

THE SENATE

FEDERAL REPUBLIC OF NIGERIA

REPORT

OF THE

**JOINT COMMITTEE ON COMMUNICATIONS,
SCIENCE & TECHNOLOGY, ICT & CYBER
CRIMES, AND PRIMARY HEALTH CARE &
COMMUNICABLE DISEASES ON THE
INVESTIGATION OF "THE STATUS OF 5G
NETWORK IN NIGERIA AND ITS
TECHNOLOGICAL IMPACT ON NIGERIAN
CITIZENS"**

2021

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1.0 INTRODUCTION

The Senate of the Federal Republic of Nigeria, at its sitting on Tuesday, 5th May, 2020 resolved to mandate its Joint Committee on Communications, Science & Technology, Primary Health Care & Communicable Diseases, and ICT & Cyber Crimes to conduct a thorough investigation on **"The Status of 5G Network in Nigeria and its Technological Impact on Nigerian Citizens"**(S/Res/144/01/20) and referred same to the Joint Committee for further legislative action pursuant to Sections 88 and 89 of the 1999 Constitution of the Federal Republic of Nigeria.

2.0 MEMBERSHIP OF THE JOINT COMMITTEE

2.1 SENATE COMMITTEE ON COMMUNICATIONS

Senator Oluremi S. Tinubu, OON	-	Chairman
Senator Ibrahim M. Bomai	-	Vice Chairman
Senator Enyinnaya H. Abaribe	-	Member
Senator Biodun Olujimi	-	Member
Senator Uba Sani	-	Member
Senator Adamu Bulkachuwa	-	Member
Senator Orker-jev E. Yisa	-	Member
Senator Theodor Orji	-	Member
Senator Sandy O. Onor	-	Member
Senator Micheal O.Bamidele	-	Member
Senator Obinna Ogba	-	Member
Senator Ibrahim Y. Oloriegbe	-	Member
Kolawole E. Kayode	-	Committee Clerk

2.2 **SENATE COMMITTEE ON SCIENCE & TECHNOLOGY**

Senator Uche L. Ekwunife	-	Chairman
Senator Robert A. Boroffice	-	Vice Chairman
Senator Ibrahim H. Hadejia	-	Member
Senator Clifford Ordia	-	Member
Senator Solomon A. Olamilekan	-	Member
Senator Ezenwa Onyewuchi	-	Member
Senator Obinna Ogba	-	Member
Senator (Dr.) Istifanus D. Gyang	-	Member
Senator Kola Balogun	-	Member
Senator Akon Eyakenyi	-	Member
Mohammed Gana	-	Committee Clerk

2.3 **SENATE COMMITTEE ON ICT & CYBERCRIMES**

Senator Yakubu Oseni	-	Chairman
Senator Buhari Abdulfatai	-	Vice Chairman
Senator Ibrahim H. Hadejia	-	Member
Senator Jika D. Haliru	-	Member
Senator Orker-jev E. Yisa	-	Member
Senator Francis E. Onyewuchi	-	Member
Ayoh Ogon	-	Committee Clerk

2.4 **SENATE COMMITTEE ON PRIMARY HEALTH CARE & COMMUNICABLE DISEASES**

Senator Chukwuka G. Utazi	-	Chairman
Senator Umar S. Suleiman	-	Vice Chairman
Senator Theodore Orji	-	Member
Senator Yaroe B. Dauda	-	Member
Senator Matthew Urhogide	-	Member
Senator Oloriegbe Y. Ibrahim	-	Member
Senator Ibrahim A. Danbaba	-	Member
Serifat Adebisi	-	Committee Clerk

3.0 **METHODOLOGY**

3.1 The Joint Committee met to strategize and adopt the methodology for executing the mandate of the Senate. As part of its adopted methodologies, the Joint Committee communicated with major stakeholders across the various sectors directly involved, requesting for relevant information that would aid the Joint Committee in the discharge of its assignment.

Among others, the Joint Committee requested stakeholders to provide information on the following:

- i. The current status of 5th Generation Network in Nigeria;
- ii. Results of the 3-month study trial conducted by MTN which commenced in November, 2019;
- iii. The state of Nigeria's readiness to deploy 5G Network;
- iv. The merits and demerits associated with the deployment of 5G Network in Nigeria;
- v. Stakeholders' position(s) concerning the views by some scientists and medical experts that 5G is injurious to public health;
- vi. The likely negative impact of the deployment of 5G on the health of Nigerian citizens;
- vii. The technological impact of the deployment of 5G network on Nigerian citizens;
- viii. Recommendation(s) for thorough test prior to the deployment of 5G and/or any other new technology in the communications sector;
- ix. Steps taken independently, or to liaise with other critical stakeholders such as the Ministry of Health; Ministry of Environment; and Ministry of Science & Technology to set up a Ministerial or an Inter-Ministerial Task Force on electromagnetic fields to examine the health risks associated with the deployment of 5G Network.

Having taken into consideration the various views and opinions expressed by Distinguished Senators during debates on the Motion in Plenary, the Joint Committee called for and received memoranda from relevant stakeholders including but not exhaustive of the following:

- i. Federal Ministry of Communications & Digital Economy
- ii. Federal Ministry of Science & Technology

- iii. Federal Ministry of Health
- iv. Federal Ministry of Environment
- v. Nigerian Communications Commission (NCC)
- vi. National Information Technology Development Agency (NITDA)
- vii. Galaxy Backbone
- viii. Nigerian Communications Satellite Limited (NIGCOMSAT)
- ix. National Office for Technology Acquisition and Promotion (NOTAP)
- x. National Agency for Science and Engineering Infrastructure (NASENI)
- xi. National Space Research and Development Agency (NASRDA)
- xii. National Environmental Standards and Regulations Enforcement Agency (NESREA)
- xiii. National Primary Health Care Development Agency (NPHCDA)
- xiv. Nigeria Centre for Disease Control (NCDC)
- xv. Major Mobile Network Operators (MNOs)
- xvi. Association of Licensed Telecommunications Operators of Nigeria (ALTON)
- xvii. National Association of Telecoms Subscribers (NATCOMS)
- xviii. Major Telecoms Equipment Manufacturers

4.0. REMARKS BY THE CHAIRMAN, SENATE COMMITTEE ON COMMUNICATIONS

The Chairman, Senate Committee on Communications, Distinguished Senator Oluremi Tinubu, *OOV*, observed that 5G is the Fifth Generation of wireless communication technologies supporting cellular data networks that is conceived as the next great leap in speed for wireless devices. She also noted claims by its proponents that 5G aims to deliver data rates that are 10 to 100 times faster than the current 4G networks. The significance of this is that mobile devices will be able to send and receive information in less than one-thousandth of a second, appearing instantaneous to the user.

She observed that the main advantage of 5G networks over the previous generation networks is their ability to provide larger or wider connectivity bandwidth and low latency, which leads to faster download speeds of up to 10 gigabits per second (Gbps) and will not just be used for low bandwidth Internet content such as text, images, audio, and light video, but will allow the use of real time applications such as TV broadcasting, gaming, autonomous vehicles, Internet of Things (IoT), Virtual Reality (VR), Artificial Intelligence (AI), and the likes.

Despite the benefits attributed to 5G, the Chairman pointed out prevalent global reactions against its deployment especially as it borders on its probable negative

health effects on humans which have resulted in protests and violent demonstrations in different parts of the world including Nigeria. These concerns include increased cancer risk, cause of COVID-19, cellular stress, increase in harmful free radiations, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans.

She stated further that these and other considerations bordering on human health necessitated the Senate, in line with its statutory obligation, to mandate four of its Standing Committees to thoroughly investigate the **"The Status of 5G Network in Nigeria and its Technological Impact on Nigerian Citizens"**

Stating the compliance of the Joint Committee with the provisions of Sections 88 and 89 of the 1999 Constitution of the Federal Republic of Nigeria (as amended), the Chairman stressed the need for all invited stakeholders to appear before the Joint Committee to make their submissions taking the following details into consideration:

- i. The current status of 5th Generation Network in Nigeria;
- ii. The state of Nigeria's readiness to deploy 5G Network;
- iii. The merits and demerits associated with the deployment of 5G Network in Nigeria;
- iv. Stakeholders' position(s) concerning the views by some scientists and medical experts that 5G is injurious to public health;
- v. The likely negative impact of the deployment of 5G network on the health of Nigerian citizens;
- vi. Results of the 3-months study trial conducted by MTN which commenced in November, 2019 and the spectrum utilized for the purpose; and
- vii. Evidence of Environmental Impact assessment (EIA) with regards to the installation of 5G in Nigeria (if any).

She concluded that as the direct representatives of the Nigerian people, it was the responsibility of the Nigerian Senate to seize the opportunity of the Public Hearing to bring major stakeholders together with a view to clearing the air on the issue of 5G for the greater benefits of Nigerians.

5.0 REMARKS BY THE CHAIRMAN, SENATE COMMITTEE ON SCIENCE AND TECHNOLOGY

The Sponsor of the Motion and Chairman, Senate Committee on Science and Technology, Distinguished Senator Uche L. Ekwunife stressed the concerns raised by several groups and individuals over the likely hazards posed by 5G which have created scepticism in the minds of the people across the globe, especially in the Third World Countries where many are battling with diseases with no known sources.

She stated that in view of the controversies surrounding 5G, it became a Matter of Urgent National Importance to the National Assembly which necessitated the Public Hearing especially when the World Health Organisation (WHO) is still conducting health risk assessment associated with exposure to radio frequencies generated by 5G network, with results expected to be published in 2022.

She added that since the beginning of 5G conversations, the entire concept lacks proper awareness. She noted further that the world has passed the stage of feeding on rumours and speculations but relying on established scientific proofs and evidences.

She concluded by calling on the Nigeria Centre for Disease Control (NCDC) and independent scientists who have no vested interest in telecommunications to commence independent research on the public health impact of 5G network using the 1998 International Commission on Non-Ionizing Radiation Protection (ICNIRP) standards and come out with reliable research results.

6.0 REMARKS BY THE PRESIDENT OF THE SENATE

In his remarks, the President of the Senate, Distinguished Senator Ahmad Ibrahim Lawan, *PhD; CON* noted that the Public Hearing was significant due to the controversies that the 5G network has generated. He stressed that concerns of citizens emanated from the limited knowledge of the 5G network and ascription of the origin of COVID-19 virus to 5G, hence the urgent need to seek clarification not only from the Federal Government, but also from the private and the public sectors.

According to him, relying on reports from experts, the 5th Generation Network is supposed to be an improvement and advancement in communications especially because it has capacity for speed and accuracy in conveying messages and

information which will eventually improve on humanity's dominance over nature and also enhance living in a realistic and sustainable manner.

He stated further that the Senate resolved therefore to investigate the issues concerning the deployment of 5G in compliance with its desire to broaden public knowledge and have a very informed public policy on possible adaptation of the technology.

Despite all the reported benefits associated with the deployment of 5G, the President of the Senate stressed that the primary objective and motivation of the National Assembly is not the immediate economic gains that may accrue from 5G but the guaranteed security of Nigeria and the safety of its citizenry.

He urged the Public Hearing to provide satisfactory answer to the question, "Is Nigeria ready for the 5G technology?". According to him, the Public Hearing must be able to gather and synthesize diverse opinions that will ensure that the deployment of 5G will bring about a secured Country, a safe people coupled with enhanced and better economy.

7.0 THE 5TH GENERATION NETWORK

According to its proponents, 5G is the Fifth Generation of wireless communication technologies supporting cellular data networks which mobile or cellular phone companies started deploying globally in 2019. It is conceived as the next great leap in speed for wireless devices. It is claimed that 5G aims to deliver data rates that are 10 to 100 times faster than the current 4G networks. The significance of this is that mobile devices will be able to send and receive information in less than one-thousandth of a second, appearing instantaneous to the user. The technology not only enhances connection between people, but also between machines, objects and devices.

While the "G" usually associated with cellular networks stands for "Generation", 5G is different from other previous generations mainly because of its peak capacity and reduced latency i.e. the time between when information is sent from a device until it is used by a receiver. 2G has a maximum speed of about 50kbps (kilobytes per second) and allows basic operations like calls, SMS and MMS. 3G networks reach up to 2mbps (megabytes per second) when stationary.

Just like 4G networks, 5G networks are also cellular networks, where the service area is segmented into small geographical areas referred to as cells. All 5G

capable devices in the same cell are connected to the Internet or other private networks through a local antenna or base station in the cell.

The main advantage of 5G networks is their ability to provide larger or wider connectivity bandwidth and low latency, which leads to faster download speeds of up to 10 gigabits per second (Gbps). As a result of the enormous bandwidth, 5G networks will not just be used for low bandwidth Internet content such as text, images, audio, and light video, but will also allow the use of real time applications such as TV broadcasting, gaming, autonomous vehicles, Internet of Things (IoT), Virtual Reality (VR), Artificial Intelligence (AI), and the likes. The applications of 5G can be categorized in Enhanced Mobile Broadband (eMBB), Ultra Reliable Low Latency Communications (URLLC), and Massive Machine Type Communications (mMTC). While the eMBB is scheduled to be deployed by most countries by 2020, other categories of application will be deployed in subsequent years.

The high speed of 5G networks is attributed to the use of high frequency radio waves. However, higher frequency waves are limited in coverage area. In order to ensure wider service area, 5G networks are on 3 frequency bands: (a) Low, (b), Medium, and (c) High. Each cell may combine the three different frequencies using three different antennas to provide a trade off between speed and distance. That is, devices closer to the high frequency antennas enjoy higher speed while devices that are very far from the high-speed antennas can still enjoy 5G service via the low and medium frequency antennas, but at lower speeds.

The frequency range of different 5G bands are, Low-band = 600MHz - 700MHz; Medium-band = 2.5GHz - 3.7GHz; and High-band = 25GHz - 39GHz. Thus, devices that will take advantage of the 5G network will need to be fitted with 5G capable network cards or chips.

All the communication emerging technologies (1G-5G) use an Electromagnetic wave that is being propagated at different frequencies. The whole frequency spectrum is divided into seven regions in order of decreasing wavelength and increasing energy and frequency. These divisions are Radio waves, Microwaves, Infrared (IR), Visible light, Ultraviolet (UV), X-rays and Gamma rays.

The two types of radiations that come out of this spectrum are Ionizing and Non-Ionizing radiations. The Non-ionizing radiation is characterized by longer wavelength and low energy and this make it incapable to ionize atoms or

molecules. Visible light, microwave, radio waves, infrared, and 5G fall in the category of Non Ionizing radiation.

7.1 DIFFERENCES BETWEEN PREVIOUS GENERATIONS OF CELLULAR NETWORKS AND 5G

Previous cellular technologies include the following:

- a. **1G Network:** The 1980s brought the first generation—or 1G—of networks with voice-only, analogue service. The maximum speed of data transmission on a 1G network reached around 2.4kbps;
- b. **2G Network:** The 2G network came to being in the early 1990s, allowing cell phones to move into the digital world. 2G allowed for call and text encryption as well as SMS, picture messaging and MMS. The peak speed for 2G was about 50kbps;
- c. **3G Network:** The advent of a 3G network with more data, video calling and mobile internet began in 1998. What we may now consider a “slow” network in many large municipalities was the height of technology until 4G came along. 3G networks reach 2mbps on stationary or non-moving devices and 384kbps on devices in moving vehicles;
- d. **4G Network:** Released in the late 2000s, 4G is the current standard of cellular networks. It is 500 times faster than 3G and has been able to support high-definition mobile TV, video conferencing and much more. When a device is moving, as when you are walking with your phone or are in a car, the top speed can be 10s of mbps, and when the device is stationary, it can be 100s of mbps. The 20MHz bandwidth sector has peak capacity of 400Mbps;

As more people get access to mobile devices and the Internet of Things expands, as many as 24 billion devices are expected to need cellular network support by 2024 which is where 5G comes in.

