ATC KENYA

ENVIRONMENTAL IMPACT ASSESSSMENT PROJECT REPORT FOR THE PROPOSED ROOFTOP BASE TRANSCEIEVER STATION (BTS) IN WITHEITHIE ESTATE ON PLOT L.R NO: JUJA /KALIMONI BLOCK 30 (NJEMUWA INVESTMENTS) KIAMBU COUNTY.

FOR

ATC KENYA OPERATIONS LIMITED

SITE ID: MOUNT KENYA UNIVERSITY THIKA (TBA)

This Environmental Impact Assessment Project Report is prepared in Accordance with Environmental Management and Coordination CAP 387

June 2020

Report Prepared By:

EarthCare Services Limited
for the posterity of resources and development

4th Floor, Transnational Plaza
Mama Ngina Street
P.O Box 22433 – 00100
Nairobi – Kenya
Office Tel: +254 20 2603517
Mobile: +254 724 343755

GPS Coordinates: -1.06951 & 37.05656

Certification

This Environmental Impact Assessment Project Report has been prepared by a registered and licensed firm of experts. It is submitted to the National Environment Management Authority [NEMA] in conformity with the requirements of the Environmental Management and Coordination Act Cap 387 and Environmental (Impact Assessment and Audit) Regulations, 2003. To the best of our knowledge, we certify that all the information contained in this report is true.

Project proponent:	ATC Kenya Operations Limited
PIN No.:	P051647613G
Contact Person:	Kennedy Nzioka
Designation:	Project Manager
Signature:	Date.....
Address:	ATC Kenya Regus Delta Corner Office 614, 6th Flr Chiromo Rd Westland. P.O. Box 14805-00800, Nairobi, Kenya.
Telephone:	+254734616103
Email:	Kennedy.Nzioka@americantower.com

EIA/EA Firm:	Earthcare Services Limited
Registration Number:	1799
EIA Experts:	John Kuloba
Registration Number	1018
Signature:	**Date**.....……
	(For Earthcare Services Ltd)
Address:	P.O. Box 22433-00100 Nairobi Kenya
Telephone:	020 2603517 / 0724 -343 755
Email:	kuloba@earthcare.or.ke

Acknowledgement

Earthcare Services Limited would like to exclusively thank the project proponent for entrusting us to carry out an Environmental Impact Assessment for its proposed development and compile a report on their behalf.

We acknowledge the facilitation by ATC Kenya Operations Limited and for providing necessary information and supportive materials required throughout the assessment process. Special thanks go to the Project Manager, Mr. Kennedy Nzioka among other staff. We are further appreciative to the residents of Witheithie Estate Area where the proposed project is located, who participated during the public consultation process.

Non-Technical Summary

The mobile telecommunications industry in Africa is in a transitional phase with changing industry structure and dynamics. Africa currently has over 800 million mobile connections and nearly 450 million unique subscribers. The coverage of mobile network has varying range from 10% to 99% across countries in Africa with an average of 70% mobile coverage.

Despite the huge growth and potential future opportunity, the mobile industry in Africa faces many challenges – both infrastructural and operational.

1. The mobile operators face challenges to power their existing networks, both off-grid and on-grid, because of unreliable power supply and heavy reliance on expensive diesel power to power up their existing networks.
2. The mobile operators face infrastructure challenges to expand mobile coverage to uncovered population (majority of which live in rural and remote areas without access to grid electricity and road infrastructure) owing to higher operational costs and poor roads.

The mobile networks in Africa have grown beyond the reach of grid electricity and mobile operators have deployed a significant part of their tower infrastructure in areas without any access to grid electricity infrastructure. According to GSMA analysis and estimates, Sub-Saharan Africa has a total of over 240,000 towers across countries providing mobile coverage to 70% of the region's population. The size of the tower portfolio is expected to grow to over 325,000 towers by 2020. Majority of telecom tower sites in Africa are deployed in either off-grid areas or problematic grid areas with unreliable power supply. Africa currently has an estimated 145,000 off-grid sites which is expected to grow to 189,000 sites by 2020. The number of bad-grid sites is expected to grow from 84,000 in 2014 to over 100,000 sites by year 2020.

American Tower Corporation, one of the largest global Real Estate Investment Trusts (REITs), is a leading independent owner, operator and developer of wireless and broadcast communications real estate was Founded in 1995. Our global portfolio includes approximately 171,000 communications sites, including nearly 41,000 properties in the United States and approximately 130,000 properties internationally. In addition to leasing space on wireless and broadcast towers, we provide customized solutions through our in-building systems, outdoor distributed antenna systems and other right-of-way options, managed rooftops and services that speed network deployment.

Headquartered in Boston, Massachusetts, American Tower has offices across the United States and in Argentina, Brazil, Chile, Colombia, Costa Rica, France, Germany, Ghana, India, Kenya, Mexico, Nigeria, Paraguay, Peru, South Africa and Uganda.

The demand for mobile data connectivity is increasing dramatically across different markets in the world. ATC Kenya Operations Limited aims to offer industry-based solutions across Kenya to improve coverage and the delivery of community-based solutions. We provide cost-effective options for the expansion of wireless network coverage in your service area. Our wireless solutions support the development and upgrading of network-based applications.

Our expertise in building, upgrading and operating tower sites allows us to assist our customers in providing a better service at a reduced cost. With more than 2000 sites located in Kenya and a commitment to grow to suit our customers' needs, by providing networks and improving wireless communications.

Based on the aforementioned emerging trends in telecommunication sector, the proprietor (ATC Kenya Operations Limited) has proposed to construct a Rooftop Base Transceiver Station (BTS) in Witheithie Estate Area Georeferenced by coordinates (**Latitude -1.06951 & Longitude 37.05656**) Kalimoni area Witheithie. The proposed BTS shall be erected on a residential apartment on **Plot LR. No JUJA /KALIMONI BLOCK 30 (NJEMUWA INVESTMENTS)** and shall only occupy ten meters (10m) by ten Meters (10m). The property is owned by **Angelo Muchiri Waweru** (Herein referred to as the Lessor), it has been leased to ATC Operation Kenya Limited for a period of time specified in the attached lease agreement. The site is under intense development mainly residential and business ventures.

The Environmental Management and Coordination (Amendment) Act (2015) Cap 387 and the Environmental (Impact Assessment and Audit) Regulations, 2003, it is compulsory that projects such as the proposed BTS installation undergo an Environmental and Social Impact Assessment (ESIA) process to evaluate existing and potential positive and negative impacts of the project, so as to attune the project to sustainability requirements. EMCA ensures that proposed development takes into consideration appropriate measures to mitigate any adverse impacts to the natural and social environment, this will further ensure environmental safeguard and sustainable development.

The general objective of the EIA investigations is to carry out a systematic examination of the present environmental situation within the project area to determine whether the proposed project will impact adversely on the physical and biological elements of the environment within the project area. This is in line with Section 58 (1) of EMCA Cap 387 that requires proponents to carry out EIA on projects that appear in the Second Schedule of the Act.

This Environmental Impact Assessment (EIA) project report covered the whole project site and its surrounding areas that are likely to be impacted by the proposed development. The EIA was carried out based on field assessments public consultations with the neighbours to the proposed project site, relevant stakeholders and proponent. Relevant documents were reviewed. ATC Operation Kenya Ltd provided the proposed project details description.

Data collection was carried out through structured questionnaires, interviews and observations during site visits. The study covered anticipated direct and indirect impacts of the project during construction, operation and decommissioning phases of the proposed project. Mitigation measures to the possible negative impacts were identified and an Environment Management and Monitoring Plan (EMMP) that provides viable and environmentally friendly options prepared. In addition, a plan for prevention of accidents during construction, operation and decommissioning phase was prepared. The accident prevention plan covers injuries that may result from working with machines, fall from heights, electrocution and exposure to toxic chemicals and injuries due to flying objects, dust, hot splashing objects etc.

The need for construction of the proposed Mount Kenya University Thika Rooftop BTS project arose out of a desire for general service improvement by Airtel subscribers in the area. This was occasioned by poor network coverage. The BTS is designed to meet and exceed Environmental Management and Coordination Act, Kenya Communications Act No. 2 of 1998, CAK guidelines and other legal requirements. The project is expected to be implemented in four phases including planning, construction, and operation as well as decommissioning phase. Activities during construction phase will include tower foundations and footings, hoisting of the mast amongst other activities.

These activities will result to negative impacts including, noise pollution, and solid waste generation in form of surplus materials, occupational health and safety risks, increased demand energy. Construction phase will also be beneficial since it will create temporary employment opportunities to construction workers.

During operation phase the area occupants will benefit from improved network coverage. Some negative impacts are however anticipated including increased energy consumption, electronic wastes generation, perceived health and safety risks due to EMF exposure and occupational health and safety risks. Decommissioning phase will have impacts similar to those in the construction phase.

Based on the consultant's analysis of the proposed project, site inspection and public consultation we can conclude that the proposed construction of BTS will have both beneficial and insignificant impacts during construction, operation and decommissioning phases. The negative impacts will be managed to acceptable levels by implementing the proposed mitigation measures provided in this EIA report such that the overall benefits of this project will far much outweigh the adverse impacts.

We therefore recommend that the proponent be given a license to implement this project subject to adherence to the Environment and Social Management Plan (EMMP) proposed in this report and other statutory requirements. We also recommend the following measures;

- Install cooling and fire suppression systems that are CFC free.
- The tower should be installed with an anti-climb device to prevent unauthorized climbing.
- The contractor should follow good engineering practice in construction of the BTS site.
- An emergency preparedness and response plan should be put in place during all phases of the project.
- The proposed project should be implemented in compliance with relevant legislations and planning requirements.
- The tower should be inspected at least twice a year and Base Transceiver Station be inspected as frequently as may be necessary to maintain the tower in a safe and weather withstanding condition
- Warning signs indicating DANGER, HIGH VOLTAGE and NO TRESPASSING should be attached permanently on the fence or wall surrounding the base station.
- Ensure maintenance technicians are trained on radio frequency exposure safety; and
- Install CFC free air conditioners at the proposed site. Such as R134A or R134B are preferable if need be.
- Implement the formulated Environmental Management and Monitoring Plan (EMMP) to mitigate the predicted negative environmental and social impacts during construction, operation, and decommissioning phases.
- Conduct statutory annual environmental audits and EMF annually through licensed advisors during operations phase.
- Ensure that worker's occupational health and safety standards are maintained through capacity building, proper training, and providing protective clothing.
- All activities concerning construction and maintenance shall be strictly monitored by an engineer or a designated official. This is important to ensure quality of maintenance works.

The result of this Environmental Impact Assessment has indicated that there are no significant negative impacts likely to be generated by the activities of the proposed project. Most of the potential negative impacts to be generated have been rated low (-1) and those rated high are of positive nature and beneficial to all the affected stakeholders and Kenya at large. In conclusion, this EIA study has established that the construction of BTS by ATC Operation Kenya Limited in collaboration with Airtel Kenya will improve mobile communication capacity in Menja (Juja) area and their environs and will not generate significant negative impacts that will compromise the ecological and environmental well-being of the project area as well as health and safety of the area residents.

Abbreviation

ACA	Australian Communications Authority
AM	Amplitude modulation
ANSI	American National Standards Institute
APC	Adaptive Power Control
ATC	American Tower Corporation
BTS	Base Transceiver Station
CAK	Communications Authority of Kenya
CBD	Convention on Biological Diversity
CDMA	Code Division Multiple Access
CPP	Consultation, Public involvement and Participation
CPs	Contracting Parties
CW	Continuous Wave
DECT	Digital Enhancement Cordless Telecommunications
DNA	Deoxyribonucleic acid
DTX	Discontinuous transmission
EEG	Electroencephalogram
EIA	Environmental Impact Assessment
EIRP	Effective Isotropic Radiated Power
EMCA	Environmental Management and Coordination Act
EME	Electromagnetic Energy Level
EMMP	Environmental Management and Monitoring Plans
EMR	Electromagnetic Radiation
ERP	"Evoked" or "event-related" potential
FCC	Federal Commissions Commission
FDA	Food and Drug Administration
GSM	Global System for Mobile Communications or Group Special Mobile
IAPs	Interested and Affected Parties
ICNIRP	International Commission for Non-Ionizing Radiation Protection
IEGMP	Independent Expert Group on Mobile Phones
ITU	International Telecommunications Union
KCAA	Kenya Civil Aviation Authority
NEMA	National Environment Management Authority
NRPB	National Radiation Protection board
SAR	Specific Absorption rate
TDD	Time Division Complex
TDMA	Time Division Multiple Access
TETRA	Terrestrial Enhanced Trunk Radio Systems
ToR	Terms of Reference
UMITS	Universal Mobile Telecommunication

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1.1. General Outline

The mobile telecommunications industry in Africa is in a transitional phase with changing industry structure and dynamics. Africa currently has over 800 million mobile connections and nearly 450 million unique subscribers. The coverage of mobile network has varying range from 10% to 99% across countries in Africa with an average of 70% mobile coverage.

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In many developed countries, over half the populations already use mobile phones and the telecommunication is still growing rapidly. The industry estimates that there are as many as 5 billion mobile phone subscribers worldwide today (According to GSMA). In Kenya alone, close to 28 million are connected and using mobile phones. Because of this trend, increasing numbers of mobile base transceiver stations have had to be installed to equal the numbers. For instance, by the year 2000, there were about 20,000 base stations in operation in the United Kingdom and about 82,000 cell sites in the United States, with each cell site holding one or more base stations.

1.2. Mobile Network Coverage and Subscriber Growth

Mobile networks in Africa have grown beyond the limited reach of other basic supporting infrastructure such as grid electricity and road transport. MNOs in the region have invested significantly in expanding network coverage to reach an average of 70% of the population across countries in Africa. This is a tremendous growth from the coverage level of 37% in 2009. The average mobile network coverage (2G) across Africa is expected to reach to approximately 85% by year 2019.

However, with nearly 450 million unique subscribers and a subscriber penetration of less than 40%, Africa has one of the lowest mobile subscription levels in the developing world. The low subscription levels can be attributed various factors including demographic, economic and regional. The higher cost of services in Africa

is one of the factors affecting the subscriptions in semi-urban and rural areas despite presence of mobile network coverage.

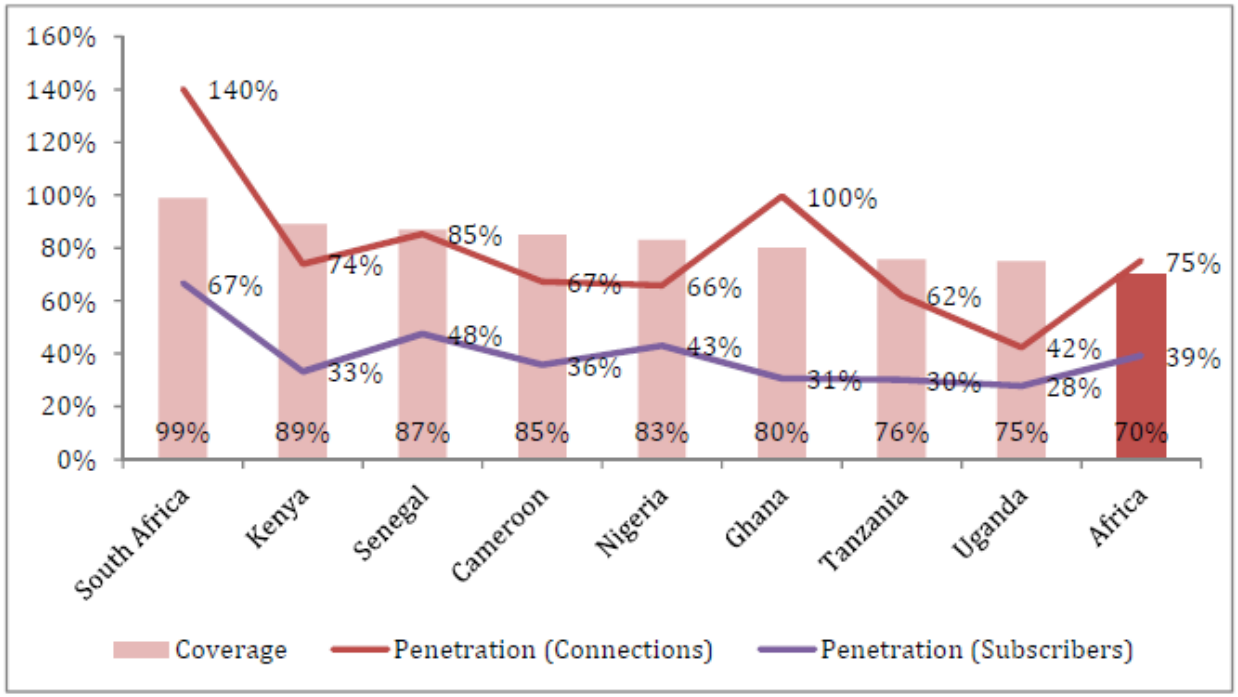

Figure 1: Mobile Coverage and Subscriber Penetration

Nigeria is the largest market by mobile connections and unique subscribers in Sub-Saharan Africa followed by South Africa and Kenya. South Africa leads in mobile network coverage with 99% of its population having access to mobile network signals.

Expansion of mobile network coverage will require a huge investment in network infrastructure including both active network equipment and passive tower infrastructure. Passive infrastructure, including tower and power, forms a major chunk of investment in expanding the mobile networks. In addition to the huge CAPEX investment in networks, the costs of operations remain very high in African countries, especially owing to the higher costs of providing energy to the base station sites[1].

Conversely there are other debates going on including discussion of Base transceiver stations being powered by low- radio antennae that communicate with users' handsets as having health risks. The increased use of mobile phones around the world has raised public concern on possible health issues associated with exposure to electromagnetic emissions. These concerns relate to both mobile phone handsets and mobile phone base stations. Here in Kenya, occupants of several areas have made several petitions, to oppose the construction of base stations in their neighbourhood. However, a recent survey by the World Health Organization (WHO) has shown that the Radio Frequency (RF) exposure occasioned by the BTSs ranges from 0.002% to 0.2% in relation to the maximum level of exposure permitted internationally. Such exposure is comparable to the RF exposure caused by Radio or Television broadcast transmitters and is therefore too low (approximately 1000 times lower than the permitted maximum exposure levels) to pose a threat to human health.

