the feasibility of introducing Fixed service (FS) (Microwave backhauling).</li> </ul>
57 – 66 GHz (V-band/mm Wave)	Q4 - 2022	<ul style="list-style-type: none"> <li>- Adoption and implementation of the 57-66GHz (V-band) band policy for FWAS to support 5G (NR-U) private and dedicated networks</li> </ul>
2.0 GHz (Portion 1800-2170 MHz)	Q4 - 2023	<ul style="list-style-type: none"> <li>- Review band, develop, and adopt band policy to facilitate the introduction of IMTs in the band (P-LTE) to support rural and private networks</li> </ul>
17.7-19.7 GHz (space-to-Earth)  27.5-29.5GHz (Earth-to-space)	Q4 - 2022	<ul style="list-style-type: none"> <li>- Continue monitoring regional and international industry developments relating to the use of ESIMs</li> </ul>
	Q4 - 2022	<ul style="list-style-type: none"> <li>- Develop, adopt, and implement technical and regulatory requirements for the operation of ESIMs in the band (following WRC-19 outcomes)</li> </ul>
5.0GHz	Q1 - 2022	<ul style="list-style-type: none"> <li>- Adopt and implement revised guidelines on the utilization of the 5GHz band following outcomes of WRC-19 in respect to RLANs FWA, BFWA among other uses.</li> </ul>
6.0 GHz (5 925 – 6425)MHz	Q4 - 2022	<ul style="list-style-type: none"> <li>- Adoption of ATU-R recommendation 005-0 on the introduction of Wi-Fi in the low part of the 6GHz band to support 5G NR-U</li> </ul>
900MHz (880-960 MHz)	Q1 - 2022	<ul style="list-style-type: none"> <li>- Post new channel arrangement deployment evaluation (consultative)</li> </ul>
700MHz band (Digital Dividend 2 spectrum)	Q1 - 2022	<ul style="list-style-type: none"> <li>- Adoption of the 700MHz band policy and; Call for applications</li> <li>- Invite application for spectrum (public notice)</li> </ul>
2100MHz (1920-2170 MHz)	Q4 - 2021	<ul style="list-style-type: none"> <li>- Adoption and implementation of the new 2100MHz band policy,</li> <li>-</li> </ul>
2.3 GHz (2300 – 2400 MHz)	Q2 - 2022	<ul style="list-style-type: none"> <li>- Adoption and implementation of the new 2.3GHz band policy,</li> <li>- Invite application for spectrum (public notice)</li> </ul>
3.5 GHz (3400-3600 MHz)		<ul style="list-style-type: none"> <li>- Adoption and implementation of the new 3.5GHz band policy,</li> <li>- Invite application for spectrum (public notice)</li> </ul>

71 - 76 GHz/81 - 86 GHz	Q1 - 2022	<ul style="list-style-type: none"> <li>- Adoption and implementation of the 71-76/81-86GHz (E-band) band policy</li> <li>- Invite application for spectrum (public notice)</li> </ul>
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**Table 3:** Additional Projects

<b>Service/Applications</b>	<b>Activity particulars</b>	<b>Planned work period</b>
<i>Broadcasting services</i>	<ul style="list-style-type: none"> <li>- Consultation with stakeholders on the introduction of Digital Audio Broadcasting in the frequency range 174-240MHz,</li> <li>- Participate in ITU International and bilateral coordination activities on the optimization of the GE84 Plan under ITU frameworks,</li> <li>- Evaluate the utilization of the digital terrestrial television operational frequency band in the range 470-694MHz</li> </ul>	Q2 - 2023
<i>Satellite communications</i>	<i>Manage the filing and coordination of Uganda's satellite systems either commercial, academic, or experimental small satellite (CubeSats).</i>	Q4 - 2025+
	<i>Develop and consult with stakeholders on the framework for Satellite communications in Uganda.</i>	Q4 - 2021
	<i>Manage Uganda's ITU international satellite coordination processes under Resolution 559 (WRC-19).</i>	Q2 - 2023
<i>Aeronautical services, National Security and Defense requirements.</i>	<i>Harmonize Aeronautical-Civil aviation, national security, and defense systems radio frequency spectrum requirements to ensure continued support and protection of these critical services.</i>	Q1 - 2024

### **8.3.3 Spectrum Management Practices and Improvements**

To support the five-year spectrum Master Plan, UCC will undertake and/or continue with the initiatives highlighted below.

- i)* Continued consultation with stakeholders on various spectrum matters that may impact spectrum use,
- ii)* Timely implementation of WRC outcomes,
- iii)* Continued collaboration with government agencies on matters of spectrum use where applicable,
- iv)* Continued support of innovations especially those aimed at improving spectrum utilization,
- v)* review of the UCC spectrum management processes and practices to facilitate among others, the implementation of this Master Plan.

## **9. SPECTRUM AUTHORIZATION**

The grant of the rights to access and the use of the radio frequency spectrum resources shall be done using the approach that delivers against the national objectives in keeping with the relevant provisions of the respective UCC spectrum managements frameworks, including:

- i)* Competitive call for applications,
- ii)* Registration before use,
- iii)* Class authorization subject to operations or transmission technologies adhering to specified rules,
- iv)* Spot application (first come first served).

The right to use the spectrum may include the sharing of the spectrum as deemed appropriate and approved by UCC. The sharing mechanisms shall cover sharing in respect of frequency, geography separation and/or time-sharing including spectrum pooling.

## **10. SPECTRUM FEES**

The established Uganda Communications (Fees and Fines) Regulations 2019 shall continue to apply. However, UCC may, in consultation with stakeholders and as deemed appropriate review the radio frequency spectrum fees in the period.