- e. **5G Network:** 5G differs from previous generations of cellular networks in some key aspects:
 - i. **Speed:** Speed is one of the most highly anticipated elements of the next generation network. It is the fastest of all generations of cellular networks and 5G is expected to be nearly 100 times faster than 4G. Rapid speeds have obvious consumer applications as well as industrial benefits. Those speeds are possible because most 5G networks are built on super-high-

frequency airwaves, also known as high-band spectrum. The higher frequencies can transmit much more data, much faster than on 4G;

- ii. **Latency:** Measured in milliseconds, latency is the time it takes for devices to communicate with each other or with the server that is sending them information. In addition to delivering faster connections and greater capacity, a very important advantage of 5G is the fast response time. 3G networks had a typical response time of 100 milliseconds, 4G is around 30 milliseconds and 5G will be as low as 1 millisecond. This is virtually instantaneous, opening up a new world of connected applications;
- iii. **Capacity:** The third benefit is that 5G has more capacity than its predecessors, so one is less likely to experience network congestion when connecting in areas where a lot of mobile users congregate. 5G will support a 100x increase in traffic capacity and network efficiency;
- iv. **Spectrum:** 5G also uses spectrum better than its predecessors. It is designed to get the best out of every spectrum from all bands including low bands below 1 GHz, to mid bands from 1 GHz to 6 GHz, to high bands known as millimeter wave (mmWave);
- v. **Capability:** Compared to previous generation networks, 5G has the best capability and is a unified platform. While 4G LTE, for instance, was introduced with a focus on higher speeds in comparison to the previous generation networks, 5G is completely designed with the aim to render new services in a unified way along with elevated experiences for mobile broadband users.

7.2 WHAT ARE ELECTROMAGNETIC FIELDS?

Electromagnetic fields consist of waves of electric and magnetic energy moving together through space. Often the term "Electromagnetic Field" or "EMF" is used to indicate the presence of electromagnetic radiation in the atmosphere. The World Health Organization (WHO) defines EMF as oscillating waves generated when an electric current flows through an electric field. These fields are used to transmit information over long distances and form the basis of telecommunications and broadcasting all over the world. Mobile telephones, television and radio transmitters as well as radars produce EMF fields. There are two main sources of electromagnetic fields – natural and man-made sources.

a. **Natural sources of electromagnetic fields**

Natural sources of EMF are present everywhere in our environment but are invisible to the human eye. These EMFs are produced by natural elements such as the sun and thunderstorms. Electric currents inside the sun generate a magnetic field that spread throughout the solar system including the earth. The field causes activity at the surface of the sun. The level of EMF from the sun rises and falls depending on the intensity of the sun, interference by clouds and other factors. Other natural sources of EMF include the earth and lightning.

b. **Man-made sources of electromagnetic fields**

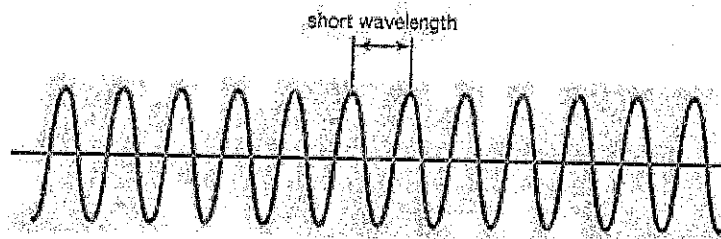
Human activities also produce EMF. These include X-ray machines in hospitals that are used to scan the human body to diagnose ailment as well as broadcast and telecommunications equipment that facilitate communication.

c. **How are EMFs measured?**

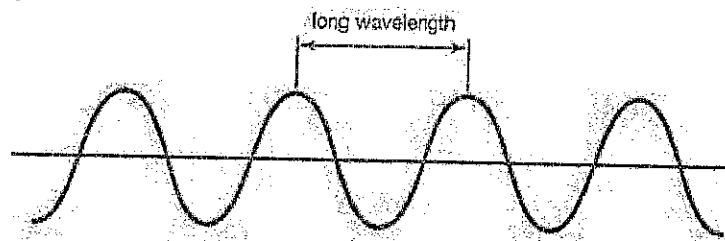
EMFs are measured in many ways. The most common ways of measuring them are based on their frequency or the corresponding wavelength. EMF of different frequencies interact with the body in different ways. The frequency simply describes the number of oscillations or cycles per second, while the wavelength is the distance between one wave and the next. Wavelength and frequency are inseparably intertwined: the higher the frequency the shorter the wavelength.

The table below illustrates this point:

High frequency



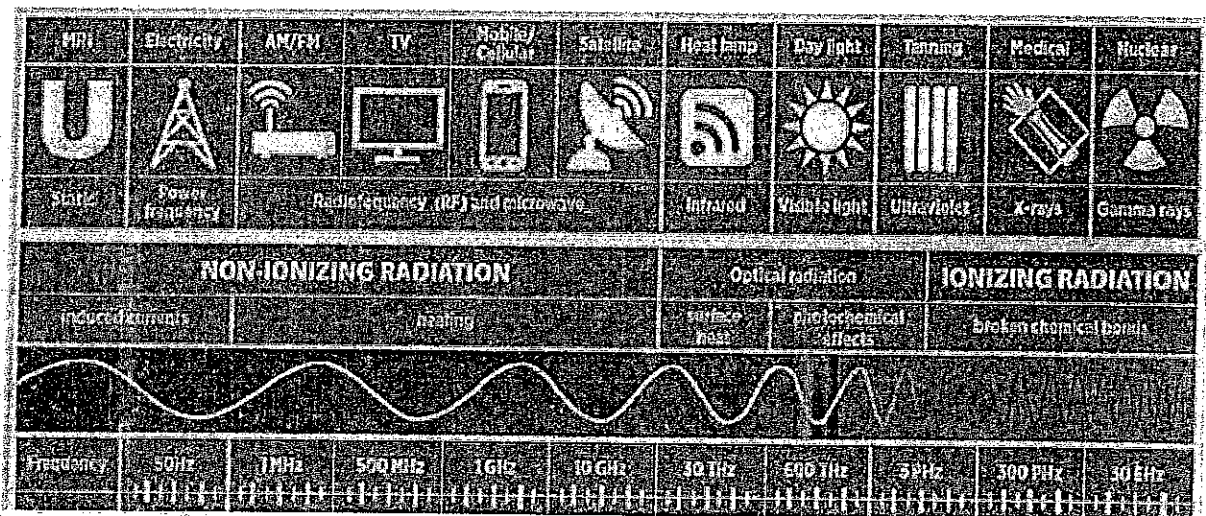
Low frequency



Regardless of the source of EMF whether natural or man-made, they produce radiation. There are two types of radiation emitted by EMF - ionizing and non-

ionizing radiation. Ionizing radiation are powerful electromagnetic fields that come from X-rays or gamma rays. These types of EMF can break chemical bonds, cause ionization in the human body, damaging the cells and potentially causing diseases like cancer. Prolonged exposure to these types of EMF is very dangerous. Telecommunications base stations do not produce these types of radiation.

Telecommunications and broadcast industry equipment produce what is called non-ionizing radiation. This means the radiation levels lack sufficient energy to break apart DNA and cause damage to human cells. The table below shows the electromagnetic spectrum:



7.3 INTERNATIONAL AND LOCAL AGENCIES THAT DETERMINE HUMAN EXPOSURE TO RADIATION?

There are a number of bodies across the world, including national telecommunications regulators that determine the level of exposure to radiation that is safe for humans. These include the World Health Organization (WHO), the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and the International Telecommunications Union (ITU). Telecommunications and environmental standards regulators also put measures in place to ensure compliance with global best practices set by the aforementioned international bodies.

a. World Health Organization (WHO)

In response to public and governmental concerns, the World Health Organization (WHO) established the International Electromagnetic Fields Project in 1996 to

assess the scientific evidence of possible adverse health effects from electromagnetic fields. WHO conducted a formal risk assessment of all studied health outcomes from radiofrequency field exposure and it has not found any evidence to suggest that radiation level emitted by telecommunications equipment have adverse health effects on humans. In addition, the International Agency for Research on Cancer (IARC), a WHO specialized agency, continues to review and monitor human exposure to radiation from telecommunication equipment and others to ensure that they are within safe limits. WHO also constantly identifies and promotes research priorities for radiofrequency fields and health in a bid to ensure safety of the human race.

b. **International Commission on Non-Ionizing Radiation Protection (ICNIRP)**

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) is an international Commission that is specialized in non-ionizing radiation protection which developed the RF-EMF Guidelines wherein radio frequency EMF (RF-EMF) limits were set to protect workers and the public. ICNIRP is an independent non-profit scientific organization based in Germany. It was founded in 1992 by the International Radiation Protection Association (IRPA) and it is responsible for setting guidelines for safety from non-ionizing radiations caused by EMFs. All telecommunications operators and equipment manufacturers defer to ICNIRP guidelines for safety.

ICNIRP developed its initial guidelines in 2008 which provide comprehensive guidance on radiation exposures. In response to recent outcry linking 5G to the novel COVID-19 pandemic, the Guidelines were updated in March 2020 to provide further guidance on safe use of mobile technology and exposure to radiation. As a matter of extra caution, its guidelines contain restrictions that enable telecommunications technology manufacturers and operators to deploy far lower levels of radiation than the maximum safe limits. The restrictions ensure that the resultant peak spatial power will remain far lower than required to adversely affect the health.

Responding to recent rumors that link COVID-19 to 5G, ICNIRP stated thus: "the claim that exposure to EMF generated by 5G can both cause COVID-19 and increase its severity are not supported by any evidence (not even extremely weak evidence), and the large body of scientific knowledge regarding the EMFs relevant to 5G demonstrates that those claims are not feasible.

c. **International Telecommunications Union (ITU)**

In addition to WHO and ICNIRP, the International Telecommunications Union (ITU), which is a specialized Agency of the United Nations that is responsible for issues that concern information and communication technologies, also provides guidance to over 900 telecommunications companies across 193 member countries. This is done through the ITU Study Group which looks into EMF and climate change.

The Study Group, known as the Telecommunication Standardization Sector (ITU-T) has issued what is called the ITU-T recommendations which provide high-level frameworks for the management of human exposure to EMFs emitted by telecommunication equipment. These "best-practice regulatory guidelines" on EMF as they are called, also offer guidelines for the assessment of human exposure based on existing ITU-T Recommendations and standards produced by other standards development organizations (SDOs) such as ICNIRP.

ITU-T recommendations which come in the ITU K-52, ITU K-61 and ITU K-70 documents aim to help with compliance of telecommunication installations and mobile handsets or other radiating devices with safety limits for human exposure to EMF.

ITU K-52 document provides guidance on compliance of telecommunication installations and mobile handsets or other radiating devices used against one's head with safety limits for human exposure to EMF. It offers general guidance, a calculation method, and an installation assessment procedure.

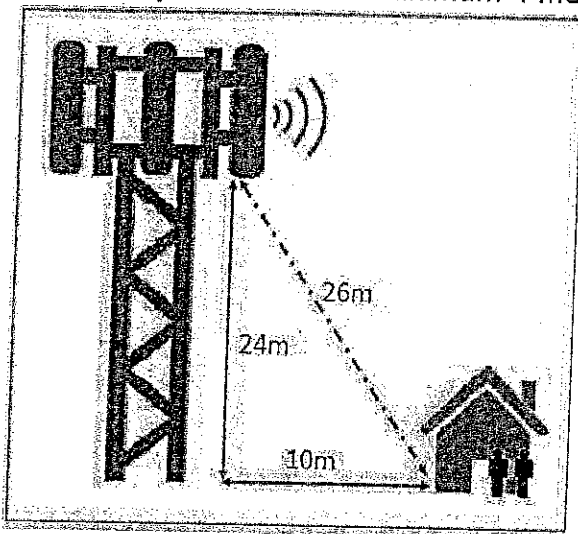
The ITU K-61 document helps telecommunication operators to verify compliance with exposure standards promulgated by national regulatory authorities. It gives guidance on measurement methods that can be used to achieve a compliance assessment. It also provides guidance on the selection of numerical methods suitable for exposure prediction in various situations.

Finally, the ITU K-70 document supports telecommunication operators in ensuring the compliance of the radiated emissions generated by telecommunication masts and other systems. The system as a whole will generally be expected to comply with a radiated emissions limit. This may be the same or different to the limit applicable to the individual constituent equipment. The method presented in this document is particularly suited to the analysis of systems that are physically very large, for which practical testing by every

individual user is impossible or is very expensive and practically difficult to perform.

d. **The Nigerian Communications Commission (NCC) and National Environmental Standards and Regulations Enforcement Agency (NESREA)**

ICNIRP guidelines set a compliance boundary of 4 meters between a base station and any building. In Nigeria however, the standards are higher. From 2001 to 2014, NCC guidelines prescribed a set-back (or boundary) of 5 meters, providing a greater margin of safety in the interest of the public. From January 2014 and onwards, the National Environmental Standards and Regulations Enforcement Agency (NESREA) prescribed a new set-back of 10 meters, a further increase in the margin of safety for the Nigerian public. So practically speaking, Nigeria has a stricter regime for managing radiation compared to many other countries that only adhere to the minimum 4 meters set by ICNIRP.



The minimum height of a base station in Nigeria is 24 meters. Considering the new minimum 10 meters distance between a base station and any building, telecommunication antennae in the country will have a distance no less than of 26 meters to the nearest building. This guarantees at least six times the minimum distance required by ICNIRP. This enormous margin of safety ensures that Nigerians are exposed to far less radiation than international bodies prescribe as maximum.

In addition to prescribing set-back standards for base stations, the NCC approves all telecommunications equipment and devices that are imported to Nigeria in a bid to ensure that all prescribed safety and technical standards are met. The Commission, through its type-approval regulatory function, authenticates

specifications, standards and conformity of telecom equipment or devices for use in Nigeria. Type-approval requires telecommunications operators, original equipment manufacturers or device sellers who intend to import such equipment or device to submit a sample to the NCC for testing. Once the NCC certifies that the equipment or device meets all extant safety and technical standards, approval is then given for importation and deployment in the Country's telecom ecosystem.

8.0 SUMMARY OF STAKEHOLDERS' PRESENTATIONS

8.1 FEDERAL MINISTRY OF COMMUNICATIONS AND DIGITAL ECONOMY

- a. The Federal Ministry of Communications and Digital Economy observed that 5G is the next generation of mobile broadband that will eventually replace or support the 4G LTE network. The 5G network will guarantee faster download and upload speeds as well as low latency;
- c. Concerning the current status of 5G in Nigeria, the Ministry clarified that there is no 5G deployment in Nigeria at the moment and that the three months Proof of Concept (PoC) trial approval given to MTN in November, 2019 had since been concluded and equipment decommissioned. The 5G Non-Commercial Proof of Concept (PoC) trials took place in Lagos, Abuja, Calabar, Kano, Abeokuta and Ibadan within the three (3) months trial period with the objectives of comparing the test results with Standards and Specifications, assessing the impact of the technology with the existing legacy systems, evaluating health and safety, and also use the lessons learnt to guide commercial deployments. This trial was witnessed by relevant stakeholders such as the Ministry of Communications and Digital Economy (MoC&DE), Security Agencies, Operators, Equipment Vendors and others while operators are waiting for government's decision on 5G after the trial;
- d. Commenting on the state of Nigeria's readiness to deploy 5G network, the Ministry drew the attention of the Joint Committee to a Committee put in place to develop plan/policy on deployment of 5G in Nigeria. He also pointed out that a Consultation Document (CD) is being developed for the deployment of 5G in Nigeria which will include planning spectrum identified for 5G with input from all relevant stakeholders such as the relevant Committees of the National Assembly and the security agencies.
- e. The Ministry, however, identified that are likely to hinder effective deployment of 5G in Nigeria such as lack of pervasive fiber infrastructure, lack of stable power

supply, high cost of Right of Way (RoW), insecurity, multiple taxation, multiple regulations and community apprehensions. The Ministry also made case for a robust public education and enlightenment to assure citizens of their safety, and a Committee has been put in place to drive the sensitization;

- f. The Ministry also identified the gains of 5G over other previous generations to include the provision of fast speed, autonomous car technology, better gaming experiences, robotic medical advancements, evolution of Internet of Things (IoT) etc. The demerits of 5G networks on the other hand include the tendency to lead to increased gap in the digital divide in the Country as most of the devices currently being used in telecommunications networks today do not support 5G. This means that 5G compatible devices like mobile phones will be purchased by users to access 5G services that are still very expensive;
- g. Other demerits include increased potential security and privacy issues due to the sophistication and vast technological improvements in functionalities of 5G technology. Again, the number of 5G sites required to provide similar coverage as GSM is much larger. This implies large investments are required to rollout comparable coverage of 5G networks; and 5G phones experience higher battery drain compared to previous mobile generations. This means more frequent recharging of 5G phones compared to those of previous generations;
- h. Responding to the claim by some scientists and medical experts that 5G is injurious to public health, the Ministry stated that 5G network is transmitted just as every other mobile technology is transmitted by non-ionizing electromagnetic wave which does not have the capability to break the DNA of humans. The Ministry cited David Robert Grimes, physicist and cancer researcher who stated that, "People are understandably concerned over whether they might elevate their risk of cancer, but it's crucial to note that radio waves are far less energetic than even the visible light we experience every day";
- i. On the likely negative impact of the deployment of 5G network on the health of Nigerian citizens, the Ministry stressed that there is no scientifically proven evidence of any negative impact on human health associated with radiation from mobile networks including 5G. The Ministry noted further that conclusions reached by the World Health Organization (WHO); UK Advisory Group on Non-Ionizing Radiation (AGNIR); the Institution for Engineering and Technology; and the International Commission for Non-Ionizing Radiation Protection (ICNIP) are

clear to the effect that radiation from mobile networks and devices including 5G has no known or scientifically proven negative health impact;