[1] GSMA Intelligence Analysis Ericsson Mobility Report 2014

1.3. Synopsis of Tower Companies.

The telecom tower industry in Africa is dominated by MNOs owning majority the towers. However, with the recent aggressive focus of Tower Companies in Africa has been leading to majority tower portfolios being transferred to Tower Companies as ownership or management contracts.

Tower-sharing is more nascent in the African continent. Less than 20% of the current tower estate or about 44,000 towers are owned and operated by Tower Cos. But change is likely to occur rapidly. According to industry estimates, additional 20,000-25,000 towers in Africa are likely to transfer from MNO-captive to Tower Co-owned and operated, by the end of 2014, increasing their share across Africa to almost 30%.

With many of the MNOs looking at offloading their tower assets, the ownership of towers by Tower Companies is expected to reach to 60% of the total towers by 2020. The major Tower Cos and their tower portfolio is illustrated below.

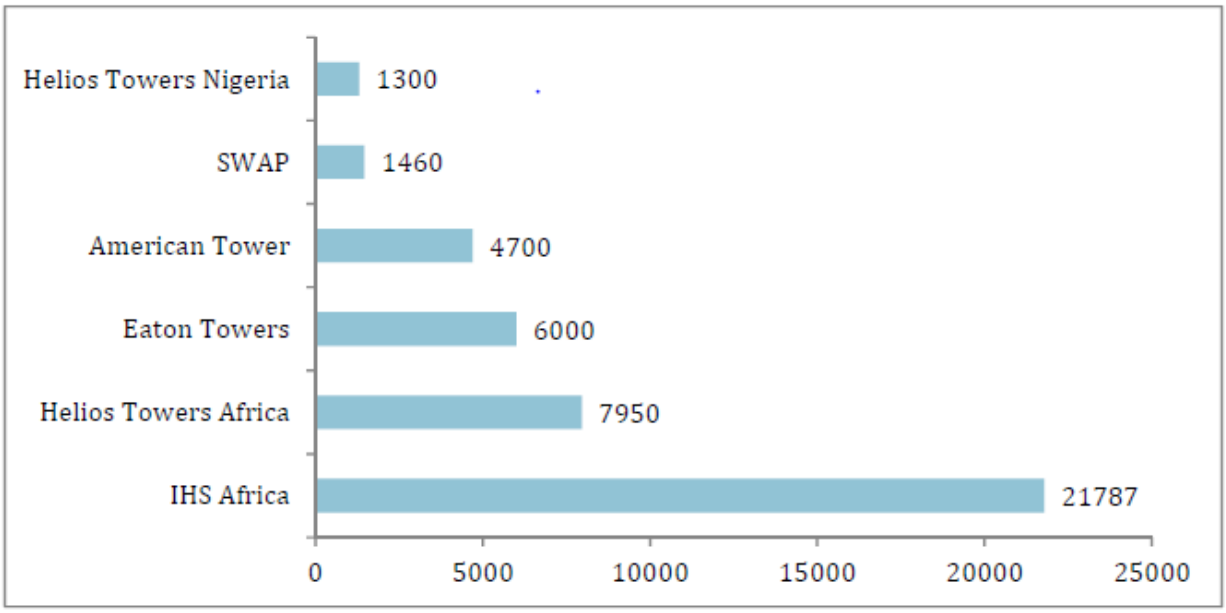

Figure 2: Major Tower Cos and their Tower Portfolio

IHS Africa leads the Africa Tower Co industry with over 20,000 towers under its portfolio owing to the recent deals with MTN and Etisalat in Nigeria. Helios Towers stands second with about 9,000 towers across Africa and Nigeria. Other major Tower Cos American Tower Company (5,800 towers) and SWAP technologies (about 1500 towers). There is also an emergence small local Tower Cos across the continent, such examples being Tower Co of Madagascar, TASC in Middle East, Frontier Tower Solutions in Burundi, Infratel in South Africa.

Based on the aforementioned statistics, ATC Operation Kenya Limited "herein referred as the proponent". American Tower having acquired Eaton Towers Holdings Limited in 2019, adding approximately 5,800 sites to its African portfolio and constructs more than 4,500 sites globally is now a leading independent pan-African tower company. In Kenya alone ATC Operation Limited has over 2000 towers. The proprietor acquires, build and lease shared infrastructure services to mobile operators. We pride ourselves in our highly

experienced local teams, diverse site portfolio and our ability to customize our offering to meet the exact needs of our customers.

The demand for mobile data connectivity is increasing dramatically across different markets in the world. ATC Operation Kenya Limited aim to provide the necessary passive infrastructure for our customers (mobile and data network operators) to be able to service this increase in demand. We provide space and power on our towers, typically under agreements, to help operators increase both coverage and capacity, placing tower companies in the middle of the wireless communication value chain.

Our expertise in building, upgrading and operating tower sites allows us to assist our customers in providing a better service at a reduced cost. Our portfolio of over 2000 sites in Kenya are well situated to meet current network needs and are designed to be able to accommodate future capacity and backhaul demands.

1.4. ATC Operation Kenya Limited Corporate Social Responsibility

Our corporate responsibility program is built upon five core pillars: ethics, people, environment, philanthropy and performance. Putting corporate responsibility at the core of how we strive to operate has a positive impact on our business performance. At ATC We believe that encouraging innovation and thought leadership, as well as seeking to meet high environmental, social and governance standards and practices, positively impacts our bottom line and the communities in which we operate. Our unwavering commitment to corporate responsibility plays a critical role in our overall strategy.

1.5. Overview of Electromagnetic Radiation (EMR)

EMR is part of everyday life, emitted by natural sources like the sun, the Earth and the ionosphere, as well artificial sources such as:

- Microwave telephony radio towers
- HF radio communication facilities
- Mobile phone base stations
- Broadcast towers
- Radar facilities
- Remote controls and
- Electrical and electronic equipment

Radio frequency EMR is non-ionizing radiation. This means that it is not able to directly impart enough energy to a molecule or atom to break chemical bonds or remove electrons. It has been known for many years that exposure to sufficiently high levels of RF EMR can potentially cause tissue damage. This is because the human body is unable to cope with the excessive heat generated during exposure to very high RF levels. In contrast, ionizing radiation (such as X-rays) can strip electrons from atoms and molecules. This process produces molecular changes that can lead to damage in biological tissue. It is important that the term 'ionizing and 'non-ionizing' not be confused when discussing biological effects of EMR. This is because each type of radiation interacts differently with the human body. It should however be noted that RF radiation from base stations is well below guideline limits and will therefore cause no harm to human beings.

1.5.1. Exposure to Radio Frequency Radiation from (BTS)

Safety guidelines are set for telecommunication operators to observe and adhere to, as a means of protecting the public from excessive radiation exposure. Computation and measurements are the means through which compliance of the operators can be checked and safety of the public assured. There are a few computational formulae that can be used to check radiation exposure levels at a given distance away from the base transceiver stations and to confirm compliance to the safety limits. It is worth mentioning that SAF computations are a little complex, involving tissue modelling and determination of tissue fluid properties amongst other related processes for accurate computations. The direct computation methods are however meant for getting approximate values, which may not be as accurate.

Measurement of SAR on the other hand must be used when the transmitter is operated in close proximity to the human body, but where the transmitter is not normally used in close proximity to the human body, the exposure limits can be derived by defining the exposure levels in terms of power density, Electric Field Intensity and Magnetic Field Intensity. The calculated results are based on Effective Isotropic Radiated Power (EIRP), which is the measure of power in the main beam, and antenna gain, which is the measure of the antenna's directivity in focusing the beam to a particular direction.

Using the "inverse square law" of power density at any point R away from the antenna to calculate the maximum power density at a point on the ground 50m from the transmitting antenna whose assumed transmitter power is 60W gives a power density of 0.00478mW/cm^2 at a distance of 50 m from the antenna. This is much less than the safety limits figures given in Annex 2 (Radio Frequencies and Safety Limits).

A large proportion of power is usually focused into an approximately horizontal beam typically about 6° wide in the vertical direction and while the rest goes into a series of weak beams called side lobes on either side of the main beam. The main beam is tilted slightly downwards but does not reach ground level until the distance from the tower is at least 50m (usually 50 – 200m).

This implies that directly below or near the base of the antenna, there is very weak signal (side lobes) since the main beam, which has the strongest signal does not reach the ground until at least 50 meters horizontally away from the base of the mast. It is however the wish of many people to have BTS sited at some distance far away from "sensitive" areas such as schools, hospitals etc. although there is little logic to this argument:

First, the ground level power density does not drop with distance in any regular manner until you get to some several hundred meters away from a base station. Second, people living, working or studying in a building usually get less exposure from a BTS that is on their building than they would from a base station several hundred meters away as discussed above. Horizontal distance from a base station is less of a factor in ground level power density than antenna height, antenna power transmitted and antenna propagation pattern. Therefore, the height of the antenna rather than the horizontal distance from the mast should be of greater concern.

In addition, moving base station antennas away from an area where there are mobile phone users would:

- Increase the exposure of the users to radiations from their handsets since handsets adjust their power output upwards the farther away, they are from the base station.
- Require the base station antenna power to be increased so as to reach the intended community.
- Limits the availability of the service to the occupants of the area in question

While BTS operate at higher powers than do the mobiles, the RF exposures that people get from BTS are typically thousands of times lower than those of mobile phone sets.

1.5.2. RF-Radiations and Health Concerns

As a general rule all BTS infrastructures should be designed and installed having regard to the requirements of KBS 1847-1. There are concerns regarding this topic from a number of viewpoints. From the public perspective the relate to the extent to which radio frequency [RF] emissions from mobile phone base stations [MPBS] pose a health hazard and whether masts should be positioned away from sensitive site such as schools and nurseries. The main issues from the scientific view point relate to determining the significance of reported on cells, tissues and laboratory animals from very low mobile phone band RF emissions in experimental situations and assessing the relevance of these effects to human health. From regulatory and policy stand points the issues relate to determining which guidelines are appropriate for regulating the output of MPBS masts and deciding whether there is a case for applying a ''precautionary approach" to the setting of masts.

General

Mobile phone base station are radio frequency transmitters operatively low power output. The radio frequencies are in the microwave part of the RF spectrum and range from 800 megahertz [MHz] to 3 [GHz] depending on the precise type of mobile phone technology in use. Newer technologies may use frequencies as high as 60 GHz. Mobile phone signals have characteristics in terms of the frequencies used, the pulsed nature of the signals and the frequencies modulation of the pulse signals which make them different from RF emission from other sources such as power lines.

The base station transmitters are designed to limit their energy output so as to prevent the public from being exposed to the risk of the heating effect of the RF emission. However, field strengths in the area immediately surrounding a mast [the ''near field ''] may exceed present guideline limits. Under normal circumstances, the general public would not have very close access to a mast and so would not be exposed to sufficient energy to be at any risk from heating effects. The transmitters' antennas are arranged to project the energy beams toward the horizon such that energy emissions directly underneath an aerial should also be very low.

RF field exposures from base stations beyond the ''near field" [i.e. the ''far field" which exists more than about 30 cm from the antenna] fall off very rapidly, and about 10 meters from the antennas are usually orders of magnitude lower than the exposure which can result from using a mobile phone. The power output from a base station is not constant and varies according to the number of separate channels are in use simultaneously linking to distant mobile phone handsets

Factors which influence the amount of RF exposure experienced by an individual include;

- The power output, frequency and type of RF transmitter.
- The type of antenna and beam direction.
- The distance between a person and the antenna.
- The location of a person relative to the beam.
- The proximity of structures near a person which may reflect signals or shield them from the beam.
- The time spent in the RF field.

1.5.3. Health Effects

Exposure to sufficient RF field energy can result in the heating of cells and tissues. Although operating at higher frequencies than current mobile phone technology in common use, this is the basis of how a microwave oven operates. The majority of known adverse health effects associated with exposure to RF energy [e.g. induction of cataracts] can be attributed to the known heating effects. These are "thermal" effects.

There is however, a growing body of scientific evidence which suggests that other effects can occur in cells and tissues following exposure to RF fields, which occur at levels considerably below the intensities normally associated with the known 'thermal" effects. These very low levels effects are termed "non-thermal" effects, they occur at levels so low that there is not enough energy to increase the temperature of cell, tissue or organism and yet they appear to generate physical or bio-chemical changes.

The range of non-thermal biological effects include changes in the flow of calcium ions in cells, increased activity of the enzyme Omithine decarboxylase [ODC] [raised ODC activity has been associated with other factors capable of causing cancer], changes in cell membrane permeability [other than those associated with temperature changes], changes in the permeability of the blood brain barrier [which could be related to the specific RF frequency or the pulse modulation of the RF carries frequency] and poor performance of laboratory animals in memory based tasks. The mechanisms for these various effects are not clearly understood and their significance to human health is unclear.

There is conflicting evidence regarding the possibility of DNA damage to cells exposed to low level RF emissions. The possibility that DNA damage could occur is a matter of concern given the potential health consequences which could result [e.g. carcinogenesis].

Epidemiological studies to date have focused on evidence associated with exposure to mobile phones rather than the masts themselves and are therefore of limited value. The one consistent finding is an increased risk of having a road traffic accident associated with the use of a cellular phone whilst driving.

Overall the results of the clinical and epidemiological studies do not provide a clear pattern of health effects associated with low level RF exposure. Current evidence does not support a definite association between exposure and cancer, reproductive problems, congenital anomalies, epilepsy, headache or suicide. However, the consensus is that these studies themselves are inadequate to rule out the possibility of potential health risks and that much more research is needed.

In conclusion, there is significant scientific surrounding the whole issues of the importance of non-thermal, biological effects induced by very low intensity RF fields. This uncertainty and the present inability to rule out the possibility of adverse health effects forms the basis for suggesting the adoption of a strategy based on the "precautionary principle" This principle argues for caution where there are reasonable uncertainties regarding the level of exposure to an agent which could have potential adverse effects This is consistent with the philosophy of public health protection which advocates prevention of harm in preference to waiting for illness to occur

1.6. Components of a Typical Base Transceiver Stations

Greenfield Base Station comprises of: -

- Self-supporting lattice or monopole mast onto which radio and transmission antennae are mounted;
- Base Transceiver Station equipment;
- Standby sound attenuated generator within a shelter or on an open plinth or bund-wall;

- Masonry, palisade or chain link wire perimeter fence.

The area covered by such a site varies from 48m^2 to 56m^2 unless it is a Mobile Services Switching Centre (MSC) which could occupy more space due to the number of additional equipment.

Rooftop Base Station comprises of: -

- Stub tower, poles or façade mounted brackets for mounting the antennae;
- BTS equipment, and;
- Standby sound attenuated generator mainly installed in existing rooms.

The radio and transmission antennae may also be mounted on an existing mast and equipment installed on the ground nearby. Below are sample photos of these typical base stations and their equipment: -

Plate 1: Photo of a Typical Rooftop BTS.

1.7. Scope of the Project

The project will involve construction of Base Transceiver Station and its associated infrastructure.

1.8. Objectives

Main reasons for the BTS Installation include;

- To improve the existing networks in Thika area and its environs,
- To comply with the provisions of the licence issued by Communications Authority of Kenya, and
- To meet the national communications strategies set out for the country in the next plan period.

1.9. Significance of the Project

The proposed project is aimed to improve telecommunications infrastructure through Base Transceiver Station (BTS) installation. These can later be used by network providers to improve their network coverage in such areas. The main project objective of the proposed BTS will be achieved through the following benefits linked to a BTS:

- Improved mobile telephony coverage
- Promotes universal access to ICT this is in line with the digitalisation of government services;
- Easier information dissemination, this greatly enhances security of the region;

1.10. Objectives of EIA

The general objective of the EIA investigations is to carry out a systematic examination of the present environmental situation within the project area to determine whether the proposed project will impact adversely on the physical and biological elements of the environment within the project area. This is in line with Section 58 (1) of EMCA Cap 387 that requires proponents to carry out EIA on projects that appear in the Second Schedule of the Act.

The key objectives of this study include the following:

1. To identify and evaluate the significant environmental impacts of the proposed project.
2. To determine the compatibility of the proposed development with the neighbouring land uses and evaluate local environmental conditions.
3. To highlight environmental issues of the proposed project with a view to guiding policy makers, planners, stakeholders and government agencies to help them in understanding the implications of the proposed project on environmental elements within the project area;
4. To review existing legal, institutional and policy framework relevant to the proposed project;
5. To find out impacts associated with the proposed project with an objective of suggesting mitigation measures for the adverse impacts;
6. To assess the relative importance of the impacts of alternative plans, design and sites;
7. To generate baseline data for monitoring and evaluation of how well the proposed mitigation measures are being implemented during the project operation period;
8. To develop an Environmental and Social Management and Monitoring Plan (EMP) to guide in decision making and for future auditing;
9. To raise stakeholder awareness on the impact of the project on the environment with a view to making them understand the implication of the project in their environment;
10. To develop an EIA report in conformity with the EMCA Cap 387 and Environmental (Impact Assessment and Audit) Regulations 2003.
11. To incorporate environmental management plans and monitoring mechanisms during construction, operation and decommissioning phases of the project.

1.11. Terms of Reference

The general Terms of Reference (ToRs) for this report covers the following was to conduct a project report for the proposed development. The specifics include, to:

- Description of the proposed project components and activities in each phase including pre-construction, construction, operation and decommission phases. The project description has included location, project design, the technology, procedures and processes, materials to be used, project cost, products, by-products, and waste generated;
- Description of policy, legal, and institutional framework that are relevant to the environmental management and the proposed project;

- Gathering baseline information/existing environmental data and any other relevant information related to the project area including physical, biological and socio - economic conditions;
- Hold appropriate meetings with the project proponent, architect to establish the procedures, define requirements, responsibilities and a time frame.
- Provide a description of the proposed activities throughout the entire implementation process of the project with a special focus on potential impacts to the surrounding environment and facilities.
- Develop an Environmental and Social Management and Monitoring Plan and cost estimates for the proposed project.
- Produce an EIA report that contains among other issues potential negative and positive impacts and recommendation of appropriate mitigation measures to minimize or prevent adverse impacts as per the EIA/EA regulations of 2003

1.12. Environmental Impact Assessment Outputs

The output from this environmental impact assessment exercise is a detailed Environmental Impact Assessment report outlining environmental impacts and mitigation measures. A comprehensive environmental management Plan has also been prepared as part of this report.