- j. Concerning the interaction between Base Stations and human health, the Ministry cited the position of the WHO which states that, "Considering the very low exposure level and research results collected to date, there is no convincing scientific evidence that the weak Radio Frequency (RF) signals from base stations and wireless networks cause adverse health effects." That, "studies to date provide no indication that environmental exposure to RF fields, such as from base stations, increases the risk of cancer or any other disease." (WHO Online Q&A September, 2013; WHO Backgrounder 2006);
- k. With regards to mobile phones and health, the Ministry quoted the WHO that many studies have been performed over the last two decades to assess whether mobile phones pose a potential health risk. That to date, no adverse health effects have been established as being caused by mobile phone use. (SOURCES: WHO Fact Sheet 193 June 2011);
- l. The Ministry stated that the results of the 5G Non-Commercial Proof of Concept (PoC) trial which took place in Lagos, Abuja, Calabar, Kano, Abeokuta and Ibadan for a maximum of 3 months showed improved capabilities of 5G over existing technologies and given that the worst case radiation levels are well below the specified safe limits, Nigeria should still observe the trend of 5G deployments around the globe and engage in extensive sensitization of the public through all channels before commencement of commercial deployments in the country;
- m. The Ministry promised to strengthen the work of the Technical Advisory Committee, a multi-stakeholder Committee, to advise on emerging technologies and products and concluded its submission by noting that the 5G technology is an invaluable resource that can assist Nigeria to resolve critical challenges in different spheres of life when deployed for use in the Country and that efforts to address militating factors against deployment of the 5G network should be accelerated. The need to build the National Backbone which will run from Lagos to Katsina (Trans-Saharan Optic fibre network) to move much of the bandwidth from the shore to the hinterland and for distribution to the geopolitical zones should be considered a matter of urgency; and

- o. The Ministry also stressed the need for the completion of feasibility studies for the various broadband projects to ascertain actual cost implications for their implementation, sustainability plans, etc; and further solicited the support of all stakeholders towards the provision of enabling environment including free Right of Way (RoW); tax waivers; sustainable power supply; elimination of multiple regulations and charges; recognition of telecommunications infrastructure as public utilities infrastructure; and engendering public trust and confidence.

8.2 THE NIGERIAN COMMUNICATIONS COMMISSION (NCC)

- a. The Nigerian Communications Commission (NCC) stated clearly that there is no 5G deployment in Nigeria at the moment;
- b. That following the request by MTN, NCC approved the conduct of 5G Non-Commercial Proof of Concept (PoC) trials in Lagos, Abuja, Calabar, Kano, Abeokuta and Ibadan for a maximum duration of three (3) months in November, 2019. The trial exercises were conducted with relevant stakeholders such as the Ministry of Communications and Digital Economy (MoC&DE), Security Agencies, NCC, Operators, and Equipment Vendors in attendance. The three months Proof of Concept (PoC) trial has since been concluded and equipment decommissioned;
- c. The objective of the trials was to compare the test results with Standards and Specifications, assess the impact of the technology with the existing legacy systems, evaluate health and safety; and also use the lessons learnt to guide commercial deployments. Operators are waiting for government's decision on 5G after the trial;
- d. The Commission further stated that MTN was assigned additional temporary bandwidth on their existing assignments in the 26GHz and 3.5GHz Frequency bands. The demo network architecture used was based on 5G's 3GPP (3rd Generation Partnership Project) specification of Non-Stand Alone (NSA) and Stand Alone (SA) architectures and were able to demonstrate enhanced Mobile Broadband eMBB, low latency, voice options and some use cases such as application of 5G in medicine, Hologram, Virtual Reality, Robotics, EMF exposure among others;
- e. That the EMF radiation for worst case exposure from the trial was 11.4% of the limit specified by International Commission for Non-Ionizing Radiation Protection

(ICNIRP) which was far below the limit and therefore presented no health hazard to the public;

- f. In a Report signed by all the officials involved in the PoC trial, the Nigerian Communications Commission (NCC) observed that, "in all assessments, the 5G PoC non-commercial trial was successful and the objectives met. It was also observed that all nations across the globe are planning and putting necessary resources in place to take advantage of the 4th industrial revolution provided by 5G technology to improve the socio-economic wellbeing of their citizens by using 5G to create jobs, increase transparency and efficiency in governance as well as secure the lives and properties of the citizenry. 5G is the technology of the future and Nigeria cannot afford to be left behind";
- g. Going further, the Commission proposed the following recommendations for consideration:
- The National Frequency Management Council (NFMC) should reserve all the spectrums identified for IMT at the last WRC-19;
 - The Commission should endeavour to apply for all the spectrums identified for IMT in the last WRC-19 for allocation by the NFMC for planning;
 - The Commission should ensure that all identified spectrum bands are cleared of any encumbrances to make it available for assignment for 5G services;
 - Action should be expedited on the approval of the INFRACO project of the Commission to ensure broadband infrastructure availability for 5G deployment;
 - The Ministry of Power should be engaged to ensure availability of stable and uninterrupted power supply to support 5G deployment in Nigeria;
 - Given the densification of cell sites that will arise as a result of 5G deployment, the Commission will need to effectively collaborate with other relevant Government agencies such as NESREA and NOA towards sensitizing and educating the general public on the low health impacts of 5G base stations; and

- Although the PoC trial results show improved capabilities of 5G over existing technologies and given that the worst case radiation levels are well below the specified safe limits, Nigeria should still observe the trend of 5G deployments around the globe and engage in extensive sensitization of the public through all channels before commencement of commercial deployments in the Country;
- h. Concerning the state of Nigeria's readiness to deploy 5G Network, the attention of the Joint Committee was drawn to a Committee put in place to develop plan/policy on deployment of 5G in Nigeria, noting that all stakeholders including relevant Committees of the National Assembly and the security agencies will be involved;
 - i. According to the Commission, the deployment of 5G in Nigeria could be faced with a number of challenges such as lack of pervasive fibre infrastructure, lack of stable power supply, high cost of Right of Way (RoW), insecurity, multiple taxation, multiple regulations and community apprehensions. Hence, there is need for robust public education and enlightenment to assure citizens of their safety and a Committee has been put in place to drive the sensitization;
 - j. The 5G or 5th Generation of mobile networks is regarded as a significant improvement on today's 4G technology. It is being designed to meet the very large growth in data and connectivity of today's modern society, the Internet of Things (IoT) with billions of connected devices, and tomorrow's innovations. In addition to delivering faster connections and greater capacity, a very important advantage of 5G is the fast response time referred to as latency;
 - k. It also comes with huge capabilities that are not supported by today's 4G such as Enhanced Mobile Broadband where download speed is in excess of 20Gbps; Massive Machine Type Communications where more than one million devices can be connected within a square kilometer (Internet of Things) and Ultra-Low Latency communications with less than 1ms response time for critical missions. 5G will facilitate the use of Artificial Intelligence (AI) at scale which will lead to effective and efficient solutions being crafted and applied to several industries such as Logistics, Transport, Agriculture, Education, Financial Services, Governance, etc.;
 - l. 5G also stands to improve job creation; increase GDP; enhance creativity and innovations; diversify the economy; improve transparency and efficiency of

governance; and enhance security of lives and properties. To this effect, all nations across the globe are planning and putting necessary resources in place to take advantage of the 4th industrial revolution provided by 5G technology to improve the socio-economic wellbeing of their citizens;

- m. Despite the gains of 5G, the technology may lead to increased gap in the digital divide in the country as most of the devices currently being used in telecommunications networks today do not support 5G. This means 5G compatible devices like mobile phones will need to be purchased by users to access 5G services that are very expensive. There are also increased potential security and privacy issues due to the sophistication and vast technological improvements in functionalities of 5G technologies;
- n. Furthermore, the number of 5G sites required to provide similar coverage as GSM is much larger. This implies large investments are required to rollout comparable coverage of 5G networks. 5G phones also experience higher battery drain compared to previous mobile generations. This means more frequent recharging of 5G phones compared to those of previous generations;
- o. The Commission also stated that no license has been issued for the deployment of 5G in Nigeria at the moment and that the three months Proof of Concept trial concession given to MTN last year November has since lapsed and trial discontinued;
- p. The Commission stressed its policy on technology neutrality whereby licensed telecommunications resources like Frequency Spectrum and Numbering Plan are licensed/assigned to licensees on a technology neutral/agnostic basis. However, 5G is more than just an evolutionary step to a new generation of technology, but represents a fundamental transformation of the role that mobile technology plays in society. This, therefore, necessitates a global need to develop a policy/plan;
- q. Reacting to the view that 5G technology is injurious to public health, the Commission is of the opinion that radiation from Mobile Networks and Devices including 5G are Non-Ionizing Radiation with very low power that cannot disrupt the DNA or molecular structure of human. It is stressed further that the radiation from 5G Base Stations is far less than those from 4G Base Stations as a result of improved technologies such as MIMO Antennas, Beam forming and Beam stirring;

- r. Again, the radiation level of 5G radio module in distance of 10 meters is 0.159W/m² compared with the radiation level of a mobile phone in a standby state which is 0.2W/m² while that of hair dryer and microwave oven which is 1 W/m² and 3 W/m² respectively. The implication of this is that the typical radiation level of 5G C-band Radio Module is even less than 4G Smartphone and hair dryer;
- s. It was pointed out that health issues claim is not a new story. The same concerns were raised during 3G and 4G introduction, but after 20 years of 3G launch, and 10 years of 4G, there is no proof that links cancer or general health issues to such wireless technologies. However, despite the lack of evidence of adverse health effects, precaution is always encouraged;
- t. It was further emphasised that there are no scientifically proven evidence of any negative impact on human health associated with radiation from mobile networks including 5G. The conclusions of relevant international organisations such as the World Health Organization (WHO); UK Advisory Group on Non-Ionizing Radiation (AGNIR); the Institution for Engineering and Technology (IET); and the International Commission for Non-Ionizing Radiation Protection (ICNIRP) are very clear to the effect that radiation from mobile networks and devices including 5G has no known scientifically proven negative health impact;
- u. Concerning the interaction between Base Stations and human health, the Commission quoted the position of the World Health Organisation (WHO) that, "Considering the very low exposure levels and research results collected to date, there is no convincing scientific evidence that the weak Radio Frequency (RF) signals from base stations and wireless networks cause adverse health effects." It goes further to state that "Studies to date provide no indication that environmental exposure to RF fields, such as from base stations, increases the risk of cancer or any other disease."
- v. Stressing the technological impact of 5G on Nigerian citizens, the Nigerian Communications Commission (NCC) maintains that the technology ensures deep coverage; strong security; ultra-low latency; extreme user mobility; ultra-low energy; ultra-high density; extreme capacity etc.;
- w. That although the Proof of Concept (PoC) trial results showed improved capabilities of 5G over existing technologies and given that the worst case

radiation levels are well below the specified safe limits, Nigeria should still observe the trend of 5G deployments around the globe and engage in extensive sensitization of the public through all channels before commencement of commercial deployments in the country;

- x. In conclusion, the Commission observed that every new technology comes with improvement with far better capabilities and efficiencies over the previous version. Hence, 5G comes with better capacities and efficiencies over the previous generations. In addition, electromagnetic radiation emission from 5G networks are far better and safer than preceding generations of mobile network; and
- y. Furthermore, 5G networks will provide enormous economic benefits to the citizens by providing more jobs opportunities, creativities and innovations; though the need for sensitization of the public before deployment of 5G in the country is important. In this regard, the support of the NASS is highly desirable and critical.

8.3 OFFICE OF THE NATIONAL SECURITY ADVISER (ONSA)

- a. The Office of the National Security Adviser (ONSA) expressed its awareness of the PoC trial by MTN which the Nigerian Communications Commission (NCC) and other stakeholders monitored and supervised within a period of three months between November 2019 and January, 2020 in 3 major cities of Lagos, Abuja and Calabar. Relying on the information gathered from the NCC, the ONSA noted that the trial has since been concluded and the 5G installations used during the testing were decommissioned;
- b. Concerning the current status of 5G in Nigeria, the ONSA maintained that according to investigations by the NCC and ONSA, there is currently no deployment of 5G in Nigeria and neither is any telecommunications service provider authorised to deploy 5G infrastructures for operation in Nigeria nor any 5G spectrum licensed to any telecoms service provider;
- c. The ONSA further noted its concern about the "persisting apprehension and uncertainty among the general public despite the revelations and sensitizations efforts of the NCC". According to the ONSA, this "current misinformation on the part of the general public is mainly premised on lack of understanding and the negative effects of propagation of false information about the health implications of the technology which has led to wanton destruction of telecommunication

infrastructure in some countries". To this effect, the ONSA advocated the need to develop a framework for the adoption of 5G technology as well as set up sensitization and awareness programmes to enlighten the general public to avoid such reoccurrence in Nigeria;

- d. On the technical implication, the ONSA stressed the high frequency ranges of 5G which require additional high-power base stations to meet the high bandwidth requirements, in contrast with previous 3G and 4G infrastructure translating to an additional cost to the service providers which would also cascade down to higher tariff on the end users. Consequently, all these requirements amongst others will likely take a significant amount of effort, huge cost on subscribers and time to achieve restructuring of existing infrastructure while requiring gradual or phased roll out;
- e. It was however stated that 5G technologies possess the advantages of higher speed; improved reliability; and significant reduction in latency and increased capacity to carry multiple connections simultaneously. The technology is also envisaged to offer data rates of up to 20 Gigabytes per second (Gbps) which is about 10-20 times faster than existing 4G LTE networks;
- f. Going further, it was stated that these attributes of 5G technology are crucial facilitators of economic growth and technological development in Nigeria. The technology is expected to open doors of opportunities for innovations and indigenous developments in critical sectors across Nigeria's economy especially in projecting the growth of the nation's digital economy through the provision of the platform for job creation, poverty alleviation and corresponding growth in Gross Domestic Product (GDP) in telecommunications and other sectors of the economy;
- g. On the other hand, the ONSA pointed out that the rolling out of the 5G infrastructure will be cost intensive and initial investments might take time to materialise because the stakes for telecoms operators are high, as millimetre (mm) wave signals of 5G systems cannot travel as far as lower-frequency 4G waves. Other demerits include possible existence of backdoors, vulnerabilities, cyber-attacks, and other malicious activities from foreign vendors as well as degrading or disrupting technological services;
- h. Expressing its national security concerns associated with 5G technology deployment, the ONSA noted the possible existence of deliberate vulnerabilities

and backdoors within some 5G network equipment which could make the infrastructure highly susceptible to eaves dropping, tracking, cyber-attacks, military or industrial espionage or other malicious activities as well as compromise of the Nigerian cyberspace. The ONSA further expressed its concern about the possibility of manufacturers or foreign actors to easily gain remote access and disrupt or degrade telecommunications services;

- i. In this regard, the ONSA recommended the establishment of an Inter-Agency Working Group to assess the national security risks posed by 5G technology and develop necessary Risk Management Framework for the technology. While the risk assessment would provide the necessary information that would guide decision-making towards the adoption of the technology, the Risk Management Framework would ensure that future deployment of the technology would be done in a manner that protects Nigeria's national security interests;
- j. While noting the ongoing debates about the potential health implications associated with the deployment of 5G technology, especially in the wake of the Corona Virus pandemic which has brought about negative media attention to the technology due to pervasive insinuations that it may be responsible for the COVID-19 outbreak, the ONSA identified with the positions of several local authorities, particularly the Nigerian Communications Commission (NCC), and the Federal Ministry of Communications and Digital Economy, who have severally debunked allegations of health hazards associated with the 5G technology and reassured the public;
- k. The ONSA also identified with the position of the International Telecommunications Union (ITU) on "Human Exposure to Electromagnetic Fields and Specific Absorption Rate" published in December 2019 which clarifies that "5G frequencies and modulations fall within current International Radio Frequency safety limits" and "that 5G emission levels are similar to 4G meaning that overall exposures will not change much";
- l. Similarly, the ONSA buttressed its position by identifying with the position of the World Health Organization (WHO) in its several reports stating "that no adverse effects have been casually linked with exposure to 5G wireless technologies and no consequences for public health are anticipated". On this premise, "the ONSA is of the view that current postulations and publications suggesting hazardous health effects of 5G are inconsequential and do not reflect the scientific use case and available evidential base surrounding the technology";

- m. The ONSA, in its view, concluded by recommending that Nigeria can go ahead with the deployment of 5G technology in Nigeria. This is in line with the ongoing efforts to reposition Nigeria for increased global economic competitiveness in the current digital age; and also considering the potential of the technology to offer arrays of technological improvements and opportunities that will enhance security and socio-economic wellbeing of the country thereby enhancing national security by implication;
- n. The recommendation of the ONSA as stated in paragraph "m" above is hinged on the institution of the Inter-Agency Working Group, comprising of the ONSA, NCC, MoC&DE, and other relevant stakeholders, to address all the national security concerns afore-mentioned in order to complement all efforts to exploit the benefits that the technology portends. In doing so, the ONSA stressed the need to plan in advance, develop local contents, and indigenous capacity to interface with relevant international organizations and stakeholders towards the formulation of robust framework that can guide the preparation, planning and deployment of 5G in Nigeria; and
- o. In conclusion, the ONSA recommended the facilitation of far-reaching engagement to debunk misinformation on the 5G systems and create more awareness on the benefits of the technology. Such sensitization is crucial for the protection of Critical National Information Infrastructure (CNII) of the telecommunications sector and other sectors of the Nigerian economy.