1.13. Methodology

In undertaking the study, experts employed a participatory approach that entailed a range of research methods:

1.13.1. Desk Review

This involved desk studies and review of all relevant available documents on the project activities and components from the proponent. The team also reviewed all the available and relevant national and international legal standards and guidelines.

1.13.2. Field Study

A major element of the study is primary research - both qualitative and quantitative among relevant stakeholders. Interviews were carried out with neighbours to the project as well as those most likely to be affected by the project. *Annex contains the questionnaire administered.*

1.13.3. Public Consultation

Public consultation was carried out in June, 2020 at the project site which involved consultations with the neighbours, stakeholders, and interested parties in terms of interviews and administration of questionnaires.

1.14. Data Synthesis

The data collected was used to prepare a comprehensive environmental management and monitoring plan (EMMP) encompassing the potential impacts, mitigation measures and monitoring indicators which form part of this report.

1.15. Reporting

The main output is an EIA project report comprising of executive summary, methodology, project description, study area, legal and institutional framework, anticipated impacts and an Environmental Management and Monitoring Plan (EMMP).

1.16. Team Members

The EIA team members are covered in Table 2 below.

Table 1: Team Members

Name	***Position***	***NEMA EIA/Audit Expert Registration Number***
John Kuloba	EIA/EA Lead expert	1018
Elly Orwe	Environmental Associate Expert	6507

1.17. Justification

Airtel Kenya Limited in Collaboration with ATC Operation Kenya Limited intends to improve the existing network in the proposed project area by establishing a rooftop (RF) BTS in the area. This will greatly improve mobile telecommunications network in the project area. Transmission surveys and research carried out by the company indicate increased high demand for communication services in Thika Kalimoni and its environs and this proposed project is part of the expansion programme to improve the existing networks for better coverage in the Country.

Chapter Two: Project Description

2.1. Site Ownership

The proposed Mount Kenya University Thika Rooftop (BTS) project site (Property Owner) is registered Under Mr. **Angelo Muchiri Waweru** on **(Plot L.R. No Juja /Kalimoni Block 30 (Njemuwa Investments)** ATC Operation Kenya Limited negotiated a lease agreement to construct and install a Rooftop Base Transceiver Station (BTS) on a property under the aforementioned "lessor "on a property approximately measuring 5m by 5m on the rooftop and 4m by 3m on the ground floor for generator). Lease agreement between the landlord and ATC Operation Kenya limited is attached in annex of this report.

2.2. Proposed Project Location

The proposed project site is located approximately 0.6KM off Thika Superhighway bordering on Redeemed Gospel Church and Jubilee appointed time church amongst other residential apartments and business ventures. The site is Georeferenced by **Latitude -1.06951** and **Longitude 37.05656.** Witheithie Kiambu County.

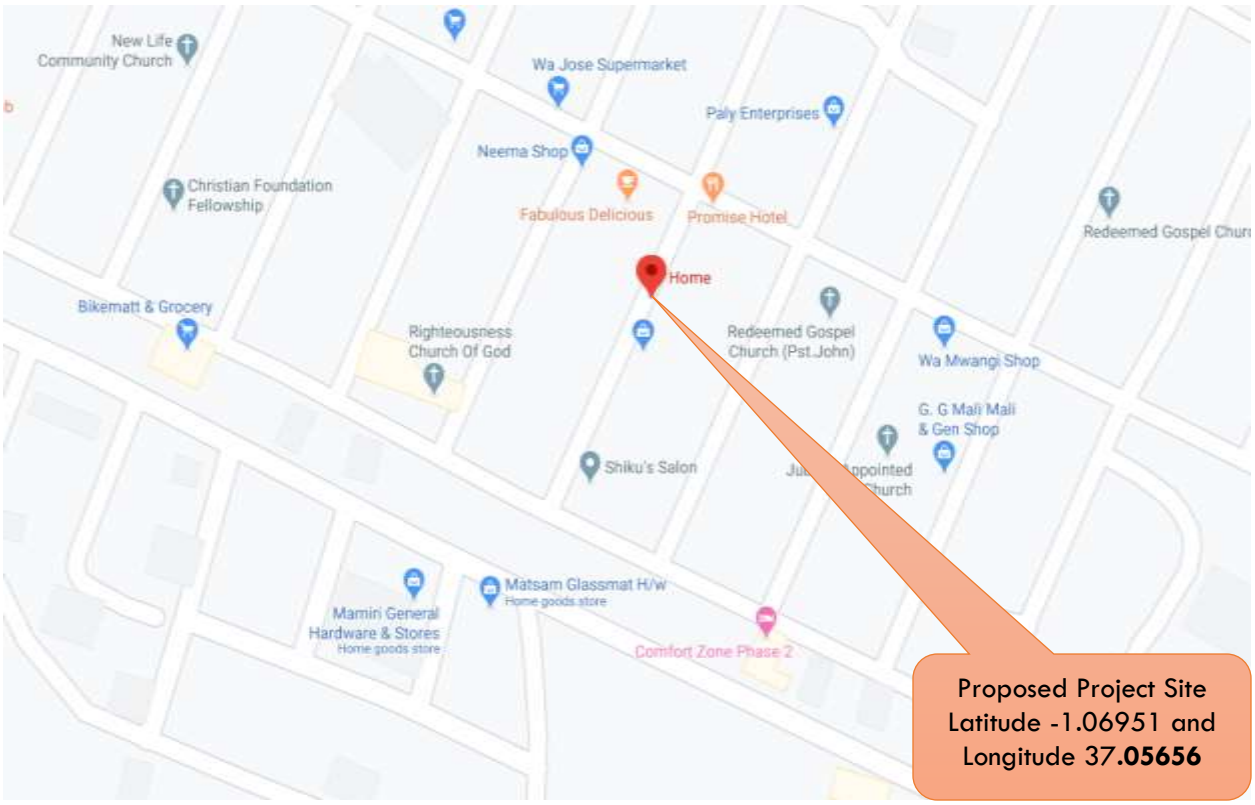

Figure 3: Proposed Site Location

2.3. Proposed Project Design

The leased site measures approximately 5m by 5m on the rooftop at fourth floor and 4m by 3m on the ground floor for generator back-up room. It will be enclosed in 0.8m parapet wall and 0.2m chain-link and metal bars to act as security fence. The site will have approximately 2.5m wide gate. There will be a standby generator enclose at the ground floor in one of the leased rooms which will help solve the temporary power surge and blackouts problem. The generator will be resting on concrete plinth of 1.6x3.5m and 100mm raised above the floor to prevent accidental oil leaks from contaminating area soils. The mast design is a

four-legged Ramboll tower which will be fitted with a lightning finial or spike connected to an earth mast through a 25mm insulated copper tape running along tower leg to the earth material manhole, Aviation warning light, and RF antennas. It will be painted red and white as required by Kenya Civil Aviation Authority. Other installations at site will include an access ladder, wall mounted siren and flasher, site light and motion detector, separate post-paid mounted KPLC meter board, mounted ATS board, fence board and power distribution board. Details see site plans attached in annex 3 of this report.

2.4. Project Activities

Implementation of the proposed project will be in five (5) phases namely:

(i) Planning phase
(ii) Site selection phase
(iii) Construction phase
(iv) Operation phase and
(v) Decommissioning/Recovery phase

2.4.1. Planning Phase

Comprises the following activities:

- Inception of project and a survey undertaken to determine mobile phone demand.
- A technical survey undertaken to determine the need for a densification BTS
- Site acquisition and lease arrangement with the landlord.
- Preparation of site plans and drawings

2.4.2. Site Selection Phase

Had a number of activities including:

2.4.3. BTS Site Selection Criteria

In order to develop an effective telecommunications network, the selection of antenna site considered technical, socio-economic, historical, cultural, and environmental and employee health and safety factors. The antenna site selection process was based on the following priorities:

- To utilize previously developed land
- To develop on land that does not require the displacement and/or resettlement of occupants.
- Technical suitability of the identified plot.
- To develop on land that is not located in, or in the vicinity of, an environmentally or culturally sensitive area.

Taking the above factors into consideration, Airtel Kenya Limited primary objective, however, is to establish partnerships with established Service Providers for the co-location of their antennas on existing masts. The benefits of such partnerships are that they will reduce potential for environmental and social impacts and minimize logistical issues such as available utilities, site access and security.

2.4.4. BTS Site Selection Process

The Site acquisition Managers identifies a general area (with a radius of approximately 500m) in which the location of the antenna is optimal regarding technical requirements. After this, a radio engineer performs a

field reconnaissance, and in addition to considerations regarding technical communications, the radio engineer performs an environmental assessment to ascertain the potential issues that could arise as a result of this development. During the site validation process, the radio engineer does the following:

- Clears each candidate site following the criteria listed;
- Performs assessments at each site to determine technical, social and environmental compatibility;
- Completes site evaluation forms and pass them to the site Acquisition Group Leader.

2.4.5. EIA Project Report Preparation

Environmental Impact Assessment project report is prepared to comply with Environmental Management and Coordination Act (EMCA) CAP 387 and Environmental (Impact Assessment and Audit), Regulations of June, 2003 as well as the Kenya Communications Act of 1998 and other related legislations.

2.5. Base Transceiver Station-Components

These include:

a) 24m self-supported 4-legged tower on 700x400 R.C Beams.
b) 1m wide lockable gate with steps 2xsteps@250mm 3xrisers @250mm.
c) SMPS on concrete beams
d) Antennas mounted at various heights as recommended by the site engineer in charge of the proposed project site.
e) Existing 4m long x 1.2m high masonry wall to be demolished to pave way for the R.C. beams
f) Proposed 1.5m wide, 2.5m high palisade gate
g) TX antenna mounted at suitable height as will be appropriately advised by the site engineer attached to the proposed project site.
h) 2.1m High 14.5m long palisade fence with razor coil.
i) Site light and motion sensor mounted on fence.
j) 150mm wide covered cable tray run on the ring beam
k) Storm water holes for storm water drainage out of the site.
l) ACDB & DCBD mounted on fence

Cabling Procedure

a) Transmission lines shall not be installed in a way that will impede climbing or safety devices.
b) Transmission lines shall not be mounted to climbing ladder rungs or climbing pegs.
c) Excess transmission line shall not be stored (coiled or looped) on the tower.
d) All transmission line connectors, splices, terminations, and jumpers shall be weatherproofed

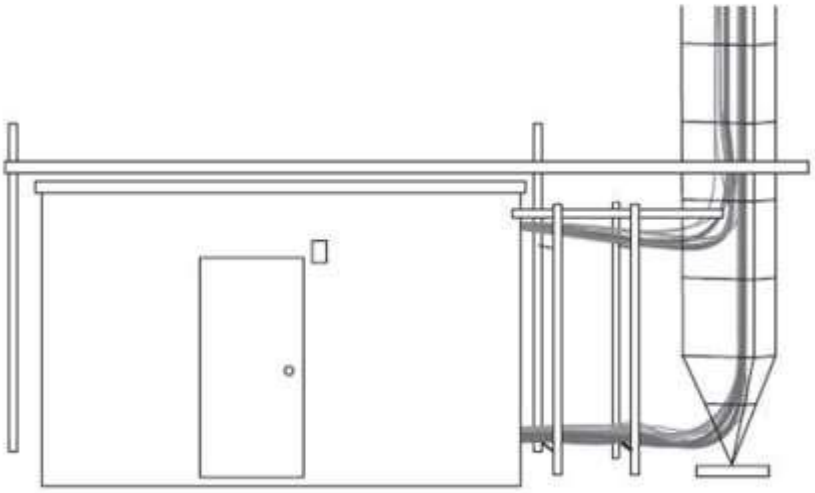

Figure 4: Typical Antenna Transmission Line Drip Loop

2.6. Structural Stability of Tower (Safety)

Below are key highlights of tower design and construction to guarantee safety:

- The tower has been designed to withstand maximum regional wind speeds at maximum antenna loading;
- Adequate factors of safety have been used in the design to safeguard against foundation and structural failure;
- Fall protection measures shall be observed and implemented at any and all towers and structures, regardless of ownership, where climbing is required;
- Tower members have been galvanized to protect them from corrosion hence longer lifespan;
- Installation certificates on safe to climb are issued for each tower installed;
- Routine Maintenance will be done to check status of deterioration that may compromise safety
- Lightning protection to arrest lightning strikes will also be provided;
- Towers shall not be overloaded;
- OSHA or other applicable Occupational Safety and Health standards regulations shall be observed in all phases of tower construction and maintenance; and
- Overall, all ATC Operation Kenya Limited towers abide by international building standards, the Kenya Standards, and have sound structural stability.

2.7. Project Output

The project output will be a base transceiver station that will facilitate calls between mobile phone users. The base transceiver station will serve users within its coverage area commonly known as a cell. The new cell will be a unit of the wider Airtel Kenya network which will enable mobile phone subscribers to communicate.

The proposed base station will be linked to others by the microwave link creating a microwave-linked network enabling all base stations to communicate with each other and the major switches. The signal transmission by a person making a call will be managed by RF antennas. The antennas will communicate with cellular handsets through RF energy. The telecommunication equipment installed in the base station will relay

the call to switches located in the network and thereafter the call will be re-routed to the recipient. To be able to locate the recipient of a cellular call the telecommunication system at all times, keeps track of all cellular handsets in the systems and where each handset is located. In this way, the system is able to manage incoming calls and re-route them to the right base station and, subsequently, to the call receiver.

2.8. Materials For Construction

This section examines materials to be used in construction/ installation of the site at the proposed location. The consultant will further explore and discuss the expected products and by-products if any, including wastes to be generated by the proposed project as well as the methods of their disposal.

- **The Equipment Cabinet:** The equipment cabinet will be made of steel (powder coated) and aligned with MDF board on the inside. The container will be completely sealed.
- **Base Supporting the Equipment Shelter:** The base supporting the equipment shelter will be made of concrete (cement, aggregates and sand) and the floor lined with anti-static tiles.
- **The antennas (mast):** The antennas frame will be made of steel and powder coated.
- **The disc:** The disc will be made of steel and powder coated.

Plate 1: Typical Cabinet Structure

These materials have no negative impacts on their surrounding ecosystem and they will not disturbed the other living biome or biota of the area during the life span of the project.

Table 2: Materials used in construction, products, by-products, wastes and disposal mechanism

Segment to be Constructed	Material to be Used in Construction	Product	By-Product	Wastes Generated	Waste Disposal Mechanism
The container/equipment shelter	steel (powder coated) and aligned with MDF board	None	None	None	None
The base supporting	Concrete (cement, aggregates and sand) and the floor is lined with anti-static tiles.	None	None	No Excavation Expected as the BTS will be mounted on already existing structure	None
The antennas (mast)	steel and is powder coated	None	Scrap Metals	Scrap Metals	Sold to scrap metal dealers
The disc	steel and is powder coated	None	None	None	None

2.8.1. Construction Phase

General Construction Procedures

Construction contractor for the antenna site is required to comply with American Towers Operation Kenya Limited environmental, health and safety (EHS) conditions stipulated in the construction contract and described herein. These procedures include;

- All foundation designs shall comply with the guidelines set forth in "Foundation Design and Installation drawings"
- The foundation shall be appropriate for the structure;
- If a site is to use concrete-encased grounding electrodes within the foundation or other concrete structures, appropriate measures shall be taken to accommodate the grounding system within a Concrete structure before the concrete is poured.
- A foundation for a prefabricated shelter shall be in accordance with manufacturer's specifications.
- Design of foundation shall consider any special precipitation conditions unique to the installation locality. These considerations include, but are not limited to, elevated (pier type) platforms used in low-lying areas prone to regular flooding and elevated foundations to prevent burial of site due to flooding. Special foundation designs include:
    - Columns

Table 3: Summary of Project Activities

Item	*Project activities*
Installation of tower	• *Transportation of semi assembled components to site;* • *Construction of tower foundation;* • *Assembling of tower;* • *Hoisting;* • *Painting of tower if practicable;* • *Installation of Antennas, Microwave, aviation warning light and lightning finial;*
Installation of communication equipment	• *Construction of electrical and earthing manholes* • *Installation of Equipment cabinet/shelter* • *Installation of telecommunication equipment.* • *Electrical installations* • *Installation of feeder cable tray*
Installation of Generator and Fuel tank	• *Construction of base supporting the generator* • *Installation of generator and fuel tank* • *Electrical installation*
Installation of air conditioners	• *One of the major considerations in site development is to maintain an environment in which the equipment can operate efficiently. A properly designed Heating, Ventilation, and Air Conditioning (HVAC) system provides the proper environmental conditions. The proprietor will install inbuilt ACME Air conditioning using R-134a or 410a amongst other refrigerants which are Non Ozone Depleting substance.*

2.9. The Operation Phase

During the operation, monthly environmental site inspections will be performed by the maintenance technicians to ensure that the EHS conditions are maintained at the site. During the generator fuel delivery maintenance technicians will be on site to confirm, the fuelling contractor complies with the prescribed safety procedures. During the maintenance operations that require climbing the antenna, two maintenance technicians will be on site; one to perform the overhead maintenance work and the other to observe and act as the safety officer from below.

2.9.1. Fire Protection/Safety

The primary intent in suppressing a fire at a communication site is to protect lives. Equipment protection is secondary. If the fire is expected to be entirely suppressed by a manual extinguisher, then the suppression effort can be made, but in no circumstances shall fire suppression be attempted in order to save equipment when personnel safety is at risk. In all cases for occupied shared buildings, the fire department and tenants shall be notified immediately of the fire through Emergency Response Plan of American Towers Operation Kenya Limited. In addition, the site will be equipped with smoke detectors and 9Kg portable ABC fire extinguisher.

- Site personnel shall be familiar with the proper usage of the fire protection equipment provided at the site.
- Documentation supplied with the equipment shall be made available to personnel.
- Responsible personnel shall fully understand the content of such documentation. More complicated systems, such as an installed automatic system, should be supported with training supplied by the vendor.

2.9.2. Fire Extinguisher Installation

When installing fire extinguishers, the following requirements shall be observed:

- Portable fire extinguishers shall be maintained in a fully charged and operable condition, and Stored in their designated places at all times when they are not being used.
- Fire extinguishers shall be conspicuously located where they are readily accessible and immediately available in the event of a fire. Preferably, extinguishers shall be located along normal paths of travel, including exits from areas.
- Fire extinguisher locations shall be clearly marked.
- If more than one fire extinguisher is located in the same location and they are intended for different classes of fires, the intended use of each extinguisher shall be marked conspicuously to aid in the choice of the proper extinguisher at the time of a fire.
- Cabinets housing fire extinguishers shall not be locked.
- Fire extinguishers shall not be obstructed from view.