8.4 NATIONAL INFORMATION TECHNOLOGY DEVELOPMENT AGENCY (NITDA)

- a. NITDA acknowledged its participation in the demonstration in Abuja on 25th November, 2019. The demo was used as a form of Proof of Concept (PoC) of the 5G technology. Aside from the demo, no other 5G networks have been deployed in Nigeria;
- b. The Agency also noted that 6 spectrum bands have been identified by NCC for 5G networks, but have not been licensed to any Mobile Network Operators (MNO) in Nigeria;
- c. That despite 4G, which is the current standard, being 500 times faster than 3G and supports more advanced activities, proponents are of the view that evolution to 5G guarantees much more accelerated internet speed than 4G. 5G is also said

to fast-track the mass adoption of technologies that rely on internet connectivity, from connecting self-driving cars and drones to virtual reality, remote surgery and Internet of things (IoT). It supports a wide range of new applications and use cases, including smart homes, traffic safety, critical infrastructure, industry processes and very-high-speed media delivery;

- d. The Agency further observed that since 2018, telecommunication providers began deploying fifth-generation (5G) networks to meet growing demands for data from consumers and industrial users. This is because 5G networks are expected to enable providers to expand consumer services, support the growing number of connected devices, support new industrial uses, perform advanced data analytics, and enable the use of advanced technologies;
- e. It listed some of the advantages associated with the deployment of 5G Network in Nigeria to include high speed internet connection based on higher bandwidth of up to 10Gigabits per second and a very low latency; improvement on the ability of Nigeria to be part of the fourth industrial revolution which is digital-based and relies on high speed networks, and to adopt real time and high bandwidth applications such as cloud computing, virtual reality, AI, IoT, e-learning, remote working, messaging and collaboration, Unmanned Aerial Vehicles (UAV), autonomous vehicle, on-demand HD/UHD video streaming etc. on a 4G network;
- f. The deployment of 5G in Nigeria will also easily assist and fast-track the implementation of the National Digital Economy Policy and Strategy thereby enabling the Country to achieve a digital economy; and also help the Nigerian military, the Police Force and other law enforcement Agencies in improving their efficiency and effectiveness by providing high speed networks to support military grade technologies such as intelligence, surveillance, and reconnaissance systems;
- g. The technology will further positively transform Nigeria by connecting everything and everybody. It will create millions of jobs, and significantly help to increase the Country's Gross Domestic Product (GDP); and can solve some of our problems such as insecurity and improve governance and efficiency in the society;
- h. However, the Agency attributed what could be considered as disadvantages associated with the deployment of 5G Network in Nigeria to a large number of 5G radio base stations that will be required per cell due to the short service

range of the technology. This will translate to costly investments by the Nigerian MNOs;

- i. Since increased bandwidth comes with less coverage span, as the 5G network gets rolled out, more cell towers will be required to produce immense bandwidth because the cells are not able to cover as much space as a 3G or 4G cells. Because more cells will need to be rolled out, 5G users should expect that their coverage may not be as widespread at the initial stage of deployment;
- j. Again, the possibility of frequency interference exists as other radio frequency enabled devices utilize the higher frequencies used by 5G networks. Radios, cell towers, and even satellites communicate using radio frequencies. Frequency is measured in Hz and the radio frequencies tend to operate in the GHz range. Early reports on the 5G network indicate that this network is going to transmit its data in the range of around 6GHz. Unfortunately, this radio frequency range is already crowded by other signals, such as satellite links. With numerous types of signals operating in the range of 6GHz, it is fair to wonder whether or not the overcrowding is going to pose a problem as users try to transmit their data signals at this frequency, hence the need for effective spectrum band management;
- k. A large number of 5G radio base stations per cell translates to more electric power requirements;
- l. 5G network is also not backward compatible with devices fitted with older generation wireless devices. This translates to users purchasing devices that are 5G ready or retrofitting older devices with 5G devices where possible. In other words, 5G adoption may require huge investments by Nigerians;
- m. The Agency is of the opinion that the claim by some scientists and medical experts that 5G is injurious to public health is unverified and a biased conspiracy theory. This is because reputable international organisations in the telecommunications and health industries have declared the 5G radiations safe as they all belong to the same class of non-ionizing radiation as the 3G and 4G;
- n. According to its research findings, the Agency emphasised that there are no empirical evidences or research-based findings that prove that 5G networks are injurious to public health. Research findings show that 5G radiations are non-ionizing, and the power is not enough to cause adverse health effects. Therefore, radiation from 5G is minimal and not harmful to humans and other living things;

- o. NITDA further quoted the findings of the World Health Organization (WHO) that, "Tissue heating is the main mechanism of interaction between radiofrequency fields and the human body. Radiofrequency exposure levels from current technologies result in negligible temperature rise in the human body." It stressed further that, "As the frequency increases, there is less penetration into the body tissues and absorption of the energy becomes more confined to the surface of the body (skin and eye)";
- p. The Agency maintained that although various information on the internet, especially the social media, suggest a correlation between 5G and diseases in humans (especially COVID-19), none of the speculations are based on facts or scientific/research-based findings. While most of these speculations are centred on the existence of correlation between 5G and COVID-19, WHO debunks these claims by asserting that, "the Corona virus disease spreads primarily through contact with an infected person when they cough or sneeze. It also spreads when a person touches a surface or objects that have the virus on it, and then touches their eyes, nose, or mouth. There is currently no research linking the Corona virus and telecom technologies such as 5G";
- q. Based on these research findings, NITDA concluded that 5G is neither harmful nor injurious to public health. However, the Agency says it is aware that NCC is coordinating a local extensive study and testing on 5G networks. The findings of this study will guide the deployment of the technology in Nigeria;
- r. The Agency however recommends that despite all the research findings globally which show that 5G is neither harmful nor injurious to public health, NCC, in collaboration with the Mobile Network Operators (MNOs), Federal Ministry of Health, Federal Ministry of Science and Technology, Federal Ministry of Environment and the Nigeria Centre for Disease Control among others, should conduct a scientific experimental study over a period of about 6 months to ascertain if a correlation exists between 5G networks and public health. An experimental group and control group can be created consisting of test animals (e.g. rats) to ascertain if 5G networks can be harmful to humans. This, according to NITDA, is the recommended approach that is applied to any new technology in the information and communication technology sector and Nigeria should not be an exception; and
- s. In conclusion, NITDA reiterated the position of the Federal Ministry of Communications and Digital Economy that Nigeria does not operate 5G yet and there is no frequency spectrum released for its deployment. As an Agency under

the supervision of the Federal Ministry of Communications and Digital Economy, the Agency assures the Legislature and Nigerians, that as responsible regulators, it will never compromise the health and welfare of Nigerians in its efforts to adopt and deploy technologies.

8.5 NATIONAL AGENCY FOR SCIENCE AND ENGINEERING INFRASTRUCTURE (NASENI)

- a. Commenting on the present status of 5G in Nigeria and its readiness to deploy the technology, NASENI observed that there is currently no functioning 5G network in Nigeria. The Agency noted that 5G development is still in its infancy worldwide, hence, no exact time can be given to when 5G will come to Nigeria;
- b. It was stressed further that according to a number of studies and some observations, Nigeria's internet speed is a far cry from what is obtainable in other countries of the world. It was stated that while it is worth noting that Nigeria envisions a 90% 4G/5G penetration by 2025, based on the outcome of previous years, we are more likely to see massive rollouts and expansion of 4G services throughout the nation instead;
- c. NASENI highlighted the merits associated with the deployment of 5G to include greater speed over the previous technologies, reduced latency, increased capacity, high resolution and bi-directional large bandwidth, improved military technologies and services etc. The demerits however include high cost of installation, incompatibility with old devices, security and privacy issues, unauthorized use of 5G infrastructures by its manufacturers for intelligence gathering and provision of backdoor access to classified data;
- d. Concerning the danger posed to human health by 5G, the Agency drew the attention of the Joint Committee to the position of the US Federal Emergency Agency and Federal Communications Commission (FCC) on the controversy whereby the FCC stated clearly that there is no correlation between Corona virus and 5G. Going further, it stated that the UK public health agency stated that there is no evidence that 5G can damage the immune system or cause brain tumors or have any biological effect on human health;
- e. NASENI therefore believes and relies on such researches along the line that there are no proven health related issues on 5G. Hence, its deployment is not injurious to public health. 5G, according to the Agency, produces a form of radiation that is not strong enough to penetrate and damage human cells;

- f. On the likely negative impact of the deployment of 5G on the health of Nigerians, NASENI stated that there is no confirmed negative impact from all studies and researches worldwide using the cases of countries that have deployed the technology. These countries include the United States of America (USA), the United Kingdom (UK), South Korea, New Zealand, China, South Africa, Japan, Canada, Norway, Australia, Ireland etc; and
- g. The Agency, however, concluded by expressing its fears on the issue of local content and ownership in Nigeria. It noted that transition to 5G will bring additional challenge because the progress of ownership and local content in Nigeria has been poor. The Agency is worried about the dominance of foreign companies in areas such as equipment manufacturing and software development in the Nigerian telecommunications industry. The situation is likely to continue with the introduction of 5G and Nigerians will continue to be consumers even for future generations if the issue is not seriously addressed. NASENI therefore recommends the enforcement of local content in the telecommunications sector that will mandate the usage of indigenous software and hardware, assembling of android smart phones and providing an enabling environment for local production and industries.

8.6 NATIONAL ENVIRONMENTAL STANDARDS AND REGULATIONS ENFORCEMENT AGENCY (NESREA)

- a. In its submission, NESREA noted that telecommunication is made possible by means of electromagnetic radiation in the non-ionizing frequency range of the Radio waves, comprising the Microwave Frequency (MWF) and Radio Frequency (RF). The energy of propagation of these radiations into space is proportional to the frequency of radiation and inversely proportional to the wavelength. This energy can be absorbed by a material medium in which the energy propagates to produce some effects in the medium, eliciting the concern of the public regarding the health effects of radiation. Essentially, propagation of radiations from the antennas travels horizontally and attenuated by the walls of buildings or objects in its line-of-sight. Hence, since people do not live near the antennas mounted on the mast, they are less likely to be affected by the radiation;
- b. According to NESREA, 5G network is the technology of the future that provides more bandwidth on the data network thereby improving better internet experience compared with the 3G and 4G technologies especially in crowded places like airports and even residential areas. The technology will also enable

file downloads, video streaming at greater speed so that more data will be transmitted from the computers to smart devices, making them more versatile than ever;

- c. Despite the merits attributed to 5G, it was observed that the higher frequency 5G will not travel far due to the increased energy of propagation compared with the 3G and 4G. The likely tendency of less coverage may require more booster antennas at close ranges than we already have for 3G and 4G. This may lead to the indiscriminate installation of telecommunication Base Transceiver Stations (BTS) nationwide;
- d. The clustering of antennas may further exacerbate the fears of the public to exposure of radiations from BTS. The effects of cumulative and chronic exposure to the radiations are not known and there is lack of consensus on the health effects among the scientific community, hence the need to exercise the precautionary principle as recommended by World Health Organization (WHO) and the International Commission for Non-Ionizing Radiation Protection (ICNIRP);
- e. Concerning environmental and health concerns of 5G on the citizens, the Agency envisaged likely environmental concerns to include distortion of the scenic and aesthetic value of a place, generation of spent batteries and electronic waste, waste oils and used filters, prolonged exposure to noise from backup power generating sets which can induce headaches, high blood pressure, gradual deterioration in wellbeing, or even death, releases of CO, CO₂, NO_x and SO_x from combustion processes from backup generators which can compromise the ambient air quality, leading to various respiratory diseases including bronchitis, asthma, etc;
- f. Furthermore, Polychlorinated Biphenyls (PCBs), a persistent organic pollutant contained in transformer equipment can bio-accumulate in the food chain to cause various illnesses; occupational health and safety issues such as height and integrity of mast, safety of the workers during construction and maintenance etc; indiscriminate disposal of waste oil can contaminate the ground water leading to pollution and where they are abstracted for drinking, it could cause injury to humans. In the same vein, unsound management of e-waste can lead to environmental contamination, release of dioxins and furans which can cause abortions in pregnant women, respiratory problems, etc;

- g. The Agency noted further that it has been inundated with public complaints specifically about sites with noise and vibrations from power generating sets, oil pollution, and indiscriminate disposal of waste, fear of mast-fall and health effects of Electro Magnetic Frequency (EMF) radiations and these complaints have been sufficiently addressed through the application of the provisions of the National Environmental (Standards for Telecommunication and Broadcast Facilities) Regulation S.I. NO 11, 2011; and adherence to the terms of the Memorandum of Understanding (MoU) endorsed by the Honourable Ministers of Environment; and Communications and Digital Economy on areas where there are conflict in regulatory standards;
- h. The National Environmental (Standards for Telecommunication and Broadcast Facilities) Regulation S.I. NO 11, 2011 have specific provisions addressing the environmental concerns associated with the sector such as setback specification, permissible noise level for day and night time as well as control of emission, RF radiations, vibration and oil pollution from power generating sets. There are also specific statutory requirements on conduct of Environmental Impact Assessment (EIA) before commencement of construction activities to be carried out with the Federal Ministry of Environment (FMEEnv). An Environmental Audit (EA) is also to be carried out with NESREA accredited consultants when the sites are operational, every three (3) years;
- i. According to NESREA, most of the telecommunication operators are complying with the EA cycle. At the moment, no EA has been received on any 5G BTS indicating that it may not have been deployed in Nigeria. So far, the Agency has been attending to public complaints on a case by case basis. When a complaint is received, officers of the Agency proceed on investigative visit to the site. If concerns are confirmed, enforcement notices are issued to the operators to carry out some remedial measures on the environmental concerns (noise, oil spill, vibration, e-waste) within a time frame. In cases where infractions were established, the Agency was able to decommission some base stations in Lagos and Abuja and also instituted court cases against violators for failure to comply with environmental requirements; and
- j. In conclusion, NESREA recommends that Nigeria cannot afford to be left behind in reaping the benefits of 5G; and in order to balance the country's need for infrastructure and the environmental challenges being faced in the sector, telecommunications operators need to conclude the EIA process with the issuance of an Environmental Impact Statement (EIS) from the Federal Ministry

of Environment (FMEnv) before commencing construction activities. Operators should also collaborate with one another through co-location to reduce the envisaged increase in the number of BTS; and adhere to NESREA compliance notices, environmental laws and regulations, among others and explore the use of environment friendly and energy efficient technologies at all their sites.