2.9.3. On Site Communications

It is required that some form of two-way communications be available at each facility, for safety reasons as well as for performing maintenance and troubleshooting.

- Important numbers shall be posted on or near the entrance door such as but not limited to:
- Police, ambulance and fire personnel
- Site owner

2.9.4. Signage

An equipment room entrance door, shelter, enclosure, tower or site compound shall be posted with signs identifying the site and providing notices and warnings. The types of site signage shall be in accordance with national regulations.

2.10. Decommissioning/ Recovery Phase

Should the site be decommissioned, American Towers Operation Kenya Limited will be required to restore the site to near its original state as much as possible in compliance with the Environmental Management and Coordination CAP 387and the Kenya Communications Act of 1998 as well as in conformity with the signed agreement between the firm and the land lord. This will require dismantling and removal of the whole equipment from site and its disposal in an environmentally friendly way far from the site. ATC Operation Kenya Limited will be required to undertake the following:

- Provide a means to guarantee that the proposed tower and associated structures will be removed and the site restored if required such as a bond or letter of credit
- The discontinuance of the site for wireless communication purposes for more than ninety days shall make the site subject to future review and approval by CAK for future reuse
- The applicant shall notify CAK within six months when the antenna ceases to operate the herein authorised cell site, within two weeks of abandonment or within such time the applicant intends to abandon the site.
- The applicant shall provide CAK with a plan for review and approval for the removal and restoration of the site to its original condition, and
- The removal of the tower and restoration of the site shall be completed within three months from the date of abandonment.

Chapter Three: Policy, Legal and Institutional Framework

4.1. Introduction

The project proponent, ATC Operation Kenya Limited proposes a development that entails establishment of a Rooftop Base Transceiver Station at Juja Menja area aimed at improving network coverage in the area. The project is subject to Policies, Regulations and Laws of the Land, this chapter therefore highlights some of the applicable legal and legislative frameworks towards the implementation of the proposed project.

4.2. National Policy Framework

4.3. Vision 2030 and the Second Medium Term Plan

Kenya's Vision 2030 is the country's long-term development blueprint for achieving economic, political and social transformation. This ambitious and aspirational development strategy, with a focus on the economic, social and political spheres, aims at achieving 10 percent average growth per year to ensure a high-quality life for all citizens by the year 2030.

Vision 2030 and the accompanying implementation plan – the Second Medium Term Plan (MTP 11) highlights the importance of Infrastructure, more so aspirations of a country firmly interconnected through a network of roads, railways, ports, airports, and water ways, and telecommunications. To achieve the goals set within the ambitious strategy document, the government recognises the need for investments in telecommunication infrastructure, including fibre optic cables, and creating awareness on their use. The proposed development will be contributing to address the available gaps in the set goals.

4.4. Sessional Paper No. 10 of 2014 on the National Environment Policy 2014

The National Environment Policy (NEP) promotes an integrated approach towards the planning and sustainable use and management of Kenya's environment and natural resources so as to ensure better quality of life for Kenya's present and future generations. It particularly reiterates the constitutional right to a clean and healthy environment and imposes on the state the duty to safeguard and enhance the environment. However, it balances this with the right to development but with due consideration for sustainability, resource efficiency and economic, social and environmental needs. This, thus requires that the proposed development will reduce impacts on the environment to the maximum extent possible, as well as putting in place appropriate mitigation measures.

As part of environmental stewardship which requires a precautionary approach to environmental challenges and the promotion of greater environmental responsibility, infrastructural development which includes among others ICT related developments, have to be subjected to Environmental Impact Assessment, Social Impact Assessment and Public participation in the planning and approval of such infrastructural projects. This EIA is thus in conformity with this requirement that requires that the responsibility for environmental quality should be shared by all those whose actions affect the environment.

4.5. ICT Policy 2006

This policy recognizes the role of ICTs in the social and economic development of the nation. Acknowledging the limitations caused by inadequate infrastructure, the policy highlights infrastructure development as one of the four guiding principles crucial for the sectors development. The Government therefore pledges to

encourage the sharing of the capacity of public and private utility providers (e.g. power, water, railway, roads etc.) that have rights of way to develop the national information infrastructure. This is an incentive that the proponent uses by negotiating access to required suitable site selected.

4.6. National Legal (and regulatory) Framework

4.6.1. The Constitution of Kenya, 2010

The Constitution of Kenya 2010 which acts as the overarching legal framework for matters on environment represents a paradigm shift in the history of the promotion, protection and implementation of environmental rights. Hailed in some quarters as a 'Green' Constitution, it explicitly recognizes the environment as part of the country's heritage, and which must be safeguarded for future generations for sustainable development. In Article 42, it becomes the first constitution in the history of this country to entrench environmental protection in the Bill of Rights. Here it explicitly provides for the environmental right to a clean and healthy environment, thus elevating environmental rights to a constitutional status and thus obligating the state therefore to enact legislation to protect that right for the benefit of present and future generations.

Article 69 imposes on the State, other obligations including, the duty to ensure sustainable management and conservation of the environment and natural resources, and to eliminate processes and activities that are likely to endanger the environment.

Article 69 (2) similarly poses a conservation obligation on parties such as companies, whether incorporated or unincorporated. It is thus obligated to cooperate with the state and other mandated institutions such as NEMA to protect and conserve the environment by ensuring minimal interruption to the ecosystem where it sets up its infrastructure related projects.

In addition, the same article establishes systems of environmental impact assessment, environmental audit and monitoring of the environment to ensure impacts of projects such as the proposed development can be minimised and mitigated. This study report is therefore taken as a fulfilment of this requirement. An Environmental Management and Monitoring Plan (EMMP) is developed to ensure sustainability of the project, from construction through to its decommissioning.

In the fourth schedule, the County government is charged with the responsibility to control air pollution, noise pollution, and other public nuisances, as well as manage county public works and services, including storm water management systems in built-up areas and water and sanitation services.

Based on the above brief description of Kenya Laws and Policies, American Towers Operation Kenya Limited has the duty to establish feasible Environmental Management Systems, Plans, Policies and Programs to demonstrate compliance to the required environmental performance related obligations. It is in this regard that the importance of this Environmental Impact Assessment survey for the proposed BTS site and its activities are mandatory in order to ensure routine monitoring and evaluation towards sustainable development and operations. The key national laws that govern the management of environmental resources in the country and are related to the proposed project are briefly discussed in the following paragraphs.

4.6.2. Environmental Management and Coordination (Amendment) Act 2015 CAP 387.

The Environmental Management and Coordination Act of CAP 387 recommends that in case of a statutory contradiction in terms of applicability of any provisions applicable to the proposed site construction,

operations and activities, the Environmental Management and Coordination Act (EMCA, 1999) will take precedence over the others.

Part II of the Environment Management and Coordination (Amendment) Act, 2015 states that every person in Kenya is entitled to a clean and healthy environment and has the duty to safeguard and enhance the environment. In order to ensure this is achieved, part VI of the same Act directs that any proponent of a new projects should undertake Environmental Impact Assessment study, while the projects proponent for ongoing projects shall conduct an Environmental Audit survey for the projects under clause 68 and prepares appropriate reports for submission to the National Environmental Management Authority (NEMA), who in turn may issue a license as appropriate.

The second schedule of the same Act lists antenna sites as activities out of character with its surroundings and not in keeping with its surroundings that must undergo Environmental Impact Assessment prior to implementation.

4.6.3. EMCA and EIA and Environmental Audit Regulations

The prescribed format for Environmental Impact Assessment and Environmental Audit guidelines in Kenya have been developed and gazetted and are fully applied in this exercise in conjunction with all other legal and policy directives provided for in the Kenyan institutions governing environmental conservation. The regulations require that Environmental Impact Assessment and Environmental Audit be conducted in accordance with the issues and general guidelines spelt out in the second and third schedules of the regulations. These include coverage of the issues on schedule 2 (ecological, social, landscape, land use and water considerations) and general guidelines on schedule 3 (impacts and their sources, projects details, national legislation, mitigation measures, a management plan and environmental auditing schedules and procedures. It finally states that a report, drawn by qualified expert(s) should then be filed to the National Environmental Management Authority (NEMA).

ATC Operation Kenya Limited has already commissioned an EIA study for proposed project for purposes of obtaining a license. The proprietor shall observe the guidelines as set out in the environmental management plan laid out in the EIA report as well as the recommendation provided for mitigation, minimization and avoidance of adverse impacts arising from the Project activities.

4.6.4. EMCA (Waste Management Regulations 2006)

This regulation gives guidelines on both operational and administrative activities that are used in handling, packaging, treatment, condition, storage and disposal of waste and is implemented by NEMA.

It prohibits anyone from disposing any waste on any part of the environment except in designated waste receptacle or facility provided by the relevant local authority which may be legitimate dump sites or landfills.

Since the proposed project will generate waste in form of waste oil and other solid wastes this act provides for the waste generator to be responsible for collection, segregation at source and proper disposal of their wastes.

Relevance: The proprietor will comply with the provisions of this act by managing wastes as stipulated under waste management regulations.

4.6.5. EMCA (Noise & Excessive Vibration Pollution Control Regulations, 2009) Legal Notice 61.

This regulation prohibits any person from causing unreasonable, unnecessary or unusual noise which annoys, disturbs, injures or endangers the comfort, repose, health or safety of others and the environment. Part 11 section 6 (1) provides that no person shall cause noise from any source which exceeds any sound level as set out in the First Schedule of the regulations.

It gives standards for maximum permissible noise levels for construction sites, mines and quarries. It also gives maximum permissible noise levels for silent zones, places of worship, residential (indoor/outdoor), mixed residential; and commercial.

Zone		**Sound level limits dB(A) (Leq,14h)**		**Noise rating level (NR) (Leq,14h)**	
		Day	**Night**	**Day**	**Night**
A	Silent zone	40	35	30	25
B	Places of worship	40	35	30	25
C	Residential: indoor	45	35	35	25
	outdoor	50	35	40	25
D	Mixed residential (with some commercial and places of entertainment)	55	35	50	25
E	Commercial	60	35	55	25

Relevance: *The proponent shall be required to implement these measures, ensure that all machineries/equipment are in good working condition to reduce noise or to work within the permissible levels.*

4.6.6. Environmental Management and Coordination (Water Quality) Regulations, 2006

The objective of these regulations is to protect human health and the environment. The regulations provide guidelines and standards for discharge of poisons, toxins, noxious, radioactive waste or other pollutants into the aquatic environment in line with the Third Schedule of the regulations. The regulations have standards for discharge of effluent into the sewer and aquatic environment. While it is the responsibility of the sewerage service providers to regulate discharges into sewer lines based on the given specifications, NEMA regulates discharge of all effluent into the aquatic environment.

Everyone is required to refrain from any actions, which directly or indirectly cause water pollution, whether or not the water resource was polluted before the enactment of the Environmental Management and Coordination Act (EMCA) gazetted in 1999. It is an offence to contravene the provisions of these regulations with a fine not exceeding five hundred thousand shillings. These regulations were found important in this EIA because of the possibility of surface water contamination by oil from the proposed site. The maximum

allowable value for oil discharge into the aquatic environment is nil according to the third schedule. This calls for proper housekeeping and measures to prevent oil spills.

In compliance with this regulation, ATC Operation Kenya Limited will employ qualified site operators who will visit the site occasionally and ensure they use the Environmental Management Plan in this report for monitoring all environmental and social parameters at stake. This will make certain the operational procedures are followed and there is regular maintenance of site facilities including service machinery to avoid oil spills into the neighboring environment.

4.6.7. Environmental Management and Coordination Act (Air Quality) Regulations, 2008.

These are regulations are still in draft form and have not been gazetted. The objective of these regulations is to provide for prevention, control and abatement of air pollution to ensure clean and healthy ambient air. The regulations provide for compliance with emission standards for various sources of air pollution including mobile sources (e.g. motor vehicles) and stationary sources (e.g. industries) as outlined in the Environmental Management and Coordination Act, 1999. Under these regulations' emissions are supposed to be controlled using specified equipment. Cases of malfunctioning air pollution control systems are supposed be reported to NEMA within 24 hours and Corrective measures taken to NEMA's satisfaction within 14 days after the occurrence.

ATC Operation Kenya Limited shall ensure compliance with Air quality regulations by undertaking regular maintenance of the generator.

4.6.8. The Public Health Act Chapter 242 Laws of Kenya

Part IX section 115 of the Act states that no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health. Section 116 requires Local Authorities to take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health. Such nuisance or conditions are defined under section 118 and include nuisances caused by accumulation of materials or refuse which in the opinion of the medical officer of health is likely to harbor rats or other vermin.

Section 118 provides what constitutes nuisance. These includes: Any dwelling or premises or part thereof which is or are of such construction or in such state or so situation or so dirty or so verminous as to be dangerous to health; any street, road or any part thereof, any stream, pool, ditch, gutter, watercourse, sink, water tank, cistern, septic tank waste pipe, drain, sewer, garbage receptacle, dustbin, refuse pit in such a way or so situated to be offensive or to be injurious or dangerous to health; any noxious matter or waste water flowing or discharged from premises; any accumulation or deposit of refuse; any accumulation of stones, timber or other material and any dwellings or premises which is so overcrowded, among other provisions.

The public health act makes it an offence for any landowner or occupier to allow nuisance or any other condition liable to be injurious to health to prevail on his land. The nuisance includes any obstruction, smell, accumulation of wastes or refuse, smoky chimneys, dirty dwellings or premises used without proper sanitation, factories emitting smoke or smell, and improperly crowded or unkempt cemetery or burial place, so long as it can be demonstrated that the situation endangers or is liable to endanger health.

The primary purpose of this Act is to secure and maintain public health. Section 116 provides that: " It shall be the duty of every local authority to take all lawful, necessary and reasonably practicable measures for

maintaining its district at all times in clean and sanitary condition, and for preventing the occurrence therein of, or for remedying or causing to be remedied, any nuisance or condition liable to be injurious or dangerous to health, and to take proceedings at law against any person causing or responsible for the continuance of any such nuisance or condition."

The following shall be deemed to be nuisances liable to be dealt with in the manner provided in the part: Any noxious matter or waste water, flowing or discharged from any premises wherever situated, in

ATC shall observe policy and regulatory requirements and important measures to safeguard public health and safety.

4.6.9. The Occupational Health and Safety Act, 2007

The Occupational Safety and Health Act, 2007 require that workplaces be kept safe for workers therein. Workers who are exposed to wet or any injurious or offensive substances are required under Section 101 of the Act to be provided with suitable protective clothing. The Act requires the management to appoint a competent person who is a member of the management staff to be responsible for safety, health and welfare in the factory or workplace. The Act also generally provides for safety and health policies and programmes, workplace safety health and welfare conditions, occupational health and hygiene and welfare conditions.

This Act was found relevant for reference in this EIA since construction phase will involve workers who will be exposed to various occupational hazards.

American Towers Operation Kenya Limited will put in place measures to ensure health and safety of workers at the work place. A comprehensive occupational health and safety audits will be carried out periodically to ensure compliance with this Act. The proprietor shall observe policy, regulatory requirements and important measures to ensure safety of the workplace.

4.6.10. Occupational EMF Exposure

Although detailed studies of workplace exposure to EMF in the United States, Canada, France, England, and several Northern European countries have found no conclusive link or correlation between typical occupational EMF exposure and adverse health effects, some studies have identified a possible association between occupational exposure to EMF and cancer, such as brain cancer (U.S. National Institute of Environmental Health Sciences 2002) indicating there is evidence to warrant limited concern. Measures should include preparation and implementation of an EMF safety program including the following components:

- Identification of potential exposure levels in the workplace, including surveys of exposure levels in new projects and the use of personal monitors during working activities;
- Training of workers in the identification of occupational EMF levels and hazards;
- Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure, limiting access to properly trained workers;
- Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by international organizations such as the International Commission on Non-Ionizing Radiation Protection (ICNIRP), and the Institute of Electrical and Electronics Engineers (IEEE).

Table 4: ICNIRP exposure guidelines for general public exposure to EMF

Frequency	Electric Field (v/m)	Magnetic Field (µT)
3 – 150 kHz	87	6.25
10 – 400 MHz	28	0.092
2 – 300 GHz	61	0.20

ATC Operation Kenya Limited will be responsible for putting in place actions or plans to address occupational exposure. These may include creating awareness on how to reduce occupational exposure, deactivation of transmission equipment during maintenance activities, limiting exposure time through work rotation, increasing the distance between the source and the worker and use of shielding materials.

4.6.11. Kenya Information and Communications Act, No 2 of 1998

Part II (Sections 3-22) of the Kenya Communications Act (KCA, 1998) created the Communications Commission of Kenya (CAK) with statutory authority to regulate the telecommunications services industry in the country. Part III (Sections 23-34) of this Act provides for:

- Provision of telecommunications services.
- Requirements of licenses.
- Telecommunications licenses
- Enforcement of license conditions
- General regulations for telecommunications services
- Obtaining service dishonestly
- Improper use of the system
- Modification of messages
- Interception and disclosure
- Tampering with communications plan
- Trespass and wilful obstruction of telecommunications officer and Prohibition of unlicensed telecommunications system

4.7. Communications Authority of Kenya (CAK) Guidelines

In Kenya the Commission, in collaboration with other lead agencies formed standing committee to deal with the issues by developing guidelines to siting of the communications base stations, masts, towers and safe use of mobile telephones and other similar technologies. The standing committee comprised of members from the following: Radiation Protection Board (RPB), Kenya Bureau of Standards, (KEBS) National Environment Management Authority (NEMA), Kenya Civil Aviation Authority (KCAA) Ministry of Local Government and Communication Commission of Kenya (CAK). The main purpose of the committee was to formulate guidelines for the communications service providers on the implementation of the communication infrastructure in a manner that does not adversely affect the environment and minimize effects of RF Radiation emission for the communication facilities.

Secondly the guidelines are to regulate the siting, construction and modification of the masts and towers. These guidelines address issues that may be of health concern with regards to radiation emissions from the facilities, encourage co-location of these facilities and use of the precautionary approach principle and also

provide information on the communication technologies and the safe use of mobile telephones. Finally, these guidelines provide procedures to harmonize regulations and requirements of different lead agencies thereby providing requirements on what the service providers needs to fulfil and the necessary approaches required.

4.7.1. Radiation Protection Act (Cap 243)

Radiation Protection Act (Cap 243) provides for protection of the public and radiation workers from the dangers arising from use of devices or materials capable of producing ionizing radiation and for connected purpose.

The Act prohibits unauthorized manufacture, production, possession or use, sale, disposal, lease, loan or dealership, import, export of any radiating device or radioactive material. All authorized buyers, sellers, users, of such device must be properly licensed. The Act is administered by the Chief Radiation Protection Officer assisted by a Radiation Protection Board. Safety Limits set by the radiation protection board are attached in annex 2 of this report. ATC has appropriate license and authorization to operate in the country see attached certificate of Incorporation.

4.7.2. The Water Act 2002

Section 94 subsection 1 (a) of the Act stipulates that no person shall willfully obstruct, interfere, divert or abstract from any watercourse or any water resource, or negligently allow any such obstruction, interference, diversion or abstraction; or throw or convey, or cause or permit to be thrown or conveyed, any rubbish, dirt, refuse, effluent, trade waste or other offensive matter or thing into or any water resource in such a manner as to cause, or likely to cause, pollution of the water resource.

- Section 25 of the Act requires a permit to be obtained for among others any use of water from a water resource, discharge of a pollutant into any water resource. According to section 29 of the same Act, application for such a permit shall be subject to public consultation as well as an environmental impact assessment as per the Environmental Management and Coordination Act, 1999. The conditions of the permit may also be varied if the authority feels that the water so used is causing deterioration of water quality or causing shortage of water for other purposes that the authority may consider has priority. This is provided for under section 35 of the Act.

- Section 75 and sub-section 1 allows a licensee for water supply to construct and maintain drains, sewers and other works for intercepting, treating or disposing of any foul water arising or flowing upon land for preventing water belonging to the licensee or which he is authorized to take for supply from being polluted. However, if the proposed works will affect or is likely to affect any body of water in the catchments, the licensee shall obtain consent from the Water Resources Management Authority.

- Section 76 states that no person shall discharge any trade effluent from any trade premises into sewers of a licensee without the consent of the licensee upon application indicating the nature and composition of the effluent, maximum quantity anticipated, flow rate of the effluent and any other information through a drainage system. The storm water is directed into the council drainage system and none is discharged in to any water courses. The consent shall be issued on conditions including the payment rates for the discharge as may be provided under section 77 of the same Act.

4.8. The Land Planning Act Cap 303

The Land Planning Act Cap 303 of 1968 of the Laws of Kenya makes provision for planning the use and development of land. Sec 6 (1) of the subsidiary legislation provides that "a local authority may, after consultation with, and with the agreement of the Minister, prepare and submit to the Minister for his approval an area plan, as the case may be, for that part of the area under its jurisdiction to which these regulations apply."

4.9. Physical Planning Act of 1996 Cap 286

This Act provides for the preparation and implementation of physical development plans for connected purposes. It establishes the responsibility for the physical planning at various levels of Government in order to remove uncertainty regarding the responsibility for regional planning. It provides for a hierarchy of plans in which guidelines are laid down for the future physical development of areas referred to in specific plan. The ostensible intention is that the three-tier order plans, the national development plan, regional development plan, and the local physical development plan should concentrate on broad policy issues.

The Act also promotes public participation in the preparation of plans and requires that in preparation of plans, proper consideration be given to the potential for economic development, socio-economic development needs of the population, the existing planning and future transport needs, the physical factors which may influence orderly development in general and urbanization in particular, and the possible influence of future development upon natural environment. The innovation in the Act is the requirement for Environmental Impact Assessment (EIA). Any change of use of the actual development without authority constitutes an offence.

American Towers Operation Kenya Limited has the responsibility of observing planning regulations by obtaining the required approvals as required under the physical planning act.

4.10. Land Control Act Cap 406

This law provides for the control of transactions in agricultural land, especially the machinery of the Land Control Boards. However it is of environmental interest that one of the points to consider in granting or refusal of consent by the Board is what impact the transaction is likely to have on the maintenance or improvement of standards of good husbandry within the specific agricultural area. Government land is land owned by the government of Kenya under the Government Lands Act (cap. 280). This includes, for example, gazetted national parks and reserves. The government lands act allows the President, through the Commissioner of Lands, to allocate any un-alienated government land to any individual. In practice, such allocations have often been made without proper regard to social and environmental factors. Trust land is land held and administered by various local government authorities as trustees under the constitution of Kenya and the trust land act (cap. 288). National reserves and local sanctuaries as well as county council forest reserves, fall on trust land. Individuals may acquire leasehold interest for a specific number of years in trust land can (in theory) be posed by the local authorities should the need arise. Local authorities should retain regulatory powers over trust land.

Private land is land owned by private individuals under the registered land act (cap .300). On registration as the landowner, an individual acquires absolute ownership on a freehold basis. The use of private land may, however, be limited by provisions made in other legislation, such an agriculture act (cap. 318).

4.11. Civil Aviation Act, No. 21 of 2013

This is an Act of parliament which established Kenya Civil Aviation Authority as the principle government body in charge of planning, developing, managing and operating a safe, economical and efficient civil aviation system. Under the Act, the Authority is mandated to ensuring safe and efficient Utilization of Kenya air space. The Act gives the Authority powers to control erection of structures that can interfere with air navigation safety. Under the Act, the Authority may require owners of obstructions/structures to reduce the height or carry out such work necessary to enable warning to the air crafts by lighting or otherwise.

The proprietor has obtain approvals from Kenya Civil Aviation Authority before masts are erected. All towers are also painted Red and White and fitted with Aviation warning light as required by Kenya Civil Aviation Authority.

4.12. The Kenyan Standards

The Kenyan standards are developed by Kenya Bureau of Standards (KEBS), the body charged with setting up operating standards for various industries. In many cases, the standards used are mostly international standards that have been adapted to suit Kenyan situation. The bureau has published the following standards for mobile phone operators:

4.12.1. KS 1894-2:2008

This Kenya Standard was prepared by Communication equipment under the mandate of the electrical Industry Standards Committee in accordance with the procedures of Kenya Bureau of Standards and in compliance with annex 3 of the WTO/TB agreement. This Kenya standard is intended to standardize the establishment and management of radio communication antenna sites. According to this Kenya Standard, the responsibility for operating a well-managed and properly engineered site rests on the site owner and on the radio site licensee. The standard provides for the establishment of a site management committee to coordinate the Engineering and environmental activities of all operators within a radius of 500m of the site(s) Part 2 of this standard seek to encourage compliance with EMCA 1999. To comply with this, American Towers Operation Kenya Limited has already commission the EIA on all proposed sites and environmental Audits for the existing sites.

4.12.1.1. KS 1590-2:2001(ICS 33.060.20)

This Kenya standard was prepared by the Communication Equipment Technical Committee (IT 06) under the supervision of the Electrical Industries Standards Committee and is in accordance with the procedures of the Kenya Bureau of Standards.

The purpose of this standard is to prepare a document to be used as a basis for National Code of Practice for the installation of Power, Telephone and Remote-Control Cables near Ground Radio Stations. It embraces the wide range of all factors considered to influence the siting of radio communications facilities. It takes account all forms of interferences to such facilities from domestic or industrial sources, interaction with other radio communication sources, electrical generating equipment, electrical and telephone distribution system and electrical traction systems. The effect of interference caused by radio communications facilities on broadcast reception in the vicinity has also received consideration, as has the general effect of such facilities on the environment.

Similarly the standard is intended to provide information to state and Local Government Authorities, organizations and members of the public on the effects that existing or planned developments could be expected on the operation of such facilities. The standard is not however, intended as a substitute for consultation between relevant authorities and concerned parties on the impact of the facilities on the communities. The standard therefore should not be applied to without reference to the parties concerned.

The standard is a compilation of technical information developed in appendices to provide background information to concerned parties who are not necessarily experts in the field of telecommunications. In appendix C information on interference standards published as at 1998, is collated and the relationship between peak and quasi-peak measurements explored on an empirical basis. This information leads to a series of graphs which develop separation distances from sources of interferences, which ideally should be adopted for the optimum performance of the telecommunication facilities. This becomes the basis for the discussion between the planned performance and its realization in a specific community. This standard is not supposed to be imposed on a community but to be used as the basis for discussion by all interested parties in the expectation of achieving the best possible solution. This standard is part 1 of a three part standard the parts of which are as follows:

4.12.2. The Kenya Standard Specification for Siting of Radio Communication Facilities:-.

1. Part1: Low frequency, medium frequency, and high frequency transmitting and high frequency receiving facilities.
2. Part 2: Guidelines for fixed, mobile and broadcasting services at frequencies above 30MHz
3. Part 3: Fixed location satellite earth stations

NB: *It is important to note that in the preparation for this standard reference was made to AS3516.1:1988, Australian Standard for siting of radio communications facilities–Part 1: LF, MF and HF transmitting and HF receiving facilities*

4.12.3. KS 1590-2:2000 KS 1590-2 and KS 1847:1-2007 KS1847-2007

The Kenya standards set out above identify key measures that should be taken into considerations during planning, construction, operation and decommissioning phases for the base transceiver station (BTS).

Finally, these standards ensure that environmental and safety considerations are given prominence during siting and operation of radio and communication facilities. By their nature, radio communication and broadcasting facilities have the potential to impact on the environment in a number of ways during both the initial construction and subsequent operation of the facilities. These standards give guidelines on Radio Frequency radiation safety. They also identify exposure risks, how to manage the risk and whose responsibility it is to perform particular tasks.
ATC Operation Kenya Limited has complied with the set Kenyan standards on Radio Communication

4.12.4. Planning Phase

During the planning phase, it's a requirement that ISO 4354 (wind action) is complied with and in normal practice and for all the ATC tower base transceiver stations, the firm complies with these standards by ensuring that, the tower foundations, structural steel works and antenna mountings are designed to carry specified loads appropriate for the project area.

4.12.5. Construction Phase

During the construction phase the company will employ a technically competent person/ or group of technically qualified individuals as the project manager who will ensure that;

- All the necessary permits are obtained and recorded in the technical log
- All the work done comply with these standards
- A site plan will be prepared to show the location of all facilities and equipments installed
- Good workmanship is applied during installations.

It is also mandatory that the structure should not act as a physical hazard to aircraft and installation should not pose safety and health hazards to the neighboring community and acoustic noise levels should be adhered to in all respects. ATC Operation Kenya Limited will comply with this by putting the following measures into place;

- Particularly, the proprietor will ensure that the proposed BTS is not in fringing on the flight path to avoid any hazards to aircraft.
- The power used at the site will be serviced by the main power sourced from KPLC and augmented with back-up generator; and
- Electronic wastes will be safely disposed.

With regard to occupational health and safety standards; American Towers Kenya Limited will comply with this by employing a project manager who will ensure all workers use the PPE's appropriately.

4.12.6. Operation Phase

During this phase, the standards require efficient operation of a transmitting facility throughout its designed life and there is a need to follow proven operational procedures and conduct regular maintenance of the site facilities. In compliance to this, the proprietor ATC will employ site operators to ensure the operational procedures are followed and there is regular maintenance of the site facilities. The site radiofrequency radiation levels produced by the BTS will be assessed by the site operators and recorded. This data and any other relevant site-specific information will be used to ensure the requirements of CD/04/13-1/99 are complied with.

The site manager will ensure that a warning sign is put at the entrance of the closed site gate and the site area secured with a steel panel fence to reduce accidents. The fuel tank at site will be highly confined to reduce fire risks and there will be a fire extinguisher to put out fire at the site in case of fire outbreak at the site. The manufacturer's recommendations for the tower installations will be tested according to the site maintenance plan. The project manager will ensure that the site operators visiting the site use the Environmental and Social Plan for monitoring. This will help in checking all environmental and social parameters at stake.

4.12.7. Decommissioning Phase

During this phase it is envisaged that the standards as set out above will apply and ATC Operation Kenya Limited will commit itself to compliance with the same. Particularly regarding the requirements of CD/04/13-1/99 are complied with.

4.13. International Environmental and Social Impact Provisions and Safeguard

International environmental and social safeguards and principles offer best practices. In most cases, these are of a comparatively higher standard than national laws. This section therefore discusses World Bank Environmental and Social Safeguard Policies as the most relevant of the safeguards and principles. The most relevant Operational Policies and safeguards are:

4.13.1. Operational Policy (OP) 4.01: Environmental Assessment, 2001

Operational Policy (OP) 4.01 on Environmental Assessment, 2001 (later revised in 2013) is to assist in identifying, avoiding, and mitigating potential negative environmental impacts with a specific objective of ensuring proposed projects are environmentally sound and sustainable.

The policy advocates for preventive measures as opposed to mitigation and compensation, if and where feasible. This policy requires attention to be paid to how projects will impact on the natural environment (air, water, and land), human health and safety and social aspects, and requires design of mitigation measures as undertaken under the EMMP. This Project report meets these minimum requirements. In addition, the policy mandates consultation of the relevant stakeholders about the project's environmental aspects, taking their views into account.

4.13.2. International Health and Safety Guidelines from World Health Organization

World Health Organization (WHO) works with the International Commission on Non-Ionizing Radiation Protection (ICNIRP) to provide scientific advice and guidance on the health and environmental effects of non-ionizing radiation (NIR) to protect people and the environment from detrimental NIR exposure as well as to develop guidelines for the same. These include recommendations on limiting exposure for the frequencies in the different NIR subgroups.

4.14. National Institutional Framework

There are many institutions mandated to deal with matters of environment and Land. However in this case, the most relevant is The National Environment and Management Authority (NEMA) and the National Land Commission (NLC).

4.14.1. National Environment and Management Authority

NEMA is established under section 7 of the Environmental Management and Co-Ordination Act, Cap 387 as the principal institution which exercises general supervision and co-ordination over all matters relating to the environment. It is also the principal instrument of Government in the implementation of all policies relating to the environment.

In specifics (and most relevant here) NEMA is charged with the responsibility to:

- Identify projects and programmes or types of projects and programmes, plans and policies for which environmental audit or environmental monitoring must be conducted under this Act;
- Monitor and assess activities, including activities being carried out by relevant lead agencies, in order to ensure that the environment is not degraded by such activities, environment is not degraded by such activities, environmental management objectives are adhered to and adequate early warning on impending environmental emergencies is given;

- Publish and disseminate manuals, codes or guidelines relating to environmental management and prevention or abatement of environmental degradation;

4.14.2. Communications Authority of Kenya

Established in 1999 by the Kenya Information and Communications Act, 1998, this is responsible for (and most relevant here):

- Licensing all systems and services in the communications industry, including; telecommunications, postal, courier and broadcasting;
- Managing the country's frequency spectrum and numbering resources;
- Type approving and accepting communications equipment meant for use in the country;
- Monitoring the activities of licensees to enforce compliance with the license terms and conditions as well as the law.

4.14.3. Radiation Protection Board

The Radiation Protection Board is a statutory body established under the Act of parliament, the Radiation Protection Act, Cap 243, Laws of Kenya as the national competent authority with the responsibility for protecting the health and safety of people and the environment from the harmful effects of ionizing radiation. It regulates the use of ionizing radiation, exportation, importation, distribution and possession of radiation sources. It also keeps a register of the owners of irradiating devices, radioactive materials and other sources of ionizing radiation imported into or manufactured in Kenya and of premises licensed to dispose of radioactive waste.

4.14.4. The National Construction Authority

This is an Act of parliament that provides for the establishment, powers and functions of the National Construction Authority (NCA) and for connected purposes. Under this Act is established the NCA which all construction contractors are expected to comply with by June 30th 2013. This Authority as per this law is supposed to reign in rogue contractors and establish order within which the construction industry does its business. Since the proposed construction falls squarely under the authority established, it is expected that the hired contractor will have registered with the authority prior to being hired.

Chapter Four: Baseline Information

4.1. Introduction

The County covers an approximate area of 2,449.2Km^2. Under the new Constitution (August 2010), Kiambu town is considered to be the headquarters of Kiambu County. Kiambu borders Nairobi City to the South, Nakuru to the west, and Nyandarua to the North West. The County lies between latitude 00^0 75' and 1^0 20' south of the equator and longitudes 36^0 54' and 36^0 85' east.

The proposed project site is located approximately 0.6KM off Thika Superhighway bordering on Redeemed Gospel Church and Jubilee appointed time church amongst other residential apartments and business ventures. The site is Georeferenced by **Latitude -1.06951** and **Longitude 37.05656.** Witheithie Kiambu County.