8.7 NIGERIAN COMMUNICATION SATELLITE (NIGCOMSAT) LTD

- a. Reacting to the current status of the 5th Generation Network in Nigeria, NIGCOMSAT drew the attention of the Joint Committee to the Press Release of 4th April, 2020 by the Minister of Communications and Digital Economy stating as follows:
 - i. That the National Frequency Management Council (NFMC) has not deliberated on or released any bulk frequency spectrum for the deployment of 5G;
 - ii. That no license has been issued for the deployment of 5G in the country;
 - iii. That a 3-month study trial commenced on the 25th November, 2019 in order to critically review and study the health and security implications of deploying 5G in Nigeria;
 - iv. That as part of the study trial process, the Nigerian Communications Commission (NCC) was directed to ensure that a team of experts, security agencies and other stakeholders fully participate in the trial process; and
 - v. That the trial process has been concluded and the study and reporting process is currently ongoing.
- b. Highlighting the merits of 5G Network if deployed in Nigeria, NIGCOMSAT is of the opinion that 5G networks offer increased bandwidth, constant connectivity, and low latency services which can enhance and expand the use of mobile technologies for consumers and businesses. Consumers are able to download a full-length, high-definition movie on their mobile devices in seconds, engage in video streaming without interruption, and participate in online gaming anywhere;
- c. Furthermore, 5G technologies are expected to create new revenue streams for technology companies and telecommunications providers, support interconnected devices and advanced Internet of Things (IoT) systems, such as autonomous

vehicles, precision agriculture systems, industrial machinery, and advanced robotics. The IoT technologies are expected to be integrated into industrial systems to automate processes and to optimize operational efficiencies;

- d. If deployed in Nigeria, 5G networks are expected to support the growing IoT industry, enabling device makers to develop and deploy new IoT devices and systems across multiple industries, and sell IoT products globally, yielding significant economic gains for technology companies and for the countries where those companies are located;
- e. 5G will also provide important business model and economic benefits globally and especially in Nigeria because of the population. It is an opportunity for policy makers to empower citizens and businesses globally, and promises to deliver improved end-user experience by offering new applications and services through gigabit speeds, and significantly improved performance and reliability;
- f. Despite all the afore-mentioned gains, it is to be noted that many of the old devices would not be compatible with 5G network, hence, all of them would need to be replaced with new expensive devices. Expansion and development of infrastructures to meet 5G requirements is highly capital intensive, while increased bandwidth will mean less coverage. Furthermore, as the 5G network gets rolled out, more cell towers will be required to meet with the increased bandwidth and radio frequency may become a problem. With numerous types of signals operating in the range of 6GHz, it is fair to wonder whether or not the overcrowding is going to pose a problem as people try to transmit their data signals at this frequency. The security and privacy issues are also yet to be resolved;
- g. According to NIGCOMSAT, every technological innovation has radiation impact. However, there is tolerance level of radiation that is generally allowed for human beings. But as for 5G, Nigeria is yet to be advised on the radiation tolerance level;
- h. NIGCOMSAT is of the view that the global roll out of 5G is a revolutionary rise that represents one of the largest emerging markets in the coming 10 years based on what is happening in the world today. Over the next 10 years in Nigeria, telecom operators will invest \$200million to \$1.5 billion in 5G network roll outs as commercial 5G networks are expected to start deployment after 2020 globally; and

- i. By this, NIGCOMSAT would also be in a better position to contribute towards the development of digital economy in Nigeria. For better penetration of 5G network in the rural/underserved areas especially in Nigeria, there is need for policy to support the utilization of satellite capacity for interoperability between 5G and satellite link.

8.8 TELECOMMUNICATIONS PROFESSIONAL BODIES (ASSOCIATION OF LICENSED TELECOMMUNICATIONS OPERATORS OF NIGERIA (ALTON); ASSOCIATION OF TELECOMMUNICATION COMPANIES OF NIGERIA (ATCON); & GLOBAL MOBILE SUPPLIERS ASSOCIATION (GSMA)

- a. As the representative bodies for telecommunication companies and telecommunications service providers in Nigeria and Africa, the Association of Telecommunications Companies of Nigeria (ATCON), the Association of Licensed Telecommunications Operators of Nigeria (ALTON), and the Global Mobile Suppliers Association (GSMA) unanimously observed that it is globally acknowledged that mobile & digital technology is a critical enabler of socio-economic growth as these technologies have contributed significantly to this journey by facilitating communication through mobile devices. From 1G through 4G, every successive generation of wireless standards – indicated by the “G” – has introduced advances in network capabilities and capacity, and it is expected that 5G which is the 5th Generation of mobile networks will be no exception;
- b. They observed that as at the end of May 2020, 386 operators in 125 countries/territories had announced they were investing in 5G, and a total of 81 operators in 42 countries/territories had launched one or more standards-based 5G service, including South Africa and the Kingdom of Lesotho, where the first commercial 5G internet service in Africa was launched. The majority of the current deployments are in the 3500 MHz band, followed by mmWave ranges 26 GHz and above. The 600 MHz and 700 MHz are notably popular as well;
- c. They observed further that Nigeria has not been left out in this journey as we have witnessed the transformative impact of the mobile networks in almost every segment of the economy since the liberalization of the telecoms industry in 2001 and the adoption of wireless mobile communications. In the wake of the COVID-19 pandemic, the positive impact of mobile networks and its central role across a broad range of socio-economic activities has been further underlined, as almost every sector of the economy from financial services, education, medicine, and social intervention have relied on mobile networks to remain functional;

- d. The Associations stated further that given the history of advancement in mobile technologies, their transformative impact, and the fact that 5G is the next-generation wireless standard after 4G and will not be the last, it is crucial that clarifications are made because where myths and unproven allegations drown evidential reasoning and science, public confidence will be lost and this will be a major setback for technological development and the many sectors to which telecoms has become an integral support agent;
- e. Reacting to the current status of 5G in Nigeria, the Associations noted that, aided by the Nigerian Communications Commission (NCC)'s approval of 5G Proof of Concept (POC) trial, one of their members, MTN, conducted 5G trials in Nigeria in Q4 2019 with the objective of exploring the possibilities and capabilities of 5G across a broad range of service sectors. At the end of the trials, a report was shared with the Commission chronicling findings for the Commission's consideration. All the equipment used for the trials were subsequently decommissioned and there have been no further developments in that regard. As such, no member of the Associations has deployed 5G network in Nigeria.
- f. They further clarified that there are three 5G usage scenarios defined by the International Telecommunications Union (ITU): Enhanced Mobile Broadband (eMBB), Massive Machine Type Communications (mMTC) or Internet of Things (IoT), and Ultra-Reliable and Low-Latency Communications (URLLC) for Mission Critical Services (MCS). Within these broad scenarios, 5G opens the potential for low-latency, data-intensive applications that can provide unique solutions to challenges facing countries. This benefit will come with citizens exploiting the new 5G-enabled opportunities in agriculture, professional and financial services, manufacturing and utilities, ICT & Trade sector, and mining. Improved 5G-enabled efficiencies and new opportunities in public services will also provide benefits that citizens will be able to exploit;
- g. According to them, the potential economic contribution of 5G to society is clear. A TMG/GSMA study estimates it at \$2.2 trillion contribution to global GDP and \$588 billion in worldwide tax revenue by 2034. In sub-Saharan Africa, mmWave 5G is expected to contribute \$5.2 billion in GDP and \$970 million in tax revenue. In Nigeria, the expected contribution of mmWave 5G to the economy is up to 20% contribution to GDP;
- h. The Associations emphasized that 5G is a transformational change from 4G and it has the potential to provide 20X faster data speeds and carries a massive

amount of data for a large number of simultaneous users. Thus, users in high-density areas – like airports, stadiums, or urban areas – can still experience the fast speeds and low latency of 5G service;

- i. As the world replaces more and more household items with 'smart devices' that connect to the internet, also known as the Internet of Things (IoT), this network capacity will be critical. 5G will potentially be able to handle more than 2.5 million connected devices per square mile and also support businesses' innovative ambitions and create new markets, transforming supply chain management and creating smarter, more efficient manufacturing;
- j. Despite the concerns raised about the possible health and safety implications of 5G, the Associations observed that none of these are yet backed by empirical evidence, citing Rob Ramage who stated that, "With any new technology, it's important to discuss what the pros and cons are so that you can have a better understanding of how it will impact your business. There's a lot of buzz around 5G, and it can be easy to get confused by what information is correct and what's not. We won't truly know what 5G can do until it's fully implemented, but what we do know is what it's built to do";
- k. It was further asserted that the allegation that the 5G network presents a major health risk to humans is not novel as similar allegations were made concerning the preceding generation of mobile wireless standards. They explained that all wireless technologies operate in compliance with international exposure guidelines, developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). The World Health Organization (WHO) formally recognizes this independent non-governmental organization, and the guidelines are technology neutral and are subject to periodic review;
- l. That the consensus of reviews by independent public health authorities, expert groups and the WHO is that these guidelines provide protection for all people (including children) against all established health hazards. The European Commission also emphasizes that the strict and safe exposure limits recommended for electromagnetic fields also apply for all frequency bands currently envisaged for 5G. Consequently, expert groups and public health agencies such as the WHO, broadly agree that no health risks have been established from exposure to the low-level radio signals used for mobile communications. With maximum exposure levels for 5G expected to be similar to existing mobile services and the overall exposure levels remaining well below the

international safety guidelines, statements from public health agencies, including the World Health Organization confirm that no health risks are expected from 5G;

- m. While the key concern of some experts is that exposure to radio signals from the 5G network will result in health risks due to some features associated with the technology and that Radio Frequency (RF) exposure above a certain level can provoke serious health effects, this concern has been taken into account by the International Commission for Non-Ionizing Radiation Protection (ICNIRP) in the development of the RF-EMF Guidelines which set radio frequency EMF (RF-EMF) limits to protect workers and the public;
- n. The World Health Organization (WHO) recognizes ICNIRP as an independent non-governmental organization and has endorsed the ICNIRP Guidelines which Wireless technologies operators globally (including members of ATCON & ALTON) are mandated to operate with. These Guidelines, which were developed in 1998, were recently updated in March 2020. They contain restrictions set to ensure that the resultant peak spatial power will remain far lower than required to adversely affect health. Although the 1998 Guidelines provided adequate limits for 5G, the 2020 update introduced better and more guidance for 5G related frequencies above 6GHz. According to ICNIRP, 5G exposures will not cause any harm provided that they adhere to the ICNIRP 2020 Guidelines. The WHO also reviewed the position of ICNIRP and concluded that EMF exposure below the limits recommended in the ICNIRP Guidelines does not appear to have any known consequence on health.
- o. Furthermore, in the United Kingdom, the Communications regulator, OFCOM, carried out EMF measurements close to 5G-enabled mobile base stations in 22 locations across England, Scotland, Wales, and Northern Ireland based on the ICNIRP Guidelines. In a report released on 17th April 2020, OFCOM noted that EMF emission levels from 5G-enabled mobile phone base stations remain at small fractions of the reference levels for general public exposure in the ICNIRP Guidelines. The measurement was carried out to verify that 5G-enabled mobile base stations remained within the EMF limits set out in the Guidelines from the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Taken together and in summary, the foregoing establishes that there are no adverse health issues directly linked to 5G (or indeed any other network equipment radiation);

- p. The Associations reiterated that 5G was first launched globally on the 1st December 2018 with South Korea as the first country to do so and that no health impact was traced to 5G networks to date. As of January 2020, 5G has been deployed in 378 cities across 34 countries as of January 2020 without any known health concerns as the EMF limits are observed. Major nations that have embraced the technology include China, the US, UK, Saudi Arabia, Spain, United Arab Emirates, Australia, and Germany;
- q. Stressing the technological impact and the unprecedented transformative capabilities of 5G on Nigeria and her citizenry, the Associations stated that from the findings drawn from a Study of the Impact of 5G commissioned by Qualcomm, between 2020 and 2035, 5G could grow global GDP by \$3tn and by 2035, it could support up to \$12.3tn worth of goods and services (retail, healthcare, education & entertainment), and generate up to \$3.5tn in revenue, and underpin more than 2million jobs;
- r. Further quoting PSB Research on 5G Economy Global Survey Report also commissioned by Qualcomm, 5G is projected as the basis of the following forecasts: 91% expect new products and services that have yet to be invented, 87% expect new industries to emerge, 82% expect small business growth and more global competition, 85% expect it to make companies more globally competitive, while 89% expect increased productivity;
- s. The Associations observed that while there is still a fair bit of work to be done towards creating the required enabling environment and support ecosystem for 5G deployments in Nigeria, gleaning from what has been achieved by its 'lesser ancestors' such as 3G and 4G, it is confident that 5G will revolutionize Nigerians' way of life from education to agriculture, security to entertainment, and governance in general;
- t. In education, 5G will transform how college students access learning material. The availability of a super-fast wireless network will enable student's access to learning materials without geographical limitations. For our educators, 5G will empower them to redefine what is possible inside and outside their classrooms. The possibility to download high quality, feature-length video tutorial in seconds; host a guest speaker from a different country via hologram; or tutoring students virtually in real-time, are all prospects that 5G can make a reality;

- u. In healthcare, 5G will make it easier to determine potential diagnoses and decide on the best treatment plan for a specific patient. Additionally, it will help predict which patients are more likely to have post-operative complications, thereby allowing healthcare systems to provide early interventions when and where necessary. With access to 5G networks, healthcare organizations can use Artificial Intelligence (AI) tools they need to provide the best care possible through virtual collaboration with experts across the globe;
- v. Furthermore, 5G specific use cases could be explored in Nigeria if 5G network is rolled out in the area of Fixed Wireless Access (FWA). FWA in homes and businesses will bring fiber-like speed and reliability to places where currently there is no infrastructure, or where wired networks would be too expensive to deploy, or in direct competition with existing fixed offerings. 5G specific use cases could also be explored for Security-Video Surveillance and Analytics, Agriculture, Manufacturing, Logistics, Immersive Gaming and Virtual Reality, Connected Vehicles etc;
- w. They recommended that, instead of a focus on conducting tests for which outcomes and results already exist, there should be investigations into developing use cases that are relevant to the Nigerian context. As highlighted earlier, 5G is characterized by three broad usage scenarios: eMBB, mMTC and mIoT, and URLLC and MCS. In order to maximize the benefits of 5G to the Nigerian Society, it is imperative that applications and use cases relevant to the local context are developed and adopted. To this end, they encourage emphasis in conducting studies on socio-economic problems that can be solved by the 5G usage scenarios and developing 5G applications and services to solve these problems. It is believed that this effort, if applied, will contribute to maximizing the socio-economic benefits that 5G has to offer Nigeria's economy and citizens.
- x. They further recommended an enabling policy environment that will facilitate the full potential of 5G and mobile technology such as the creation of a 5-7 year roadmap of spectrum assignments to enable an investment-led broadband policy and facilitate industry certainty and investor confidence. They suggested the streamlining of the conditions for 5G deployment by setting a national mobile network deployment policy that simplifies planning procedures for small cells and access to public sites for antenna siting, and to enable assignments that get as close as possible to assigning 100 MHz per operator in 5G midbands (e.g. 3.5 GHz) and 1 GHz per operator in millimeter wave bands (e.g., 26 GHz and 28 GHz) as this will best support robust 5G services;

- y. Part of the policy interventions also includes focus on facilitating cost-effective successful 5G. Deploying 5G will be significantly capital-intensive, requiring a high level of investment with uncertain returns. To support the digital policy aspirations that 5G will help to achieve, it was recommended that the government should act to ease the cost burden faced by the industry to roll out 5G networks by promoting such actions as: downward review of import duties on 5G user devices and equipment, ensuring that the cost of access to spectrum is low, and modernizing policy framework to create a better investment environment; and
- z. In conclusion, the Associations stated that there are radiation emission limits set by the International Commission for Non-ionizing Radiation Protection (ICNIRP) below which the radiation is considered safe for humans, and 5G networks have been assessed to be below the set limits and as such will not cause any harm to humans.