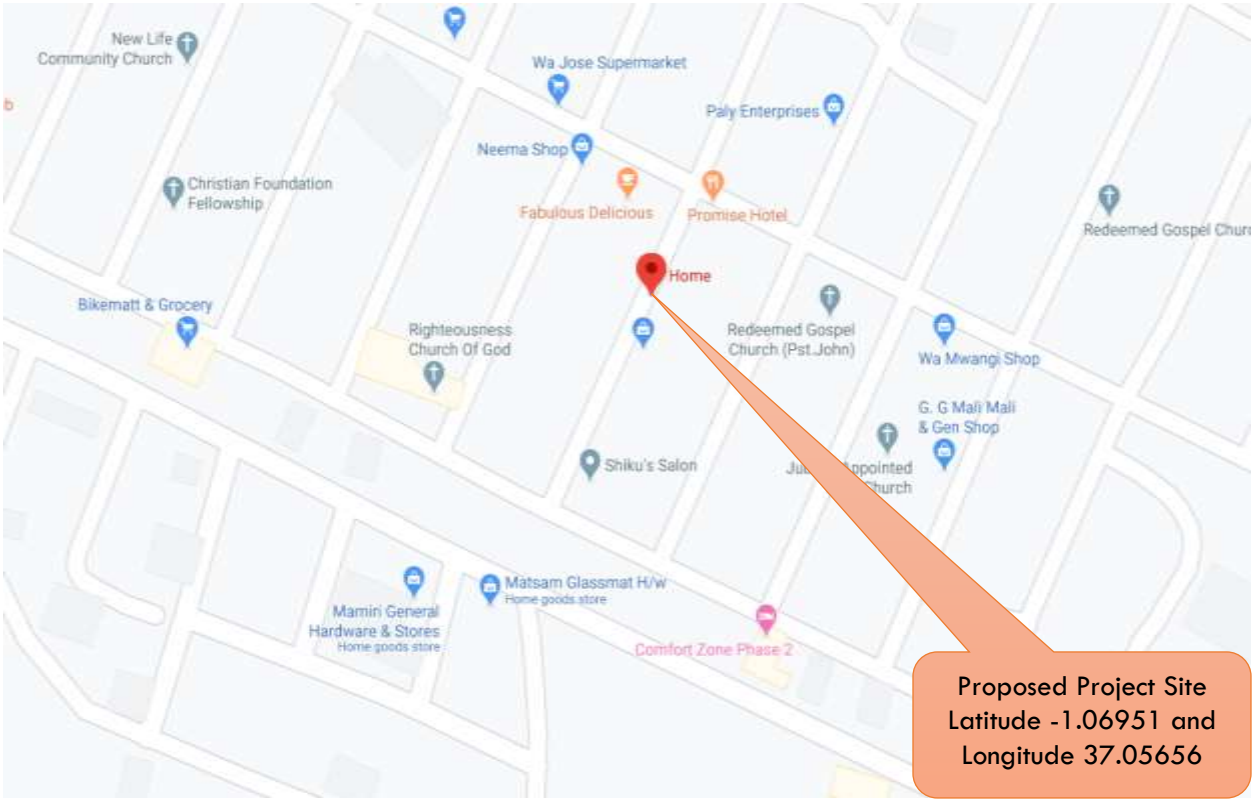

Figure 5: Site Location

4.2. Geophysical Environment of Kiambu County

Kiambu County is divided into four broad topographical zones which include, Upper Highland, Lower Highland, Upper Midland and Lower Midland Zone. The Upper Highland Zone is found in Lari Constituency and it is an extension of the Aberdare ranges that lies at an altitude of 1,800-2,550 meters above sea level. It is dominated by highly dissected ranges and it is very wet, steep and important as a North, Gatundu South, and Githunguri and Kabete constituencies. These areas are characterized by hills, plateaus, and high-elevation plains.

4.2.1. Physical and Topographic Features

Kiambu County can be divided into four broad topographic zones namely, Upper Highland, Lower Highland, Upper Midland and Lower Midland. The project area lying at about 1515 meters above sea level is located in the Upper Highland Zone, which is an extension of the Aberdare ranges. It is dominated by highly dissected ranges and it is very wet, steep and an important water catchment area. Hills, plateaus, and high-level structural plains characterize the area.

4.2.2. Climate

The region is characteristic by equatorial climatic conditions and rainfall is highly influenced by altitude and proximity to the Aberdare forest. Rainfall in the area comes in two seasons, long rains come between March to May and short rains come between October and December. The annual mean rainfall varies from 1070mm to 1750mm per annum.

Juja Town and its Environment experience a bi-modal type of rainfall. The long rains experienced between Mid-march to May then followed by a cold season. Drizzles and frost, which occur in the months of June to August, characterized the cold season. The short rains fall between Mid-Octobers to November. The town receives rainfall of a high of 2,000mm and a low of 600mm. The mean temperature in the project area is approximately 260 C with temperature ranging from 13.10 C to 270 C. July and August are the months during which the lowest temperatures are experienced, whereas January to March is the hottest months. The main wind direction is easterly, evaporation ranging from 100 to 150mm per month while the humidity varies from 50% to 90%.

4.3. Geology of Kiambu (Juja)

The geology of Juja town comprises of tertiary volcanic rocks, the most important being what is termed as Nairobi Stone. The Nairobi stone is a tertiary volcanic rock used extensively for building purposes. Soils resulting from tertiary volcanic rocks are dark reddish brown, well drained, friable and very calcareous. The general nature of the soil ranges from shallow to red friable clays. In geological terms, these are youthful soils formed after removal of black clays by erosion process. Soils disturbance human activities over a long period exists due to the town developments.

The soils in the study area are derived from volcanic rocks that gradually occur on levels between 1200 to 2000m.a.s.l. The general nature of the soil ranges from shallow to red friable clays. In geological terms, these are youthful soils formed after removal of black clays by erosion process. The soil surface of the area is mostly covered by vegetation e.g. grasses, herbaceous plants and some trees. Soil type of the site composed mainly of red volcanic soil with intermittent gravel patches.

4.4. Drainage

The proposed site currently has no elaborate storm drainage and other form of drainage. Therefore, the drainage in the proposed site will require an upgrade from the existing rudimentary types. The sewerage services are provided by Ruiru Juja Water and Sewerage Company (RUJWASCO). There were no nearby ground and surface water observed despite the area being relatively flat. Therefore.

4.5. Biological Resources

Juja Town was formerly an agricultural area (Juja Farm) which has been slowly turned into an urban town with industrial areas, housing areas, market and business areas. The flora and fauna of the proposed site is

that of any typical urbanized area in Kenya. During the site visit some few tree bushes were observed. The proposed site is fully developed and therefore most of the area is under intense infrastructural development with no vegetation cover.

4.6. Solid Waste Management

The management of solid waste in Juja Municipality is the responsibility of the Municipal Council of Juja. However, the private sector has been increasingly involved in refuse collection and disposal for example companies like Bins Nairobi Limited. Youth groups have also taken an initiative to collect waste. Most industries have their own waste and disposal structures.

4.7. Administrative Boundaries of the Project Area

Currently, the county is divided into twelve (12) sub-counties namely Limuru, Kikuyu, Lari, Gatundu South, Gatundu North, Githunguri, Kiambu, Ruiru, Thika, Juja, Kiambaa, and Kabete. These are further sub-divided into 29 divisions, 95 locations and 236 sub locations.

Figure 6: Administrative units (Source: Kiambu District Planning Unit, 2011).

4.8. Population and Demography

The social environment in the area consist of several business established enterprises, and transportation system (roads), and residential area. The interaction of these establishment with people in the area and outside the area is part of the functional Nairobi socioeconomic environment. Currently the social environment around the area auger well with movement of people, goods and delivery of services due to the existing infrastructure such as roads, railway line, Water pipelines sewerage pipelines, power lines, commercial and

residential buildings. The existing infrastructure is currently being upgraded by Ministry of Lands, Housing and Urban Development and Nairobi Metropolitan.

4.8.1. Population Density and Distribution

Kenya Population and Housing Census 2009 indicate Kiambu County population at 1,623,279 with 802,609 being male and 820,670 being female. The average population growth rate in the County is 2.81% and the sex ratio is approximately 1/1.02. During the 2009 population census, only Lari was a sub county while Githunguri was a division within Lari sub-county. Juja Town (urban Centre) had a population of 238,858 people according to the 2009 National Census, 259,867 people in 2012 and 282,723 people in 2015. The population increase is projected to be over 299,022 in the year 2017. (Source; Kiambu CIDP)).

4.8.2. Land Tenure and Land Use

The size of arable land in the county is 1,878.4 Km^2 and the non-arable land is 649.7 Km^2 and 15.5 Km^2 is under water mass. The average holding size of land is approximately 0.36 Ha on small scale and 69.5 Ha on large scale. The small land holdings are mostly found in upper parts of Gatundu North, Gatundu South, Kiambaa, Limuru and Kikuyu constituencies. The fragmentation of the land has made it uneconomical and hence majority of the farmers are converting their farms into residential plots to supplement the meagre income from the farms. The large land holdings are usually found in the lower parts of the county especially in Juja constituency and the upper highlands in Limuru and Lari constituencies. However, the proposed site land tenure is system is individual ownership.

4.8.3. Water Resources and Water Quality

The County has an existing sewerage treatment facility of 20m3 per day which is dilapidated and operating below capacity. Athi Water Services Board under the Nairobi Rivers Sewerage Improvement Project is constructing trunk sewers along main river basins in Kiambu which will benefit the County.

4.9. Energy

The main source of cooking energy in the county is firewood which accounts for about 47.3 percent, while paraffin is the major source of lighting fuel. This poses a great challenge to the realization of 10 percent forest cover within the county. Connection to the national grid is good with 98 percent of all trading centres connected and only 4 percent of public institutions currently not connected. However, connection to individual homes is low and there is need for up-scaling of the rural electrification programme. Kiambu County is endowed with a number of big rivers which can be exploited for power generation. As indicated in the photo below the presence of fourteen falls and a number of other small falls like Thika falls presents a big opportunity for hydropower generation, as the country gears towards adoption of green energy. The proposed site however, is served by three phase low voltage powerline which is 5m away from the site.

4.10. Transport and Communication Infrastructure

The county has a good road network. It has a total of 2,033.8 km of roads under bitumen standards, 1,480.2 km under gravel surface and 430.1 km under earth surface. There is a great need in improving the condition of the roads since during the rainy season, most of the roads become impassable. However, the terrain poses a great challenge for road maintenance. There has been a lot of improvement in the roads subsector with the example of Thika-Nairobi highway.

4.10.1. Site Road and Accessibility

The proposed project area and its environs have adequate road network. The subject site is served by Thika Super highway and Gatundu-Juja road with small earth road leading to the site. Feeder roads exist at the proposed project area. The feeder roads are earth graveled roads connecting residents of the proposed project area to the neighborhood markets and residential areas.

4.11. House Type:

According to 2009, Kenya Population and Housing Census, 48.3 percent of all homes in the county are stone –walled, 4.9 percent are brick/block, 4.8 percent are mud/wood. There are 74.6 percent of the houses that have cemented floors and 87.5 percent have corrugated iron sheets. Only 0.1 percent has used other forms of roofing materials. The proximity of the county to the city of Nairobi has seen transformation of large pieces of land into residential houses. The presence of good all weathered roads have given an opportunity to those working in Nairobi to reside within the county. This has led to the establishment of residential estates with the Tatu city being one of the major housing projects currently under implementation. The project area is surrounded by different housing units.

4.12. Information, Communication and Technology

Kiambu County is well covered by mobile network which is estimated at 98 percent even though landline coverage is very poor with only 214 connections in the entire county. This might be attributed to the fact that landlines are becoming obsolete and have a high maintenance cost. There are 19 post offices and 14 sub-post offices which are fairly distributed within the county. Distances to the nearest post office vary from one part of the county to another. Most of the residents (70.4 percent) are within the range of 5 Km and above while 22.5 percent of the population are in the range of 1.1-4.9 Km and only 7.2 percent of the residents are within the range of 0-1 Km. Currently there are 149 cyber cafes and eight private courier services operating within the county which are mostly located in the urban centres of Thika, Ruiru, Karuri, Kiambu, Limuru and Kikuyu. Telephony services is however limited necessitating the need to build more telecommunication infrastructures.

4.13. Economic Activities and Household Income:

Agriculture is the predominant economic activity in the county and contributes 17.4 per cent of the county's population income. It is the leading sub sector in terms of employment, food security, income earnings and overall contribution to the socio-economic well-being of the people. Majority of the people in the county depend on the sub sector for their livelihood, with 304,449 directly or indirectly employed in the sector. Coffee and tea are the main cash crops in the county. The main food crops grown in the county are maize, beans, pineapples and irish potatoes. These are mainly grown in small scale in the upper highlands of Limuru, Kikuyu, Gatundu North and South Constituencies. However, in the project area there are minimal agricultural activates with main economic activities being business ventures.

Chapter Five: Approach and Methodology

5.1. Approach

The preparation of this Environmental Impact Assessment project report was guided by the Environmental Management and Coordination Act of 1999 CAP 387; the principal legislation governing the conduct of environmental impact assessments in Kenya and the Environmental (Impact Assessment and Audit), Regulations of June, 2003. Part VI of Environmental Management and Coordination Act of 1999; Section 58 on Application for an Environmental Impact Assessment License up-to section 67 on Revocation, suspension or cancellation of Environmental Impact Assessment License and Part II of the Environmental (Impact Assessment and Audit), Regulations of June, 2003 on the project including:

a. Preparation of project report.
b. Submission of project report.
c. Comments on the project report, and,
d. Approval of the project report; has been followed in the preparation of this project report.

The Environmental Management and Coordination Act of 1999 categorically, stipulate that an environmental impact assessment should precede all the development activities especially those with anticipated negative impacts. It is further noted that in accordance with the World Bank Environmental Guidelines the establishment and construction of the proposed Juja Menja BTS Site conform to Category 'A' projects and will be assessed in conformity with the guidelines set hitherto. This proposed project report will also be prepared in accordance with the International Finance Corporation Environmental, Health and Safety Guidelines for Telecommunications.

To enrich this EIA study and ensure optimal participation of all the stakeholders, a participatory and collaborative approach was adopted. Emphasis was put on consultations between the consultant and the neighbouring communities.

5.2. Methodology

This is a scoping exercise involving observation, interviewing of neighbours and taking the photos to ascertain conditions and situations at the proposed site. After receipt of site location details including the coordinates from Site Acquisition, the EIA expert conducted site inspection involving discussions and consultations with the public and to ascertain perceptions and attitudes about the construction of BTS.

5.2.1. Data Collection Procedure

The team generated and assembled information and data in the following manner:

a) Assembling Relevant Existing Information

The team collected information on the nature of the project, including preparation of a preliminary list of potential environmental impacts and practical alternatives, including by maps, drawings and other aids for a fuller understanding of the project proposal. This key information helped in formulating appropriate mitigation measures and formed the basis of further discussion.

b) Distribution of Information to Affected Interests

The information collected in the first step above, was processed and assembled into an information package and distributed to appropriate individuals and organizations for comment. Government departments and concerned local and regional officials were contacted. The consultant issued a general public notice inviting public comment and held public meetings at the project site as well as at the district headquarters, to facilitate consultation and interaction.

c) Identifying Major Issues of Public Concern

All the concerns and issues raised by affected and interested parties were compiled into a comprehensive list. Each contribution was categorized and no issue or concern was ignored or rejected in the compilation of the list.

d) Evaluating the significance of issues on the basis of available information

The issues were identified and grouped. Their scientific validity was carefully evaluated. For those questions of a technical nature which remained unresolved, a discussion panel/workshop was organized to resolve the problem.

e) Establishing priorities for environmental assessment

A more detailed exercise was conducted at this stage and an issue to which immediate solutions could be provided and issues which had no relevance to the proposed project was dropped. The key issues remaining were arranged in order of priority.

f) Developing a strategy for addressing priority issues

Issues to which immediate solutions could be provided – such as suggesting feasible alternatives or mitigation measures that can be implemented at an early stage – were removed from the list. For those issues which needed further information in order to be resolved, terms of reference (ToR) was prepared in order to define guidelines for further examination.

The team undertook a review of the policy and legislative framework relating to the project, with an examination of the weaknesses and strengths of their legal aspects. The impact assessment team also involved review agencies and sectoral representatives of Government departments and allowed for as much public participation as was feasible during the duration of the exercise. The team at an early stage clearly defined all the communities and agencies who were allowed to influence decisions relating to the proposal. The plan identified whom to talk to, as well as when and how to undertake the communication exercise. Consent was obtained from the authorities and government agencies concerned. The project proponent, relevant experts, local people affected, as well as special interest groups were considered for inclusion in the list of persons to be covered by the communication plan.

The team ensured participation of all the IAPs by inculcating the following:

- Securing written submissions from relevant government agencies and the public
- Holding community meetings and public hearing
- Conducting preliminary field study/observation of the proposed BTS site.
- Conducting workshops/seminars
- Establishing an inter-sectoral task force.

5.3. Data Analysis and Reporting

All the data and information collected during the preparation process of the project report was processed in the consultants office located in Transnational Plaza located along Mama Ngina street Nairobi. A preliminary report was prepared and submitted to the client for review and comments. Upon receipt of comments a final report was prepared and submitted to the client and Seven copies to NEMA as required by the Environmental (Impact Assessment and Audit), Regulations of June 2003. The preparation of this Environmental Impact Assessment project report took ten (8) working days from the time of site reconnaissance.

Chapter Six: Project Alternative Analysis

6.1. Sites

American Towers Operation Kenya Limited undertook transmission surveys to select appropriate densification site that would provide the required improvement on the existing network within the proposed area and its environs. The proposed site met the technical requirements for a BTS siting and was the most optimal location to increase network coverage around Juja areas and their environs. The technical survey concluded that the proposed site was the most ideal in terms of coverage, capacity and a BTS at this site can be integrated with other base stations in Airtel Kenya Limited network. In addition, the proposed site was found to be free from local obstructions such as very tall buildings and accessible during both dry and wet weather. Any change in site would result in fresh negotiations for land lease resulting in delays in the project implementation. The site was therefore considered ideal location for the proposed densification Base Transceiver Station

6.2. Alternative Technology

A fixed telephone line is an alternative to the cellular mobile phones. However, the availability, flexibility and affordability of the cellular phones means they are an important supplement to the existing fixed line networks. In addition, fixed telephone lines will not meet the government's stated ICT vision of improving the livelihoods of Kenyans by ensuring the availability of accessible, efficient, reliable and affordable ICT services.

CDMA technology is an alternative technology to GSM. The number of channels (users) that can be allocated in a given bandwidth is comparatively higher for CDMA than for GSM. However, CDMA technology is relatively new and does not support international roaming. GSM networks dominate the world market (over 70% coverage) hence international roaming is much easier in GSM. GSM technology also allows for reliable and efficient data transfer. It even allows text and pictures to be sent from anywhere the system is available.

6.3. Alternative Tower Design

The alternative tower designs that were considered include Monopole mast, stub tower and self-supporting Lattice tower. The lattice four-legged design was considered viable due its stability. This was the best viable option due to the high-rise apartments in the project area.

A self-supporting lattice tower generally requires a larger base taking more ground space compared with a Monopole mast. A Monopole mast is simple, easy to conceal or mimic other vertical features in the landscape and requires minimum ground area. However, this design cannot rise to great heights, and can only carry a limited number of antennas. Furthermore it is not suitable for co-location.

The four-legged tower is designed to crumble inwards thereby protecting people and adjacent property. The site was chosen because of suitability with regards high rise apartments and increase in the use of mobile telephone in the area, that is, the height will not be act as a hindrance to aeroplanes passing by and in addition, the mast will be painted red and white as required by Kenya Civil Aviation Authority.

6.4. Alternative for Co-Location

Co-location involves locating one's infrastructure on another operator's primary installation and encompasses sharing of active or passive elements. Passive co-location involves sharing of structures such as tower, Ground Space & Power while Active co-location involve sharing of Antennae, RF system, BSC and many other active elements of the network. ATC Towers in collaboration with Airtel Kenya and other operators in the market practice passive co-location.

Co-location feasibility is reduced to technical and commercial viability and this is driven by factors such as Regulatory intervention, Environmental concerns, CAPEX & OPEX consideration and Industry pressure.

Co-location as an alternative is however challenged by factors such as

- Co-ordination of RF interference
- Loss of competitive advantage on coverage
- Tower loading issues /technical issues
- Disaster recovery nightmare
- Site security issues
- Commercial benefits vs. initial capital outlay
- Mast height

Co-location was a possible alternative because Airtel Kenya Limited would not need to acquire additional costly sites and benefit from shared maintenance cost and supply contracts. In this consideration; alternatives such as co-location in existing tower and development of new tower were analyzed.

The viability of this alternative however depends on Lack of anticipated Radio Frequency interferences between the two co- located networks, structural stability of the existing mast, availability of a mast to co-locate, height required for optimal transmission, ability to withstand the weight of extra antennas and availability of space for additional BTS equipment. Co-location option was viable however, based on the aforementioned technical and competition issues, this was not viable. The nearest existing rooftop BTS is located approximately 1km to the proposed site and co-location on this site would not provide the intended coverage, in addition to the existing BTS available space cannot accommodate other ICT infrastructures, therefore the proposed site was found to be most suitable.

6.5. Alternative for Height

The Engineers settled on a four-legged ADC stub tower 24m because of suitability with regards to Kenya Civil Aviation Authority, that is, the height will not act as a hindrance to aeroplanes passing by and in addition, the mast will be painted red and white as required by Kenya Civil Aviation Authority. The mast height will be designed to withstand maximum regional wind speed and it will provide the intended coverage, therefore the proposed site was found to be most suitable.

6.6. The No Project Scenario

Some of the anticipated gains for a 'No action option' include; non-interference with ecological and environmental set up of the project area and lack of probable negative effects associated with the project from construction, operation and decommissioning phase. The disadvantages for not implementing the project on the other hand would include, Lack of financial benefits on the part of the landlord resulting from lease of his property to American Towers Operation Kenya Limited leading to underutilization of an otherwise idle

space within the landlord's property. The proposed project area will still experience network problems and the area residents, foregoing the benefits expected to accrue from network related business opportunities, emergency responses (during illness, fire and insecurity), etc. The no project scenario will lead to lack of direct short term employment to Construction workers, Consultants, planners and engineers. Lack of network expansion will lead to low subscriber base for Airtel Kenya Limited which in turn will limit its revenue. The government will also lose out on revenue in form of taxes paid directly by ATC Operation Kenya Limited and the Airtel Kenya.

Chapter Seven: Consultation and Public Participation

7.1. Overview

The first consultation was with staff of American Towers Operation Kenya Ltd and the site acquisition managers or technicians. The issues discussed in this first consultative meeting included the following:

- The proposed site location
- The route maps
- The site layout plans and design
- County Government approvals
- The lease arrangement with landlord
- Proposed project budget

Consultation with the landlord and area residents was conducted to disclose the project nature and its complications through phone interviews augmented with zoom. This was occasioned by strict current guidelines of the Ministry of Health on public gathering to contain the spread of Covid 19. Structured open-ended questionnaires were sent to the most likely affected community as attached in annex 7. The proposed site is a property registered under **Mr Angelo Muchiri Waweru** who agreed on a lease agreement on conditions with ATC Operation Kenya Limited. No objections to the project were raised during consultation with the interviewees. Those interviewed sited poor network coverage in the area hence the need for service improvement.

7.2. Environmental Impact Analysis

7.2.1. Negative Impacts

The consultant explained the extent and the magnitude of envisaged environmental impacts during construction and operation of the proposed facility. The following issues were discussed.

(I) Construction Phase

- During construction phase the people were informed that activities will include: Installation of Steel mast, antennas and electrical wiring connections.
- The envisaged negative impacts that will be generated during this phase will be few, are rated low and will readily be mitigated upon by the proponent.
- These impacts will include high noise levels, construction waste, and occupational health and safety hazards among others.
- These impacts are however rated low and will be mitigated appropriately by the proponent.

(ii) Operational Phase

- During operational phase, activities of the proposed BTS site will include: receiving and transmitting radio signals, fuel delivery, refuelling of the fuel tank and maintenance operations.
- The impacts will include temporary disturbance of people at the project site. The consultant also clarified common perceptions about health impacts of Base Transceiver Stations. The residents were informed that typical RF exposures from antenna sites are less than 1% of international safety

recommendations and that WHO has found no convincing scientific evidence that the weak radio signals from base stations cause adverse health effects.

The consultant also explained that studies of high-powered radio transmitters have uncovered no increased health risks for nearby communities

(iii) Decommissioning Phase

- During the decommissioning phase the stakeholders were informed that activities at the site will include: dismantling and removal of the masts and other equipment from the site and disposal of wastes in an environmentally friendly way far from the site.
- The impacts will include possibility of high noise, occupational safety and health hazards as well as solid wastes generation.
- These impacts are however rated low and will be mitigated appropriately by the proponent.

Positive Impacts

- The positive impacts will be numerous and will include short term employment to various experts; architectural engineers, planners, construction contractors and environmental resource management consultants.
- There will be improved mobile phone communications within the vicinity of the proposed project area.
- There will be enhanced economic growth at the local and, national level

7.3. Outcome from Consultations

Public consultation enabled the consultant to communicate risks associated with the proposed BTS from construction, operation and decommissioning phase. The interviewees were informed of the possible negative impacts and how ATC operation Kenya Limited was intending to manage these impacts to acceptable levels. With this information, the public understood better the proposed project and were in a position to make an informed decision. A questionnaire was used to elicit their views. Based on the comments received during this exercise, it was concluded that no significant negative impacts were expected by area occupants. The project therefore has the support and goodwill of the public. Signed questionnaires are attached in appendix 6 of this report for ease of reference.

Chapter Eight: Impact Identification

In this Chapter, the potential impacts of the proposed Mount Kenya University Rooftop BTS construction and allied activities, which could cause significant environmental concerns, are identified and discussed. This discussion formed the basis for environmental management planning and led to designing of an ESMP for the BTS from construction, operation and decommissioning phase.

Project activities that are likely to cause potential impacts on environment are as follows:

- Project Construction
- Project Operation
- Project Decommissioning

8.1. Construction Phase

The team of experts carried out an environmental impact prediction so as to be able to;

a) determine the initial reference or baseline state of the proposed BTS site;
b) estimate the future state without the proposed action
c) estimate the future state with the proposed action
d) consider magnitude, extent and the duration of the impact
e) consider available environmental baseline data likely to be affected by the implementation of the proposed project, and to,
f) Describe impacts in quantitative or qualitative terms.

During the construction phase the proposed project activities will include: installation of the antennas, generator, fuel tank and electrical wiring connections. Some of the envisaged positive and negative impacts during construction phase include;

8.1.1. Positive impacts

There are a number of positive benefits associated with the proposed project. The following are some of the positive benefits anticipated:

Potential Positive Impacts during Construction and Operation

- Economic growth and increase in GDP- revenue generated from taxes, permits and licenses and sources of construction materials locally will boast the county government economy whose GDP has been projected to increase to 7.6% by end of 2017. It will also promote the economic growth of the country by increasing resources to support health care, education, and advancement in other Sustainable Development Goals (SDGs). The proposed project upon implementation will positively impact on the growth of the regional economy and improve standards of land use.

- Employment opportunities- Provision of employment opportunities during both construction and occupation phases of the project. The local community will benefit from direct employment in provision of skilled, semi-skilled and unskilled labour where necessary

- **Optimal Use of Unlimited Space in Witheithie Area:** the development will see conversion of the previously idle space into economic use.

- **Improved Network Coverage:** Once the infrastructure is in use, this will improve the network in the area.
- **Improved Security:** the BTS will see the volatile security of the area/region improve as a result of uninterrupted communications between and among security agents and the local communities.

8.1.2. Negative Impacts during Construction and Operational Phases

There are anticipated impacts that are likely to affect the biophysical and human environment during construction and operation phases;

8.1.3. Air Pollution

Potential impacts on the air quality during construction phase will be due to exhaust and dust emissions generated in and around the construction site by the construction equipment. Motor vehicles used to mobilize materials for construction and machines will affect the ambient air quality by emitting pollutants through exhaust emissions.

During construction period, fuel consumption by involved vehicles and machinery at the Project site is expected to rise significantly and the background concentrations of Suspended Particulate Matter (SPM), Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2) and both Carbon Monoxide (CO) and Lead (pb) are also expected to rise.

These emissions can have significant cardio-pulmonary and respiratory effects on the local population; the health effects may range from subtle biochemical and physiological changes to difficulty in breathing, wheezing, coughing and aggravation of existing respiratory and cardiac condition. The impact of such emissions can be greater at the proposed site. Dust and exhaust gas emissions from construction machineries and vehicles will however be temporary and is expected to last during construction period.

Proposed Mitigation Measures

- The proponent will be responsible for maintaining construction equipment to minimize emissions.
- Appropriate Personal Protective Equipment (PPEs) must be provided to all site workers especially painters, welders etc. These include, respirators, dust coats, aprons, safety boots, head gears, hand gloves.
- Emission of pollutants such as Carbon (IV) oxide, Carbon (II) oxide, and Sulphur IV oxide shall be averted by muffling the generator exhaust pipes and placing it in vertical position. Stack measurement can be done to check the emission levels as per air quality regulations (2014)
- Construction equipment will be maintained in good operating condition to reduce exhaust emissions;
- Staff working in dust generating activities e.g. site preparation, excavation, concrete mixing, stone dressing should be provided with personal protective equipment (PPE) the use of PPE must be enforced.
- Avoiding open burning of solid wastes during both operation and construction phase.

8.1.4. Noise Pollution

Incoming vehicles delivering construction materials and workers to site will be a source of noise in the project area. Another source will be the involved Machinery and workers at project site. This will add to the background noise level around the site. To some degree immediate neighbours to site will be affected since noise beyond some level is itself a nuisance and thus should be controlled within acceptable limits.

Proposed Mitigation Measures

- Equipment to be used should be selected on the basis of the noise minimization during acquisition, the proponent shall employ the use of simple hand-held tools.
- Muffle the generator exhaust to minimise noise pollution.
- The concrete to be used for reinforcing the BTS shall be premixed
- Equipment should also be properly serviced while in use during the construction phase.
- The proponent should also monitor noise levels during installation phase and ensure they remain within allowable limits.
- Construction activities should only take place between 0800Hrs-1700Hrs due to the proximity to residential areas so as not to disturb the immediate neighbours.
- Notify the public of installation activities that may be perceived of as noisy and intrusive prior to starting construction
- Establish means for the public to contact the engineer-in-charge (i.e., provide telephone number, email, etc.) and methods to handle complaints.

8.1.5. Solid Waste Generation

Solid wastes likely to be generated during construction phase include metal cuttings, rejected materials, surplus materials, surplus soil, paper bags, empty cartons, empty paint These materials will require proper disposal. If not well managed, they can cause unsightly views within the project area.

Proposed Mitigation Measures

- Solid waste shall be segregated at the source to separate e-waste, hazardous and non-hazardous waste. Disposal of these wastes shall be conducted through a licensed solid waste handler.

8.1.6. Occupational Hazards

Construction sites always present an element of danger. Construction workers will be exposed to accidental injuries as a result of the intensive engineering and construction activities including erection and fastening of materials, metal grinding and cutting, concrete work, steel erection and welding among others. Such injuries can result from accidental falls from high elevations, injuries from hand tools and construction equipment cuts from sharp edges of metal sheets.

8.1.7. Oil Spills

Involved vehicles will require oil change leading to oil spills. Irrespective of these possibilities, no significant adverse effects are expected as a result of oil spills given the scope, nature and duration of time to be taken in construction of the proposed project.

Proposed Mitigation Measures

- During construction phase, all machinery must be keenly observed not to leak oils on the ground. This can be done through regular maintenance of the machinery.
- Maintenance must be carried out in a designated area and where oils are completely restrained from contaminating the ground.
- All oil products and materials should be stored in site stores or in the contractor's yard. They should be handled appropriately to avoid spills and leaks.
- Residuals from diesel and lubricants used on site should be stored safely awaiting appropriate disposal in order to prevent migration of contaminant hydrocarbons into the soil and groundwater within the vicinity of the site.
- During operations, maintenance teams should obtain and make use of drip trays during fuelling and changing the generator oil so as to collect any accidental spills;
- Regular maintenance of site equipment and machinery should be carried out to ensure any leakages are detected and controlled;
- Safety procedures for fuel storage and re-fuelling should be well understood and implemented by site staff;
- Oil residuals including waste oil, lubricants, used filters, should be carefully collected and stored for safe disposal in order to prevent migration of contaminant hydrocarbons into storm water or groundwater resources.

8.1.8. Employment Opportunities

The proposed BTS will provide direct short term employment opportunities to the contractor, technicians, planners, EIA experts. Other people who are expected to benefit from the project indirectly include transporters, food vendors and shops in the project area.

8.2. Operation Phase

During the operation phase, activities of the proposed BTS site will include: receiving and transmitting radio signals, repair and maintenance operations and generator fuel delivery. The possible impacts during operation phase include the following.

8.2.1. Solid Wastes

After repair, there will be electronic wastes including worn out parts, electronic circuit boards, cartons and battery parts which will require disposal. All solid waste must be disposed of off-site at an approved landfill site.

- Implementing fuel delivery procedures and spill prevention and control plans applicable to the delivery and storage of fuel for backup electric power systems, preferably providing secondary containment and overfill prevention for fuel storage tanks;
- Implementing procedures for the management of lead acid batteries, including temporary storage, transport and final recycling by a licensed facility;
- Ensuring that new support equipment does not contain PCBs or ODSs. PCBs from old equipment should be managed as a hazardous waste;
- Purchasing electronic equipment that meets international phase out requirements for hazardous materials contents

8.2.2. Noise Pollution

During power blackout, it is anticipated that the generator will switch on automatically. To some degree people working/living in close proximity could be affected adversely since noise beyond some level is itself a nuisance and thus should be controlled within acceptable limits. Where a generator is involved, noise level may be more than the stipulated 85 dB during the day. The noise level is within the tolerance limit at a distance of 15 to 20m or so The sound pressure level generated by a noise source decreases with increasing distance from the source due to wave divergence.

8.2.3. Increased Energy Consumption

The BTS will require electricity to operate. Consumption of electricity is expected to be on the higher side. This will add additional demand for electric energy from the national grid. During operation phase, the back-up generator will consume fossil fuels. Fossil fuels are non-renewable and excessive use may have serious environmental implications on availability, price and sustainability. There is need for efficient management of energy consumption for optimal performance of the BTS.

8.2.4. Occupational Health and Safety

Possible impacts include high level RF radiation at the antennas during repairs and maintenance, possibility of technicians falling from heights. These impacts are however rated low and will be mitigated appropriately by the proponent.

Potential Mitigation Measures

Occurrences of accidents may be prevented by observing the following:

- Ensuring that the operational manuals are available and accessible for every equipment /machinery used at the site.
- Proper maintenance of all machinery and equipment to prevent premature failure or possible accidents.
- Ensuring all electrical equipment and machinery are properly grounded.
- Only properly trained employees to operate equipment or machinery and proper instructions in their safe operation is provided.
- Workers to wear personal protective equipment (PPE) throughout
- Contractor to ensure provision of a first aid kit and a trained first aider should always be on site.
- Cordon off the site with warning tape during construction activities.
- The mobile service operator will ensure provision of proper signage warning for general public. The sign board should be clearly visible and identifiable and may contain the following text as captioned

Figure 7: Typical Non-Ionizing EMF warning sign

8.2.5. Possibility of Tower Collapse

A 50m ADC stub tower that is triangular in cross section will be constructed at the proposed site. The tower will be exposed to extreme weather conditions including high temperature, low temperatures, winds etc. The extreme conditions make possibility of tower collapse real. This may put public safety at risk. There are also hazards of falling objects from the tower. However, the following measures have been put into consideration;

- The tower has been designed to withstand maximum regional wind speeds at maximum antenna loading;
- Adequate factors of safety have been used in the design to safeguard against foundation and structural failure;
- Fall protection measures shall be observed and implemented at any and all towers and structures, regardless of ownership, where climbing is required;
- Tower members have been galvanized to protect them from corrosion hence longer lifespan;
- Installation certificates on safe to climb are issued for each tower installed;
- Routine Maintenance will be done to check status of deterioration that may compromise safety
- Lightning protection to arrest lightning strikes will also be provided;
- Towers shall not be overloaded;
- OSHA or other applicable Occupational Safety and Health standards regulations shall be observed in all phases of tower construction and maintenance; and
- Overall, all ATC Operation Kenya Limited towers abide by international building standards, the Kenya Standards, and have sound structural stability.

8.2.6. Impact on Air Navigation Safety

The mast at site will be tall. This may be dangerous to aeroplanes. American Towers Operation Kenya Ltd will however comply with the requirements of Kenya Civil Aviation Authority. The mast will be fitted with an aviation warning light and painted red and white at equal distances to enhance its visibility from aeroplanes.

8.2.7. Avian Collisions

The height of some television and radio transmission towers can pose a potentially fatal risk to birds mainly through collisions. The likelihood of avian collisions is thought to increase with the height and design of the communications tower (e.g. guyed towers represent a higher potential for collisions), the presence of tower lighting (which attracts some species of birds at night or during low light conditions), and, most importantly, the tower location with regard to flyways or migration corridors. The proposed site does not hinder or obstruct migratory routes for migratory birds. In addition the tower design is a stub ADC tower at 50m high.

Recommended Prevention and Control Measures to Minimize

- Siting towers to avoid critical habitats (e.g. nesting grounds, heronries, rookeries, foraging corridors, and migration corridors);
- Avoiding the cumulative impact of towers by collocating antennae on existing towers or other fixed structures (especially cellular telephone communication antennae), designing new towers structurally and electrically to accommodate future users, and removing towers no longer in use;
- To the extent feasible, limiting the tower height and giving preference to non-guyed tower construction designs (e.g. using lattice structures or monopoles);

- If guy wired towers are located near critical bird habitats or migratory routes, installing visibility enhancement objects (e.g. marker balls, bird deterrents, or diverters) on the guy wires;
- Limiting the placement and intensity of tower lighting systems to those required to address aviation safety.
- Possible alternatives include the use white and / or strobe lighting systems.