8.9 EQUIPMENT MANUFACTURERS (HUAWEI, ZTE, ERICSSON)

- a. There is a consensus among telecommunications equipment manufacturers that 5G is the latest generation of mobile communication technology driven by technological evolution (technical evolution after 2G/3G/4G) and business needs (from voice to data, to the Internet of Things and autonomous driving, etc.). They claimed that the emergence of 5G will enable the intelligent connection of people and things, and its performance goals are higher speed (above 10Gbps, at least 10 times that of 4G), lower latency (minimum 1ms, which is 1/10 of 4G) and greater Connection (up to 1M connection/km², connection capacity is 10 times that of 4G);
- b. That compared with 4G technology, 5G uses a larger bandwidth (maximum 100MHz, 5 times that of 4G), an updated network architecture (Service Based Architecture, delay is only 1/10 of the LTE network), and more concurrent channels (32 channels/64 channels is 5 times that of LTE) and higher codec efficiency (1.3 times that of LTE). By comprehensively using the above technologies, it is possible to achieve functions that 4G cannot achieve, such as the Internet of Things and autonomous driving;
- c. Concerning the current status of 5G in Nigeria, telecoms equipment manufacturers are of the view that the development of 5G requires adequate preparation in industrial policy, spectrum planning, terminal ecology and network

deployment. In terms of industrial policy, it was emphasized that the deployment of 5G requires the advancement of industrial policies, the completion of spectrum reorganization, planning and license issuance, and the introduction and construction of local terminal ecology through tax incentives and other policies to quickly improve the level of home broadband access and carry out application scenario testing in government and important enterprises (e.g. ports);

- d. Furthermore, in terms of frequency band planning, from the perspective of protocol standards and global industrial development, broadband TDD bands such as C-Band/2.6GHz have become the core bands for 5G deployment (currently, some are also used in 4G networks), and support up to 100MHz/carrier. The stock FDD frequency band will be gradually refarming to 5G to meet the needs of the Internet of Things such as 5G voice, deep coverage and future uRLLC;
- e. While in terms of terminal ecology, according to the prediction of GSA and GSMA, there will be more than 200+ 5G terminals in 20 years, and the price of smart phones will approach 300 US dollars/unit. It is expected that H1 will have 150 US dollars/unit in the market in 2021. And in terms of network deployment, 5G deployment is concentrated in the high-frequency part, and more sites need to be built (more than 30% more sites than LTE), and due to performance improvement, the entire network needs to be upgraded and transformed. If these conditions are fulfilled, Nigeria would be ready to effect the deployment of 5G technology;
- f. They noted that on December 1, 2018, three South Korean operators achieved the world's first commercial use of 5G on the same day. According to GSA statistics, as of now, 80 operators in 42 countries have commercialized 5G networks (it is predicted that 150 operators will commercialize 5G networks by the end of 2020). The main considerations are to lead the industrial revolution with new infrastructure, such as Made in China 2025 and National Strategic Plan for Advanced Manufacturing, to lead in industry and unlock new revenue, such as South Korea and Japan, capability preparing and cost/bit reduction, to practice Rollout O&M in advance such as Vodafone, and to experience enhancement and brand promotion, such as Rain in South Africa;
- g. They also confirmed that research from international organizations and agencies indicate that EMF does not cause health problems. They referred to a study conducted on, "Establishing a Dialogue on Risks from Electromagnetic Fields" by

the World Health Organization in 2002 where it was concluded that, "concerning radiofrequency fields, the balance of evidence to date suggests that exposure to low level RF fields (such as those emitted by mobile phones and their base stations) does not cause adverse health effects; and

- h. The attention of the Joint Committee was further drawn to the statement made by the Norwegian Radiation and Nuclear Safety Authority in November, 2019 that, "The overall research shows that the radiation from wireless technology is not hazardous to health, as long as the levels are below the recommended limit values. This is the prevailing view among researchers in many countries today, and it is supported by the EU Scientific Committee. We have used cell phones and radio transmitters for decades and much research has been done on how this affects our health. Risk factors of importance to public health have not been found. They concluded that with the knowledge we have today, there is no need to worry that 5G is hazardous to health".

8.10 MOBILE NETWORK OPERATORS (MNOs)

- a. There is a consensus among Mobile Network Operators that there is currently no commercial 5G site in Nigeria. However, they are aware that the Nigerian Communications Commission (NCC) approved trials using Sub- frequency band of 3.5GHz in November 2019, and that the outcome of the trials showed 5G download speed above 1Gbps with a 2.3GB movie being downloaded in 15.78 seconds. The outcome of the demo also showed a latency of less than 5ms;
- b. MNOs agreed that NCC is yet to auction any spectrum for the deployment of 5G, relying on the Press Statement of the Honourable Minister of Communications and Digital Economy, published on 4th April, 2020, on NCC website, stating, *inter alia*, that no telecom operator has been licensed to operate 5G network, and that "The National Frequency Management Council (NFMC), of which I am the Chairman, has not deliberated on or released any bulk frequency spectrum for the deployment of 5G";
- c. The Statement goes further to state that, "A 3-month study trial commenced on the 25th of November, 2019 in order to critically review and study the health and security implications of deploying 5G in Nigeria. As part of the study trial process, I directed the Nigerian Communications Commission (NCC) to ensure that a team of experts, security agencies and other stakeholders fully participate in the trial process and my office also invited these agencies to participate in the trial. The

trial process has been concluded and the study and reporting process is currently ongoing”;

- d. There was a consensus that mobile & digital technology is a critical enabler of socio-economic growth that has contributed significantly to the facilitation of communication through mobile devices. From 1G through 4G, every successive generation of wireless standards – indicated by the “G” – has introduced advances in network capabilities and capacity, and it is expected that 5G which is the 5th generation of mobile networks will be no exception;
- e. They were also unanimous on the tremendous benefits that will accrue from the deployment of 5G. These benefits include faster data rates, very low rate of latency, access to more bandwidth, more capacity and less congestion, downward compatibility etc. Despite these benefits of the capabilities of 5G, it was stressed that the inherent disadvantages of the technology may not be immediately identified until it is fully implemented;
- f. However, it can be immediately stated that since 5G comes with high and faster data rates, cost of equipment and maintenance will lead to a higher cost of production, and a more improved battery technology will be needed for 5G devices to prevent battery drain and heat. Furthermore, more sites will need to be mounted closer to homes since the 5G waves will not be able to travel far and indoor penetration will be poor;
- g. MNOs agreed that 5G has potential for less radiation because most of the spectrum used for 5G fall within the millimeter wave band (30 GHz and 300 GHz), making the technology potentially safer than 4G or other previous technologies as it attenuates or loses its energy. While 4G spectrum goes longer distances, EMF from 5G travel shorter distances thereby leaving behind less impact on the environment in general and on human health in particular;
- h. They stated that the most common concern about 5G today is not different from the concerns that have trailed progress in telecommunications from 2G to 4G namely that exposure to some levels of electromagnetic signals could be harmful to human health. These concerns were heightened following the outbreak of the COVID-19 pandemic, with conspiracy theorists alleging that 5G has unsafe levels of radiation emitted otherwise called electromagnetic fields (EMF);

- i. MNOs further agreed that the concerns of medical experts and scientists about the health risks posed by 5G to humans are valid if Radio Frequency (RF) exposure rises beyond a certain level. However, these concerns have been duly addressed by the International Commission for Non-Ionizing Radiation Protection (ICNIRP) through the development of RF-EMF Guidelines which set Radio Frequency EMF (RF-EMF) limits to protect workers and the public. These Guidelines have been endorsed by the World Health Organisation (WHO) and Wireless Technology operators globally are mandated to adhere to them;
- j. That these Guidelines were developed in 1998 but recently updated in March 2020. The Guidelines contain restrictions set to ensure that the resultant peak spatial power will remain far lower than required to adversely affect human health. Although the 1998 Guidelines provided adequate limits for 5G, the 2020 update introduced better and more guidance for 5G related frequencies above 6GHz. Thus, according to ICNIRP, 5G exposures will not cause any harm provided that they adhere to the ICNIRP 2020 Guidelines;
- k. They concluded that the view held by some scientists and doctors from several countries warning about the dangers of 5G to the effect that it can lead to a massive increase in involuntary exposure to electromagnetic radiation is unfounded and lacks scientific merit stating the position of the World Health Organization (WHO) that, "To date, and after much research performed, no adverse health effect has been causally linked with exposure to wireless technologies";
- l. MNOs further noted that there have been several decades of RF-EMF research on numerous potential health effects, however, the only substantiated effect of RF EMF exposure relevant to human health and safety is heating of exposed tissue. They stated that the human body can accommodate a small increase in heat, in a similar way that excess body heat is dissipated when performing sporting activity. This is because the human body has a strong ability to regulate its internal temperature. Even at higher frequencies bands for 5G, this heat is even less negligible with no damage to the tissue. More so, there have been extensive studies on the acute and long-term effects of RF EMF exposure below the thermal threshold with results demonstrating no adverse health effects;
- m. Apart from the positions of public health agencies, some countries in the world have commercially deployed 5G technology. As at January 2020, 378 cities in 34 countries had commercially deployed 5G technology. Top 3 countries with

highest number of deployments include South Korea, US and UK. These deployments happened before 2020 and there have not been any health implications in these countries;

- o. Reacting to the technological impact of 5G deployment in Nigeria, Mobile Network Operators stated clearly that there is still a fair amount of work to be done towards creating the required enabling environment and support ecosystem for 5G deployments in Nigeria. However, going by the gains recorded from the deployments of 3G and 4G in Nigeria, it can be safely concluded that 5G will revolutionise the way of life of Nigerians;
- p. This is because 5G standards brings greater convenience as it promises seamless connectivity and information sharing, smart manufacturing, and greater connections by connecting billions of devices in our homes, cars, offices, and cities, using some of the fastest and most reliable ways possible. This technology brings advancement from education to agriculture, healthcare, transportation, security, entertainment, and governance in general;
- q. It was observed that while there is nothing wrong with having more tests done to adjudge the impact of 5G on health before deployment, there has been numerous tests carried out to examine the impact of radio frequencies on public health, including the radio frequencies in the 5G spectrum. For instance, the World Health Organization and the International Commission for Non-Ionizing Radiation Protection (ICNIRP) have declared, based on numerous tests carried out, that 5G Radio frequencies are safe. Other international agencies especially the European Commission stated that, "The strict and safe exposure limits for electromagnetic fields recommended at EU level apply for all frequency bands currently envisaged for 5G." It was stipulated that there are already safety limits and standards built in, that guarantee that exposure to wireless technologies, including 5G, are in no way harmful to human health;
- r. Mobile Network Operators however recommended that a robust technology verification and validation (V&V) are essential before any 5G deployment can take place. It is during this phase that virtual network functions (VNFs) and network services to ensure quality and reliability from the instant network is deployed;
- s. Furthermore, it was recommended that in order to measure the complete performance of the network, there is need for the application of scalable 5G test

systems with integrated data services that are capable of simulating real-world user behaviour in 5G field trials. 5G V&V is also intrinsically dependent upon the use of software to emulate and measure millions of unique data flows to enhance load/capacity testing and benchmarking capabilities; and

- t. It was also recommended that operators should consider the need to perform functional and load testing of base stations in production environments, as well as the need to lab test new 5G features and interfaces. End-to-end testing of the air interface at the system level, as well as infrastructure validation testing of pilot network deployments, is also key.

8.11 NATIONAL OFFICE FOR TECHNOLOGY ACQUISITION AND PROMOTION (NOTAP)

- a. NOTAP stated that like its predecessors, 5G are cellular networks, in which the service area is divided into small geographical areas called cells. Similar to other cellular networks, 5G uses a system of cell sites that divide their territories into sectors and send encoded data through radio waves. Each cell site is connected to a network backbone through a wired or wireless backhaul connection;
- b. It also stated that initial 5G services commenced in some countries in 2019, while the widespread availability is expected by 2025. 5G technology is already available in some countries, and global operators have commenced the launch of its networks in early 2019. It is anticipated that 5G mobile networks will be available in many countries by the end of 2020;
- c. NOTAP observed that 5G will enable a new network that is capable of connecting virtually everyone and everything together including machines, objects, and devices. 5G operates on high-band spectrum and will provide faster speed, greater capacity, low latency and offer more seamless connectivity to enable a new generation of applications, services and business opportunities in a new dimension that never existed before;
- d. Concerning the current status of 5G network in Nigeria, NOTAP observed that 5G network has not been deployed in Nigeria. However, the Office admitted that it was aware that the Nigerian Communications Commission (NCC) and a Cellular network operator in the Country, MTN, conducted test trials of the 5G operation in Abuja, Lagos and Calabar in November and December, 2019. This was sequel to the NCC report in November, 2019 that it had approved some spectrum bands for the 5G trial test in the country for a period of three months;

- e. On the state of readiness of Nigeria for the deployment of the 5G network, it was stated that prior to the roll-out of the 5G in a country, the necessary infrastructure and technology have to be put in place, in view of the need for significant amount of new harmonized mobile spectrum. The 5G technology comes with a physical architecture different from the preceding generations of wireless network. Significantly, the infrastructure transits from the traditional large cell towers stretched over longer coverage to a network of smaller cells that are closer together making it impossible for 5G to be deployed using the already existing towers and mast equipment that work with 3G and 4G networks. In this regards, massive physical infrastructure would need to be installed before 5G can be rolled out in Nigeria. Thus, the country cannot be regarded to be ready for the 5G roll out because of the absence of the required infrastructure;
- f. NOTAP stressed that one of the key advantages of the 5G network is increased speed and more available bandwidth, which translates to better quality and resolution for multimedia and data transmission. The 5G will work more effectively and efficiently than other previous networks. It offers low latency rate, better quality, and provides bi-directional large bandwidth shaping and will usher and accommodate a number of new technologies like wireless virtual reality headsets, Internet of Things (IOT) or remote controlled vehicles. It will also facilitate e-health, e-education, e-agriculture, e-commerce, etc;
- g. Highlighting the demerits of the 5G technology, it was stated that a critical drawback of high-band is that it has low coverage area and poor building penetration. Tons of cells will therefore be needed to create effective high-band network, thereby increasing the cost of network deployment. Building such a network is very expensive and expectedly, the cost may be ultimately borne by customers;
- h. Again, the 5G technology is a threat to the security of individuals. The Internet of Things (IoT) will put a lot of personal information out in the public networks thereby exposing personal data and threatening personal security. The United States of America objected to the China 5G roll-out on security grounds;
- i. Furthermore, another disadvantage attributed to the deployment of 5G network is its possible negative effects on human health. NOTAP noted that there are varied concerns and discussions on the health implications of 5G deployment, based on its non-ionizing radiations, which are reckoned by some scientists to be hazardous to human health. Switzerland is one of the countries that rejected the

5G on health grounds. It should also be noted that other countries such as Japan, New Zealand, Australia and Canada have also rejected the China (Huawei) developed 5G on various grounds;

- j. Analyzing the technological impacts of the deployment of 5G on Nigerian citizens, NOTAP observed that like most technologies, the 5G network will introduce great speed to connectivity, downloads and eliminate delays in data transmission. It will reduce the time spent on internet operations. It will also expose more Nigerians to the electronic age and ensure more dependence on the electronic system of operations. These are expected to drive such emerging technologies as Artificial Intelligence, Internet of Things, Big data etc;
- k. However, typical of most advanced technologies, there will be likely reduction in the human interface with systems operations, which may lead to job losses. Another effect is the implication on the educational system of the country. With a low level of ICT knowledge, penetration and application, the country will need to face the challenge of re-positioning its educational system to develop the critical mass of highly skilled ICT-savvy manpower needed to be engaged in Internet of Things, Big Data, Artificial Intelligence etc. The current educational system is grossly inadequate to drive such technology;
- l. Still on the interaction between the deployment of 5G Network and public health, NOTAP stressed that as 5G wireless technologies is deployed globally, issues bordering on the effects of radio frequency waves on public health has become of great concern. On one hand, the 5G operators continue to assure that there is no reason to be alarmed about the effects of radiofrequency waves on public health while some scientists have disagreed with this position on the other hand. The core issue which the scientists contend with is the effect of electromagnetic field (EMF) which is a field of energy that results from electromagnetic radiation. This radiation results from the electromagnetic wave propagated as data, which is transmitted to and fro the radio antennas on the telecom mast and cell phones;
- m. Power lines alternating current operate between 50 and 60 Hz which is at the lower end of the wave spectrum. The low-frequency waves of power lines together with radio waves, microwaves, infrared radiation, visible light, and some of the ultraviolet spectrum, ranging from the megahertz (MHz), gigahertz (GHz), to terahertz (THz) spectra make up what is known as non-ionizing radiation. Radiofrequency EMFs (RF-EMFs) include all wavelengths from 30 kHz - 300 GHz.

Above this exist the petahertz and exahertz spectra that include X-rays and gamma rays which are types of ionizing radiation. There are some contentions on the ionizing radiation because they have sufficient energy to break apart molecules and cause significant damage to the human body. However, it is imperative to note that mobile devices emit RF-EMFs at low levels. Whether this emission is significant enough to cause health concern is a matter of ongoing research and debate, which has been re-ignited by the advent of the 5G.

- n. A group of 30 international scientists, who were part of the working group of the International Agency for Research on Cancer (IARC) met in 2011 in Lyon, France, to assess the risk of cancer as a result of RF-EMFs exposure. At the end of their meeting, the scientists published that in view of the limited evidence in humans and experimental animals, the working group classified RF-EMFs as "possibly carcinogenic to humans (Group 2B)" based on an increased risk for glioma, a malignant type of brain cancer, associated with wireless phone use. The World Health Organization (WHO) however disagreed with the scientists;
- o. Currently, the position of WHO is that "To date, no adverse health effects from low level, long term exposure to radiofrequency or power frequency fields have been confirmed, but scientists are actively continuing to research this area."It is instructive to note that whereas the group of scientists, based on their studies, came up with a statement that classified RF-EMFs as "possibly carcinogenic to humans", the WHO disputed it but with an acknowledgement that "scientists are actively continuing to research this area". This is a strong pointer to the need for the country to strongly thread with extreme caution on the deployment of 5G network to avoid jeopardizing the health of its citizens. This should also be considered alongside the limitations in the country's health care facilities to combat any possible issue in the event of any emerging health challenge on the people;
- p. Based on the fact that there has not been conclusive evidence that RF-EMFs poses or does not pose serious health hazards on humans, NOTAP recommends that the country should exercise high level of caution on the deployment of the 5G network. It will be better to be on the side of caution and monitor the RF-EMFs studies being conducted by researchers, before taking the plunge. Secondly, that the Nigerian research community (both in the diaspora and at home) should be actively involved in the on-going global research, especially on the health implications; and

- q. NOTAP further recommends that a technical team of the Federal Ministries of Science and Technology, Health, and Communication & Digital Economy should be set up to coordinate the Nigerian research activities on 5G, with the Federal Ministry of Science and Technology as the Secretariat. Also the Nigerian Communications Commission (NCC) should be requested to urgently release the report of the test trial it conducted in 2019 to enrich the discussion and guide national discourse on the subject matter. Thus, the country should not be in a hurry to deploy the 5G network.

8.12 NATIONAL PRIMARY HEALTH CARE DEVELOPMENT AGENCY (NPHCDA)

- a. NPHCDA observed that 5G is an improvement on the current 4G with enhanced capabilities. This technology, as of February 2020, has already been deployed in 378 cities across 34 countries with South Korea having the highest number of cities followed by China, United States and United Kingdom. Other countries that have deployed in some of their cities are Saudi Arabia, United Arab Emirates, Spain, Australia, Romania and Germany;
- b. Reacting to the current status of 5G in Nigeria, the Agency stated that the Nigerian Communication Commission (NCC) had released a statement that 5G licenses have not been issued yet. The statement also added that a 3-month 5G trial had been concluded which was to study and observe any health or security challenges the network might present;
- c. The Agency noted further that the merits and demerits associated with the deployment of 5G Network in Nigeria would not be too different from the experiences of other countries that have deployed the technology but noted two major merits associated with the technology as its speed and the greater number of connected devices it allows. The demerits that could be attributed to the deployment of 5G on the other hand include the high cost of provision of infrastructure, incompatibility of old devices with 5G, elevated security threats etc;
- d. On the health implication of 5G on human health, the Agency responded that there have been varied concerns about 5G network and its effect on public health. However, according to the World Health Organization (WHO), to date, and after much research performed, no adverse health effect has been causally linked with exposure to wireless technologies. Health-related conclusions are drawn from studies performed across the entire radio spectrum but, so far, only a few have been carried out at the frequencies to be used by 5G;

- e. NPHCDA reiterated that COVID-19 is not caused by 5G because the technology has been deployed in some countries long before the outbreak of the pandemic which is against the views held by some school of thought that 5G network is the cause of COVID-19 pandemic;
- f. On the need for thorough test prior to the deployment of 5G network, the Agency recommended that global standards for deployment of such technologies be strictly adhered to while also looking out for lessons learnt by countries that have already deployed to guide our own deployment. Lessons from South Korea, the first country with substantial deployment would be instructive in this regard; and
- g. In conclusion, the National Primary Health Care Development Agency as the agency coordinating Primary Health Care (PHC) activities nationally, stated that it would find the 5G deployment very useful and therefore supports the deployment as it would, among others, enhance more effective remote monitoring since it would also afford remote health care support by skilled personnel from locations where they are available. This would lead to better synergy between the primary care and other levels of care, leading to better health outcomes.

8.13 NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY (NASRDA)

- a. NASRDA observed that 5G networks have not been deployed and operational in Nigeria as at today and the Agency does not have a reliable position on the state of Nigeria's readiness to deploy 5G network;
- b. Among other benefits that accrue from the deployment of 5G, NASRDA observed that it will create opportunities for Nigerians to have more internet-based services at greater speed for various applications, enable the Internet of Things (IoT), thus giving room for remote accessing and monitoring of properties and facilities in real-time. The technology is also a potential evolution to a smart and connected world, which presents a suitable platform for sustaining a smart city and enhancing socio-economic development;
- c. The Agency stated further that 5G is a technology that can enable interconnectivity of smart devices and support their access to high speed cloud computing. As such, data sharing amongst MDAs of Government, educational institutions, and licensing and financial institutions in Nigeria will be enabled and

reliable for real-time operations. In other words, national data infrastructures can be shared and accessed by many for different services in real-time;

- d. NASRDA does not see or envisage a likely negative impact on the health of the Nigerian citizens when 5G networks are deployed under the required standards of operation of such a wireless network. The current 5G operational frequency bands, which are the sub 6GHz and the millimeter wave range between 15-30GHz are in the non-ionizing range of the radio spectrum. Mobile and satellite communication networks are safely operating in these bands today, and unlike the X-ray and Gamma ray frequency ranges, their operation has not been known to be harmful;
- e. As such, a 5G network deployed in the allocated radio frequency range and operating under the recommended transmitted signal power is not envisaged to be harmful or unhealthy for humans. However, over-exposure to high powered 5G signals, like any other high radio frequency signals (e.g. 2G, 4G, satellite signals, etc.) and /or operation in unapproved range and signal power could be unhealthy;
- f. The Agency concluded that 5G network is like any currently deployed mobile radio network that is operated under certain given standards and recommendations, often set by the International Telecommunications Union (ITU) and a Member State's national radio communication body like the Nigeria Communication Commission (NCC); and
- g. Considering the advantages and technological impacts of 5G, it can be deployed in Nigeria for its numerous socio-economic and technological benefits while ensuring and observing the relevant operational guidelines of such a network for the health and safety of Nigerians.

8.14 NIGERIA CENTRE FOR DISEASE CONTROL (NCDC)

- a. NCDC, like other stakeholders, observed that 5G is an improvement on the current 4G with enhanced capabilities, and across the globe, its deployment mostly started in 2019, and most countries of the world are still in the planning stage of deployment;
- b. The Centre also corroborated the submissions by all other stakeholders that Nigeria is yet to issue a license to any operator to deploy 5G technology in the country except for the Non-Commercial Proof of Concept (PoC) trial conducted

by MTN with the permission and supervision of the Nigerian Communications Commission in November, 2019;

- c. The Centre further maintained that various benefits can be attributed to the deployment of the technology in Nigeria. These include, among others, enhanced capability to deploy Internet of Things (IoT) and other smart technologies, improved Gross Domestic Product (GDP) income from broadband digital technology, and enhanced internet connectivity. The Centre also identified the demerits associated with 5G network deployment as reported in some literature to include electro sensitivity, carcinogenicity, neurobehavioral and neurodegenerative diseases;
- d. NCDC admitted that while the Centre is yet to conduct a research on the impact of wireless technology on public health, it is understood that 5G is an evolution in wireless mobile phone technology with significant benefits, including its use for e-health. This means telecommunication standards will utilize higher radiation frequency far above 3GHz for the first time. However, the Centre stated, that the use of such radiation frequency has previously been deployed in technologies like point-to-point radio link and security body scanner;
- e. The Centre noted further that given the infancy of 5G technology across the globe, the level of exposure to radiofrequency from 5G network is still being investigated and claims of health injury to public health from the network remains unsubstantiated at the moment;
- f. Though the Centre suggested that more investigation would still be required to ascertain the true state of any impact of 5G on the health of Nigerians, NCDC's position at the moment aligns with the position of the World Health Organization that, "To date, after much research performed, no adverse health effect has been causally linked with exposure to wireless technologies. Health-related conclusions are drawn from studies performed across the entire radio spectrum but, so far, only a few studies have been carried out at the frequencies to be used by 5G. Tissue heating is the main mechanism of interaction between radiofrequency fields and the human body. Radiofrequency exposure levels from current technologies result in negligible temperature rise in the human body. As the frequency increases, there is less penetration into the body tissues and absorption of the energy becomes more confined to the surface of the body (skin and eye). Provided that the overall exposure remains below international guidelines, no consequences for public health are anticipated" (WHO, 2020);

- g. Concerning the interaction between COVID-19 and 5G network technology, NCDC confirmed that the pandemic is caused by a biological agent - a virus – which is scientifically unconnected with the 5G technology. Thus, there is no connection between the ongoing COVID-19 pandemic and the spread of the virus is not in any way attributable to telecommunications networks;
- h. The Centre emphasized that it is significant to draw from the conclusions of the defining research being conducted by WHO on the health risk assessment associated with exposure to radio frequencies including 5G network, when published, in order to have evidential insights on the likely negative impact of 5G deployment on the health of Nigerians. The WHO has maintained that, “currently, exposure from 5G infrastructures at around 3.5GHz is similar to that from existing mobile phone base stations. With the use of multiple beams from 5G antennas, exposure could be more variable as a function of location of users and their usage. Given that the 5G technology is currently at an early stage of deployment, the extent of any change in exposure to radiofrequency fields is still under investigation” (WHO, 2020); and
- i. While concluding that the negative impact of the 5G network on the health of Nigerians cannot be established at the moment, the Centre recommended that it is essential that further attention be giving to testing and researching potential health risk that may arise from the deployment of 5G network in Nigeria considering the real life situation rather than just laboratory conditions. It is also imperative that intense safety standards and precaution, based on available evidence, are put in place for wireless radiation system ahead of wide scale implementation.

9.0 GENERAL FINDINGS

- 9.1 All the stakeholders are of the unanimous opinion that 5G or 5th Generation of mobile networks is a significant improvement on today's 4G technology and it comes with huge capabilities that are not supported by the 4G. This new generation of mobile network helps to improve job creation, increase GDP, enhance creativity and innovations, diversify the economy, improve transparency and efficiency of governance, and enhance security of lives and properties. To this effect, all nations across the globe are planning and putting necessary resources in place to take advantage of the 4th industrial revolution provided by 5G technology to improve the socio-economic wellbeing of their citizens and Nigeria cannot afford to be left behind;

- 9.2 The Joint Committee observed that majority of the stakeholders recommend that in recognition of advantages and technological impacts of 5G over other previous generations of networks, the 5th Generation network can be deployed in Nigeria for its numerous socio-economic and technological benefits while ensuring and observing the relevant operational guidelines of such a network for the health and safety of Nigerians;
- 9.3 That the deployment of 5G in Nigeria will easily assist and fast-track the implementation of the National Digital Economy Policy and Strategy thereby enabling the Country to achieve a digital economy, and also help the Nigerian Military, the Police Force and other law enforcement Agencies in improving their efficiency and effectiveness by providing high speed networks to support military grade technologies such as intelligence, surveillance, and reconnaissance systems;
- 9.4 Regarding the current status of the 5G Network in Nigeria, all the stakeholders, especially the Federal Ministry of Communications and Digital Economy, the Nigerian Communications Commission (NCC), and the Office of the National Security Adviser (ONSA), clarified that there is no 5G deployment in Nigeria at the moment and that no license has been issued for 5G deployment on commercial basis. They all maintained that the three months Proof of Concept (PoC) trial approval given to MTN in November, 2019 had since been concluded and equipment decommissioned;
- 9.5 The Federal Ministry of Communications and Digital Economy stated that the results of the 5G Non-Commercial Proof of Concept (PoC) trial which took place in Lagos, Abuja, Calabar, Kano, Abeokuta and Ibadan for a maximum of 3 months showed improved capabilities of 5G over existing technologies and given that the worst case radiation levels are well below the specified safe limits, Nigeria should still observe the trend of 5G deployments around the globe and engage in extensive sensitization of the public through all channels before commencement of commercial deployments in the country;
- 9.6 The Joint Committee also observed however, that prior to the roll-out of 5G in a country, the necessary infrastructure and technology have to be put in place. For instance, there is need for the completion of feasibility studies for the various broadband projects to ascertain actual cost implications for their implementation, sustainability plans, provision of enabling environment including free Right of Way (RoW), tax waivers, sustainable power supply, improved security of men,

materials and equipment, elimination of multiple regulations and charges, recognition of telecommunications infrastructure as public utility infrastructure, and the need to build the National Backbone which will run from Lagos to Katsina (Trans-Saharan Optic fibre network) so as to move much of the bandwidth from the shore to the hinterland and for distribution to the geopolitical zones which should be considered a matter of urgency. Thus, the country cannot be regarded to be ready for the 5G roll out because of the absence of the required infrastructure;

9.7 The Joint Committee further observed that a Joint Committee was put in place by the Federal Ministry of Communications and Digital Economy with the mandate to develop plan/policy on the deployment of 5G in Nigeria. That the Consultation Document (CD) being developed for the deployment of 5G in Nigeria will include planning spectrum identified for 5G with the inputs of all relevant stakeholders such as the relevant Committees of the National Assembly and the security agencies;

9.8 Concerning the views expressed by some scientists and experts that the deployment of 5G technology is injurious to human health, the Joint Committee observed that majority of stakeholders, including the Federal Ministry of Communications and Digital Economy, and the Nigerian Communications Commission (NCC), are of the opinion that all wireless technologies operate in compliance with international exposure guidelines, developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). That the consensus of reviews by independent public health authorities, expert groups and the WHO is that these guidelines provide protection for all people (including children) against all established health hazards, hence, radiations from 5G are Non-Ionizing and therefore, not injurious to human health;

9.9 On the other hand, some stakeholders noted that given the infancy of 5G technology across the globe, the level of exposure to radiofrequency from 5G network is still being investigated and claims of health injury to public health from the network remains unsubstantiated at the moment. Thus, further attention should be given to testing and researching potential health risk that may arise from the deployment of 5G network in Nigeria considering the real life situation rather than just laboratory conditions. It is also imperative that intense safety standards and precaution, based on available evidence, are put in place for wireless radiation system ahead of wide scale implementation;

- 9.10 Some stakeholders further recommended that the Nigerian Communications Commission (NCC), in collaboration with the Mobile Network Operators (MNOs), Federal Ministry of Health, Federal Ministry of Science and Technology, Federal Ministry of Environment and the Nigeria Centre for Disease Control (NCDC) among others, should conduct a scientific experimental study over a period of 6 months to ascertain if a correlation exists between 5G networks and public health. That an Experimental and Control Group can be created consisting of test animals (e.g. rats) to ascertain if 5G networks can be harmful to humans which is the recommended approach that is applied to any new technology in the Information and Communication Technology sector and Nigeria should not be an exception;
- 9.11 From the various submissions, the Joint Committee realised that though available evidences weigh heavily in favour of the fact that radiation from Mobile Networks and Devices including 5G are Non-Ionizing Radiation with very low power that cannot disrupt the DNA or molecular structure of humans, there is still a lack of consensus among the scientific community as to the health effects of Radio Frequency (RF) on humans especially due to few studies that have been carried out on the frequencies to be used by 5G;
- 9.12 Concerning the interaction between COVID-19 and 5G network technologies, the Joint Committee confirmed that the pandemic is caused by a biological agent - a virus – which is scientifically unconnected with the 5G technology. Thus, there is no connection between the ongoing COVID-19 pandemic, and the spread of the virus is not in any way attributable to telecommunications networks. ICNIRP further stated that, “the claim that exposure to Electromagnetic Field generated by 5G can both cause COVID-19 and increase its severity are not supported by any evidence (not even extremely weak evidence), and the large body of scientific knowledge regarding the EMFs relevant to 5G demonstrates that those claims are not feasible”;
- 9.13 Significantly, the Joint Committee noted the position of the Office of the National Security Adviser (ONSA) that Nigeria can go ahead with the deployment of 5G technologies as this is in line with the on-going efforts to reposition Nigeria for increased global economic competitiveness in the current digital age, and also considering the potential of the technology to offer arrays of technological improvements and opportunities that will enhance security and socio-economic wellbeing of the Country thereby enhancing national security by implication;

- 9.14 The Joint Committee also noted the reservation of the Office of the National Security Adviser (ONSA) about the national security concerns associated with 5G technology deployments. Concerns such as possible existence of deliberate vulnerabilities and backdoors within some 5G network equipment which could make the infrastructure highly susceptible to eaves dropping, tracking, cyber-attacks, military or industrial espionage or other malicious activities as well as compromise of the Nigerian cyberspace, coupled with the possibility of manufacturers or foreign actors to easily gain remote access and disrupt or degrade telecommunications services;
- 9.15. To forestall the scenario in paragraph 9.14, the Joint Committee observed that the Office of the National Security Adviser (ONSA) recommended the establishment of an Inter-Agency Working Group to assess the national security risks posed by 5G technology and develop necessary Risk Management Framework for the technology. While the risk assessment would provide the necessary information that would guide decision-making towards the adoption of the technology, the Risk Management Framework would ensure that future deployment of the technology would be done in a manner that protects Nigeria's national security interests; and
- 9.16 This Inter-Agency Working Group comprising of the Office of the National Security Adviser (ONSA), the Nigerian Communications Commission (NCC), the Federal Ministry of Communications and Digital Economy and other relevant stakeholders, should address all the national security concerns afore-mentioned in order to complement all efforts to exploit the benefits that the technology portends. In doing so, the Office of the National Security Adviser stressed the need to plan in advance, develop local contents, and indigenous capacity to interface with relevant international organizations and stakeholder towards the formulation of robust framework that can guide the preparation, planning and deployment of 5G in Nigeria.

10.0 RECOMMENDATIONS

- 10.1 Having carefully taken into account the immense socio-economic and technological impacts of 5G over other previous generations of networks; the overwhelming aggregate of favourable opinions from majority of stakeholders for its deployment, coupled with the fact that same has been successfully deployed in more advanced countries, the Joint Committee hereby shares the recommendation of very sensitive Government establishments (such as the Federal Ministry of Communications and Digital Economy, the Nigerian

Communications Commission, the Office of the National Security Adviser, the National Information Technology Development Agency etc, and other telecoms professional organisations such as the Association of Telecommunications Companies of Nigeria (ATCON), Association of Licensed Telecommunications Operators of Nigeria (ALTON) and the Global System of Mobile Communications Association that it is appropriate for Nigeria to join the comity of nations that are engaged in the deployments of 5G for all its inherent gains;

- 10.2 Though there is still a fair bit of work to be done towards creating the required enabling environment and support ecosystem for 5G deployments in Nigeria, the Joint Committee is convinced that, having witnessed what has been achieved by its 'lesser ancestors' such as 3G and 4G, the technological impact of 5G will be such that will revolutionize Nigerians' way of life from education to agriculture, security to entertainment, and governance in general if the technology is deployed;
- 10.3 While the Joint Committee clarifies that there is no 5G deployment in Nigeria at the moment and that no license has been issued to any Mobile Number Operator on commercial basis, it is our recommendation that Nigeria should still observe the trend of 5G deployments around the globe and engage in extensive sensitization of the public through all channels before commencement of commercial deployments in the country;
- 10.4 Relevant Government Agencies are also urged to embark on preparing the ground by putting the necessary infrastructure and technology in place for its eventual deployment. This period of ground preparation is expected to be utilized to complete feasibility studies for the various broadband projects in order to ascertain actual cost implications for their implementation, complete sustainability plans, provide enabling environment including free Right of Way (RoW); tax waivers, sustainable power supply, improve security of men, materials and equipment, eliminate multiple regulations and charges, recognize telecommunications infrastructure as public utility infrastructure; and engender public trust and confidence;
- 10.5 The Joint Committee further recommends that global standards for the deployment of 5G technology should be strictly adhered to while looking out for lessons learnt by countries that have already deployed in order to guide our own deployment. Lessons from South Korea, the first country with substantial deployment would be instructive in this regard. It is imperative that intense

safety standards and precaution, based on available evidence, are put in place for wireless radiation system ahead of wide scale implementation;

- 10.6 Furthermore, given the infancy of the technology across the globe and the claims and counter claims surrounding the probability of health injury being posed to public health by the level of exposure to radiofrequency, it is recommended that further attention should be given to testing and researching potential health risk that may arise from the deployment of 5G network in Nigeria considering real life situation rather than just laboratory conditions.
- 10.7 The Joint Committee urges the Federal Ministry of Communications and Digital Economy to expedite the action of the Committee put in place to develop Consultation Document (CD) for the deployment of 5G in Nigeria which will include planning spectrum identified for 5G with the inputs of all relevant stakeholders such as the relevant Committees of the National Assembly and the security agencies;
- 10.8 The Federal Ministry of Communications and Digital Economy is also urged to publish the outcome of the work of its Technical Advisory Committee charged to advise on emerging technologies and products and as a matter of urgency, build the National Backbone which will run from Lagos to Katsina (Trans-Saharan Optic fibre network) to move much of the bandwidth from the shore to the hinterland and for distribution to the geopolitical zones;
- 10.9 Despite the almost general consensus concerning the harmlessness of 5G to human health, the Joint Committee hereby recommends that the Nigerian Communications Commission (NCC), in collaboration with the Mobile Network Operators (MNOs), Federal Ministry of Health, Federal Ministry of Science and Technology, Federal Ministry of Environment, and the Nigeria Centre for Disease Control (NCDC) among others, should locally conduct a scientific experimental study over a period of about 6 months to ascertain if a correlation exists between 5G networks and public health;
- 10.10 Also, concerning the interaction between COVID-19 and 5G network technologies, the Joint Committee confirms and is convinced that there is no connection between them. The ongoing COVID-19 pandemic is caused by a biological agent - a virus - which is scientifically unconnected with the 5G technology. Responding to rumors across the world that link COVID-19 to 5G, ICNIRP stated thus: "the claim that exposure to Electromagnetic Field generated

by 5G can both cause COVID-19 and increase its severity are not supported by any evidence (not even extremely weak evidence), and the large body of scientific knowledge regarding the EMFs relevant to 5G demonstrates that those claims are not feasible”;

10.11 While appreciating the concerns of the Office of the National Security Adviser (ONSA) over the national security implications of 5G technology deployments, the Joint Committee hereby recommends, as postulated by the Office of the National Security Adviser, the establishment of an Inter-Agency Working Group comprising of the Office of the National Security Adviser, the Nigerian Communications Commission, the Federal Ministry of Communications and Digital Economy and other relevant stakeholders to assess and address all the national security concerns highlighted in paragraph 9.14 and develop necessary Risk Management Framework that would ensure that future deployment of the technology would be done in a manner that protects Nigeria’s national security interests.

11.0 CONCLUSION: Mr. President, Distinguished Senators, the Joint Committee expresses its profound gratitude for the opportunity to undertake this all important national assignment as I move that the Senate do approve the recommendations of the Joint Committee.

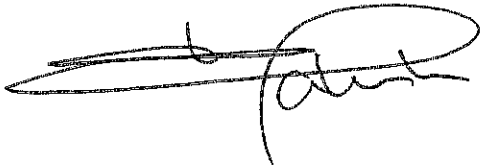
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SENATOR OLUREMI S. TINUBU
CHAIRMAN, COMMITTEE ON
COMMUNICATIONS




SENATOR UCHE L. EKWUNIFE
CHAIRMAN, COMMITTEE ON
SCIENCE & TECHNOLOGY



SENATOR YAKUBU OSENI
CHAIRMAN, COMMITTEE ON
ICT & CYBER CRIMES



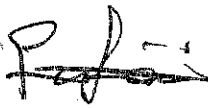
SENATOR CHUKWUKA UTAZI
CHAIRMAN, COMMITTEE ON
PRIMARY HEALTH CARE &
COMMUNICABLE DISEASES



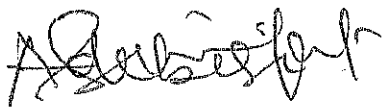
KOLAWOLE E. KAYODE
CLERK, COMMITTEE ON
COMMUNICATIONS



MOHAMMED GANA
CLERK, COMMITTEE ON
SCIENCE & TECHNOLOGY




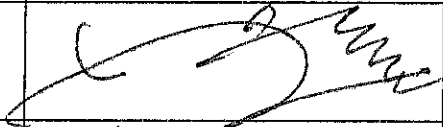


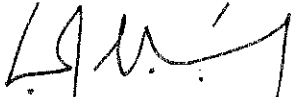
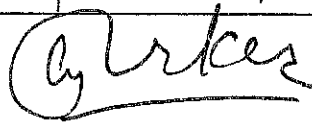
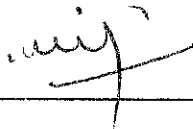
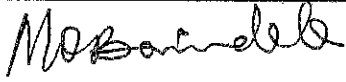
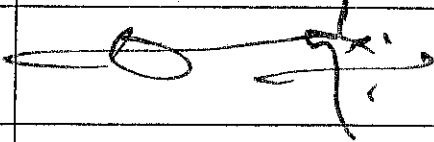
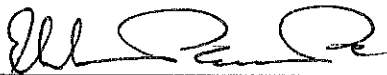
AYOH OGON
CLERK, COMMITTEE ON
ICT & CYBER CRIMES



SHERIFAT ADEBISI
CLERK, COMMITTEE ON
PRIMARY HEALTH CARE &
COMMUNICABLE DISEASES

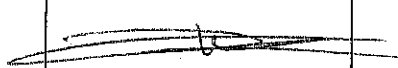

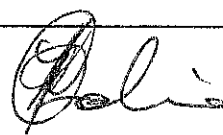
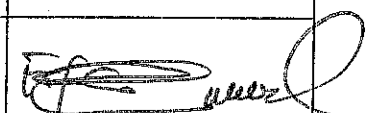
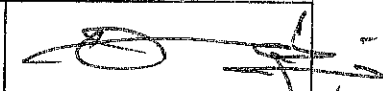
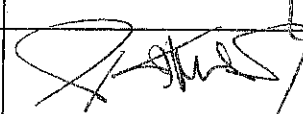
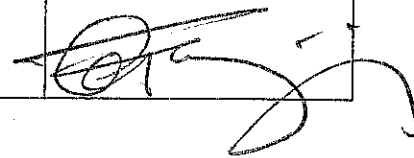
REPORT OF THE JOINT COMMITTEE ON COMMUNICATIONS, SCIENCE AND TECHNOLOGY, ICT & CYBER CRIMES, AND PRIMARY HEALTH CARE & COMMUNICABLE DISEASES ON THE INVESTIGATION OF "THE STATUS OF 5G NETWORK IN NIGERIA AND ITS TECHNOLOGICAL IMPACT ON NIGERIAN CITIZENS"

ENDORSEMENT PAGE

SENATE COMMITTEE ON COMMUNICATIONS			
1.	Senator Oluremi S. Tinubu, OON	Chairman	
2.	Senator Ibrahim M. Bomai	Vice Chairman	
3.	Senator Enyinnya H. Abaribe	Member	
4.	Senator Biodun Olujimi	Member	
5.	Senator Uba Sani	Member	
6.	Senator Adamu Bulkachuwa	Member	
7.	Senator Orker-jev E. Yisa	Member	
8.	Senator Theodor Orji	Member	
9.	Senator Sandy O. Onor	Member	
10.	Senator Micheal O. Bamidele	Member	
11.	Senator Obinna Ogba	Member	
12.	Senator Ibrahim Y. Oloriegbe	Member	
	Kolawole E. Kayode	Clerk	

REPORT OF THE JOINT COMMITTEE ON COMMUNICATIONS, SCIENCE AND TECHNOLOGY, ICT & CYBER CRIMES, AND PRIMARY HEALTH CARE & COMMUNICABLE DISEASES ON THE INVESTIGATION OF "THE STATUS OF 5G NETWORK IN NIGERIA AND ITS TECHNOLOGICAL IMPACT ON NIGERIAN CITIZENS"

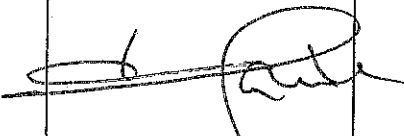
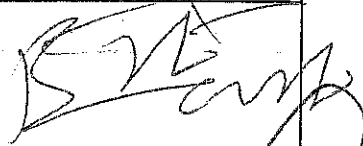
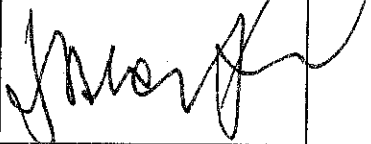
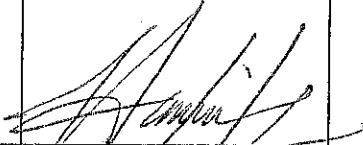
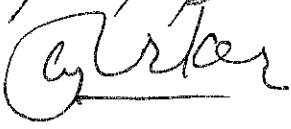
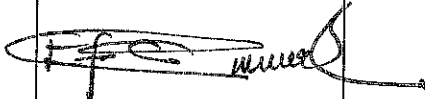
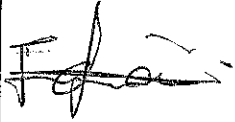
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SENATE COMMITTEE ON SCIENCE AND TECHNOLOGY			
1.	Senator Uche L. Ekwunife	Chairman	
2.	Senator (Prof.) Robert A. Boroffice	Vice Chairman	
3.	Senator Ibrahim H. Hadejla	Member	
4.	Senator Clifford Ordia	Member	
5.	Senator Solomon A. Olamilekan	Member	
6.	Senator Francis E. Onyewuchi	Member	
7.	Senator Obinna Ogba	Member	
8.	Senator (Dr.) Istifanus D. Gyang	Member	
9.	Senator Kola Balogun	Member	
10.	Senator Akon Eyakenyi	Member	
	Mohammed Gana	Clerk	

REPORT OF THE JOINT COMMITTEE ON COMMUNICATIONS, SCIENCE AND TECHNOLOGY, ICT & CYBER CRIMES, AND PRIMARY HEALTH CARE & COMMUNICABLE DISEASES ON THE INVESTIGATION OF "THE STATUS OF 5G NETWORK IN NIGERIA AND ITS TECHNOLOGICAL IMPACT ON NIGERIAN CITIZENS"

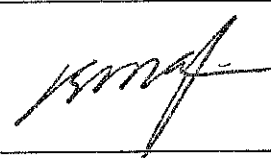
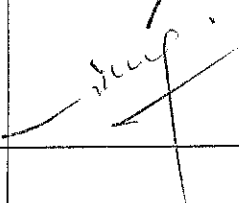
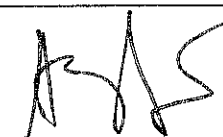
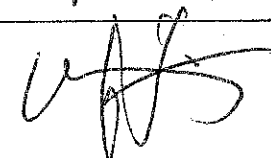
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SENATE COMMITTEE ON ICT & CYBER CRIMES

1.	Senator Yakubu Oseni	Chairman	
2.	Senator Buhari Abdulfatai	Vice Chairman	
3.	Senator Ibrahim H. Hadejia	Member	
4.	Senator Jika D. Haliru	Member	
5.	Senator Orker-jev E. Yisa	Member	
6.	Senator Francis E. Onyewuchi	Member	
	Ayoh Ogoh	Clerk	

REPORT OF THE JOINT COMMITTEE ON COMMUNICATIONS, SCIENCE AND TECHNOLOGY, ICT & CYBER CRIMES, AND PRIMARY HEALTH CARE & COMMUNICABLE DISEASES ON THE INVESTIGATION OF 'THE STATUS OF 5G NETWORK IN NIGERIA AND ITS TECHNOLOGICAL IMPACT ON NIGERIAN CITIZENS'

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SENATE COMMITTEE ON PRIMARY HEALTH CARE AND COMMUNICABLE DISEASES			
1.	Senator Chukwuka G. Utazi	Chairman	
2.	Senator Umar S. Suleiman	Vice Chairman	
3.	Senator Theodore Orji	Member	
4.	Senator Yaroe B. Dauda	Member	
5.	Senator Matthew Urhogide	Member	
6.	Senator Ibrahim Y. Oloriegbe	Member	
7.	Senator Ibrahim A. Danbaba	Member	
	Sherifat Adebisi	Clerk	