8.2.8. Lightening Attraction

Communications facilities located at elevations significantly above the average elevation of the surrounding terrain (such as hilltops, fire towers, airport control towers, and high-rise buildings) is considered exposed to lightning regardless of thunderstorm activity and soil resistivity.

The proposed Base Station is 50m tall stub tower mounted a high-rise building. Lightening tends to strike tall structures due to the intense concentrations of electric fields present at their most elevated points triggering a lightening path. This makes the houses and properties near these structures at risk. The mast will however be fitted with a lightening finial and earthed appropriately to mitigate against lightening.

8.2.9. Oil spills

Operation phase will also involve occasional visit to the proposed site using vehicles. Possibilities of fuel and oil spillage due to human error cannot be ruled out. Oil and fuel spills may be carried by runoffs from the BTS site into nearby area or water bodies where oil forms a thin film on top of water interfering with aeration of water. Low dissolved oxygen in water bodies may lead to death of aquatic organisms.

Mitigation Measures

- Implementing fuel delivery procedures and spill prevention and control plans applicable to the delivery and storage of fuel for backup electric power systems, preferably providing secondary containment and overfill prevention for fuel storage tanks;
- Implementing procedures for the management of lead acid batteries, including temporary storage, transport and final recycling by a licensed facility;
- Ensuring that new support equipment does not contain PCBs or ODSs. PCBs from old equipment should be managed as a hazardous waste;
- Purchasing electronic equipment that meets international phase out requirements for hazardous materials contents and implementing procedures for the management of waste from existing equipment according to the hazardous.
- During operations, maintenance teams should obtain and make use of drip trays during fuelling and changing the generator oil so as to collect any accidental spills;
- Regular maintenance of site equipment and machinery should be carried out to ensure any leakages are detected and controlled;
- Safety procedures for fuel storage and re-fuelling should be well understood and implemented by site staff;

Oil residuals including waste oil, lubricants, used filters, should be carefully collected and stored for safe disposal in order to prevent migration of contaminant hydrocarbons into storm water or groundwater resources.

8.2.10. Perceived Health Risks due to EMF Exposure

Base stations are designed to send signals outwards like a light house sends out light. Base Stations produce electric and magnetic energy moving together through space. They are sited with special care to ensure nobody living or passing by them is exposed to radio waves above ICNIRP guideline limits. A recent survey by world health organization has shown that the RF exposure occasioned by telecommunication base transceiver stations ranges from 0.002% to 0.2% in relation to the permitted international levels of maximum exposure. (CAK). Such exposure is comparable to RF exposure caused by radio or television broadcast transmitters and is therefore so low (approximately 1000 times lower than the permitted maximum exposure levels) to pose threat to human health. However, despite the radio wave exposure at the foot of a base station being thousands of times lower than the set guideline limits it is anticipated that there will be perceived health risks among the people residing next to the proposed base transceiver station.

The exposure limits used by the Federal Communications Commission (FCC) are expressed in terms of Specific Absorption Rate, electric and magnetic field strength and power density for transmitters operating at frequencies from 100 kHz to 100 GHz. The applicable limits depend upon the type of sources (e.g. whether a cell phone or a broadcast transmitting antenna). For this particular proposed project, the RF emissions will be inconsequential, which is less 10Hz, hence no anticipated health risk. Specifically, radio frequency are low level Electro Magnetic Field (EMF) as the figure 1 below shows. This is lower or comparable to RF exposures from radio or television broadcast transmitters. In fact, due to their lower frequency, at similar RF exposure levels, the body absorbs up to five times more of the signal from FM radio and television than from base stations.

Figure 8: Electromagnetic Spectrum

Possible Mitigation

- International guidelines developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP) is based on a careful analysis of all scientific literature (both thermal and non-thermal effects) and offer protection against all identified hazards of RF energy with large safety. These guidelines have been developed to protect everyone in the population and persons living near telecommunication gadgets that might transmit RF emissions. The proponent should strictly adhere to health-based guidelines:
- Provision of accurate information and health facts about the dangers of RF emissions to the public to increase acceptance of such technological developments.
- Limiting public access to antennae tower locations;

- Following good engineering practice in the siting and installation of directional links (e.g. microwave links), to avoid building structures;
- Taking into account public perception about EMF issues by consulting with the local community during the siting process of antenna towers.
- Evaluating potential exposure to the public against the reference levels developed by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Average and peak exposure levels should remain below the ICNIRP recommendation for General Public Exposure
- Annual EMF audit to determine the emission level and stick to the minimal emission ever.

8.3. Management of COVID-19:

Coronavirus disease 2019 (COVID-19) is an acute respiratory infection caused by severe acute respiratory syndrome coronavirus 2 (SARSCoV-2). SARS-CoV-2 belongs to the Sarbecovirus subgenus of the Coronaviridae family, and is the seventh coronavirus known to infect humans. Coronaviruses are a large family of enveloped RNA viruses, some of which cause illness in people (e.g., common cold, SARS, MERS), and others that circulate among mammals (e.g., bats, camels) and birds. Rarely, animal coronaviruses can spread to humans and subsequently spread between humans.

Measures for protecting workers from exposure to, and infection with, SARS-CoV-2, the virus that causes Coronavirus Disease 2019 (COVID-19), depend on the type of work being performed and exposure risk, including potential for interaction with people with suspected or confirmed COVID-19 and contamination of the work environment. Employers should adapt infection control strategies based on a thorough hazard assessment, using appropriate combinations of engineering and administrative controls, safe work practices, and personal protective equipment (PPE) to prevent worker exposures. Some OSHA standards that apply to preventing occupational exposure to SARS-CoV-2 also require employers to train workers on elements of infection prevention, including PPE.

General Prevention Recommendations.

For all workers, regardless of specific exposure risks, it is always a good practice to:

- Frequently wash your hands with soap and water for at least 20 seconds. When soap and running water are unavailable, use an alcohol-based hand rub with at least 60% alcohol. Always wash hands that are visibly soiled. ATC to provide these for their construction workers.
- Avoid touching your eyes, nose, or mouth with unwashed hands.
- Practice good respiratory etiquette, including covering coughs and sneezes.
- Avoid close contact with people who are sick.
- Stay home if sick.

Employers and workers in operations where there is no specific exposure hazard should remain aware of the evolving community transmission. Changes in community transmission may warrant additional precautions in some workplaces or for some workers not currently highlighted in this guidance like wearing of masks in public places. These rules should be adhered too and enforced by EHS onsite during construction.

8.4. Positive Impact

8.4.1. Improved Network Coverage

There will be improved mobile phone communications within the vicinity of the proposed project area especially to over 50,000 persons targeted. Improved Airtel network will attract related business opportunities in the area including Airtel Money services, Internet services etc. this will lead to enhanced economic growth at the local and, national level. Improved network will boost business operations within the area and improve security.

8.5. Decommissioning Phase

During decommissioning phase the activities at the site will include: dismantling and removal of the whole equipment from the proposed site and its disposal in an environmentally friendly way far from the site. The impacts are similar to those during project construction and will include possibility of high noise and radiation levels, solid waste generation and occupational health and safety risks. These impacts are however rated low and will be mitigated appropriately by the proponent.

Chapter Nine: Environmental Monitoring and Management Plan

9.1. Introduction

Environmental management is a crucial segment of any development in view of the global concept of sustainable development. Therefore, the preparation of Environmental and Social Management and Monitoring Plan (ESMMP) is a must to fulfil the multifocal aspect of the statutory compliance, social and economic concern.

9.2. Environmental Monitoring

This describes the processes and activities that need to take place to characterize and monitor the quality of the environment. Environmental monitoring is an essential component for the entire project lifespan. Annual Environmental Audits throughout the lifespan of the project and other checks by the authority (NEMA), lead agencies, communities and interested parties, where and when need arises, are critical towards the full implementation of a monitoring plan. These forms of monitoring are undertaken to establish if the project implementation has complied or is in compliant with the set environmental management standards as articulated in the EMCA, 1999, the EMCA amendment 2015, and its attendant Environmental (Impact Assessment and Audit) Regulations, 2003.

The ESMMP outlined below has addressed identified potential negative impacts and mitigation measures for the proposed development and if it's adhered to, it's considered sufficient to take care of environmental and social concerns and it shall be modified at the first environmental audit to accommodate unforeseen impacts if any. It is the primary responsibility of the proponent (and later the contractor) to promote a safe and healthy environment at the workplace and within the neighborhood in which the proposed project will be constructed by implementing effective systems to prevent occupational diseases and ill-health, and to prevent damage to property. This EMMP should be used as a tool and a checklist by the contracted engineers in planning and modification of the project.

Table 5: Environmental Management and Monitoring Plan

Activity	Environmental issues/Impact	Monitoring	Mitigation measure	Responsibility	Time frame	EMP Budget
Construction/Installation Phase						
Site preparation Transportation of materials to site Installation of Feeder cable tray, The dish, Meter box, Razor wire Electrical wire. Generator and Fuel tank	Pollution (Air pollution,)	Possibility of dust from the construction works Emissions from vehicles fleets transporting materials to site may affect the ambient air quality. Emissions from earth moving equipments	• Sprinkle water on the project site to reduce dust. • Provide gas masks to employees working at project site • Ensure the contractor takes minimum time possible • Ensure serviceable heavy construction machinery is used • Ensure use of hand tools where appropriate • Ensure vehicle engines are in good condition to reduce high levels of exhaust cases • Sensitise drivers and machine operators to switch off Engines when not in use.	ATC Engineers and Site Contractor	During Construction Period	150,000.00
	Oil Spills leading to water pollution	Accidental spills of oils and greases used in vehicles and construction machinery may	• Service the motor vehicles at designated sites/contractor's yard. • Prompt cleaning of Oil and fuel spills	Site construction contractor	During construction period	No associated costs

Activity	Environmental issues/Impact	Monitoring	Mitigation measure	Responsibility	Time frame	EMP Budget
		contaminate surface water	• Dispose cloths and rags contaminated with oil properly			
	Noise pollution	Construction works, hooting of vehicles and workers may generate noise and vibrations that will affect the neighbourhood	• Provide ear muffs to people working in noisy conditions • Ensure vehicles are driven into project site without undue noise/ hooting. • Construction works should only be done during the day. • Sensitize construction vehicle drivers and machine operators to switch off engines of vehicles and machines when not in use • Consult the surrounding communities on permissible noise levels and best working hours	Site construction contractor	During construction period	50,000.00

Activity	Environmental issues/Impact	Monitoring	Mitigation measure	Responsibility	Time frame	EMP Budget
	Increased solid waste	Solid waste during construction will include waste debris, cement bags and metal parts,	• Dispose waste debris in approved dumpsites • Ensure proper segregation of waste • Recycle useful materials • Order materials in the sizes and quantities they will be needed • Damaged construction materials should be recovered for refurbishing and use in other projects. • Use building materials that have minimal or no packaging. • Provide facilities for proper handling and storage of building materials	Site construction contractor	During construction period	50,000.00
	Impact on Public health	Dust, gaseous emissions and noise during construction may affect human health particularly in the immediate neighbourhood.	Sprinkle some water on open surfaces to reduce dust. Use serviceable machines	Site construction contractor	During construction period	150,000.00

Activity	Environmental issues/Impact	Monitoring	Mitigation measure	Responsibility	Time frame	EMP Budget
	Occupational Health and Safety.(Human Environment)	There may be work related injury e.g. equipment fall Workplace accidents. Possibility of electrocution.	• Ensure first aid kit is at the site • Ensure labour regulations are followed • Prepare a contingency plan for accident response • Conduct safety training to construction workers. • Allow only certified personnel to perform all electrical installation. • Accredited persons to supervise installations • Identify and mark all underground cables prior to excavations. • Provide personal protective equipments. • Drawings and plans should indicate sewer lines, power lines etc.	Site construction contractor	during construction period	To be estimated by Public Health Officer
Impacts During Operation						
Monthly environmental site inspection. Regular Maintenance operations Re- fuelling of tank	Increased Storm water flow	Construction of the proposed site will create impervious surfaces that will result to increased run offs from the site	• Practice good housekeeping to avoid contamination of storm water • Regularly inspect and clean storm water drains	ATC Operation Kenya Limited Maintenance Engineers	Through out operation period	50,000.00 Per month
	Increased solid and liquid waste	There will be waste generated during servicing. These	• Provide waste bins within the BTS site. • Properly segregate waste • Recycle the useful materials	ATC Kenya Limited Maintenance Engineers	Through out operation period	150,000.00 per month

Activity	Environmental issues/Impact	Monitoring	Mitigation measure	Responsibility	Time frame	EMP Budget
Waste Oil Management		includes worn out parts, and waste oil	• Properly dispose cloth and rags contaminated with oil • Contract a private refuse handler to manage waste. • Electronic wastes should be re used where practicable or collected and returned to the manufacturer for recycling			
	Possibility of tower collapse	This has been taken into consideration during tower design	• The design of tower is such that the break point is above half the tower height. • The tower has been designed to withstand maximum regional wind speed. • In case of collapse, the design provides for it to crumble inwards	ATC Operation Kenya Limited Engineers	Design phase	450,000.00
	Oil spills	There will be spillage during re-fuelling, human error or leakage from the fuel tank	• Regularly inspect the fuel tank for possible leakages. • Avoid spillages during re-fuelling • Install oil interceptors in drainage channels leaving the site	Maintenance technicians	During operation phase	250,000.00
	Fire Risks	Flammable materials will be stored within the site and this makes possibilities of fire outbreak real	• Store fuel and other flammable materials in a way that minimises risks of fire. • Install suitable fire extinguishers • Site staff should be trained on how to operate the fire extinguisher	ATC Operation Kenya Limited Maintenance Engineers	During operation phase	Included in the project cost

Activity	Environmental issues/Impact	Monitoring	Mitigation measure	Responsibility	Time frame	EMP Budget
	Air pollution	Exhausts from generator will cause air pollution. Air conditioners may release Ozone depleting substances	• Service the generator set regularly according to the manufacture's recommendations. • Install air conditioners that are CFC free.	Site technical manager	During operation phase	100,000.00
	EMF emissions	RF emissions include changes in brain activity, sleep patterns.	• Radio frequency radiation levels produced by the site should be assessed using CD/04/13-2/99 techniques and recorded. • Site manager has to ensure the requirements of CD/04/13-2/99 are complied with. • Train staff working at site on safe working practices • Medical assessments should be done staff who work where • Radiation frequency exceed occupational limits. • Ensure non occupational exposure levels are not exceeded in any area accessible to the public • Annual environmental audit on the EMF radiation level and compliance • Ensures that, Measures to restrict the public or residents from coming close to the	Site technical manager	During operation phase	350,000.00

Activity	Environmental issues/Impact	Monitoring	Mitigation measure	Responsibility	Time frame	EMP Budget
			antenna location are enforced; • Ensure that the radio frequency emission from the proposed project is below 10Hz as specified in the design.			
	Risk of Lightening	This has been taken into consideration in the tower design	• The mast will be fitted with a lightening arrestor. • Ensure the lightening arrestor is in good working condition	ATC Maintenance Engineers	Operation phase	Included in the project cost
	Impacts on air Navigation	This has been taken into consideration in the tower design	• The mast will be fitted with an aviation warning light and painted red and white as required to enhance visibility. • Make sure the aviation warning light is in good working condition	ATC Operation Kenya Limited Maintenance Engineers	Operation	Included in the project cost.
	Occupational Health and Safety(Human Environment)	Maintenance technician may be exposed to strong electromagnetic field at the top of the tower during routine maintenance Work related injury due to a fall, electrocution or equipment failure.	• Disconnect power (tug off) during servicing. • Limit exposure time through work rotation. • Train technicians tower climbing techniques • Use of fall protection measures • Fall protection measures should be appropriate for the tower structure including ascent, descent and movement from point to point. • Equip the mast with anti-climb devices to preclude unauthorized climbing.	ATC Kenya Limited Maintenance Engineers	During operation phase	No associated costs

Activity	Environmental issues/Impact	Monitoring	Mitigation measure	Responsibility	Time frame	EMP Budget
	Exposure to Covid 19	Work related exposure due to failure to adhered to MoH protocols	• Frequently wash your hands with soap and water for at least 20 seconds. When soap and running water are unavailable, use an alcohol-based hand rub with at least 60% alcohol. Always wash hands that are visibly soiled. ATC to provide these for their construction workers. • Avoid touching your eyes, nose, or mouth with unwashed hands. • Practice good respiratory etiquette, including covering coughs and sneezes. • Avoid close contact with people who are sick. • Stay home if sick • All construction workers to wear mask.	ATC Kenya Limited Maintenance Engineers	During the Period of Pandemic	150,000

Table 6: Plan for the Prevention of Accidents

Phase	Possible Accidents	Prevention	Responsible Person
Construction Phase	Presence of hazardous agents e.g. wall power cables at site	Prior to construction inspect all areas for presence of potentially hazardous agents e.g. live power cables	Contractor
	Injuries when working with machines	Allow only properly trained employees to work with powered equipments	Contractor
		Never adjust clean or repair machines when any of their parts are in motion	Workers
		Use lockout switches to prevent accidental start -ups	Contractor
		Check if all equipment are properly grounded and control switch is properly located.	Contractor
	Material/Equipment fall	Inspect equipments for cracks and stretching before using them	Contractor
		Depending on the nature of their work, ensure workers wear approved safety shoes to protect their feet	Contractor/workers
		Helmets should be worn in all designated areas and visitors included	Contractor/Supervisor/ workers
	Exposure to toxic Chemicals, fumes and spray painting	Ensure workers wear approved respiratory equipment.	Contractor/Supervisor/ workers
	Injuries due to flying objects, dust and hot splashing metals	Ensure workers wear proper eye protection when the nature of operation presents potential eye/face injury e.g during welding operations	Contractor/workers
Operation Phase	Fall from heights by maintenance technicians	Inspect the tower climbing devices before using them	Technicians
	Injuries due to mast fall	Inspect the tower regularly Avoid constructing structures/buildings within the fall zone	Proponent/landlord
	Injuries Electrocution	Put warning signs indicating DANGER in the electric security fence to warn the public	
Decommissioning phase	Electrocution of members of the public	Dismantle all electrical connections.	Contractor
	Injuries due site demolition	Hire qualified contractor Provide PPEs to workers involved.	Proponent

Chapter Ten: Decommissioning Plan

During decommissioning phase the activities at the site will include: dismantling and removal of the whole equipment from the proposed site and its disposal in an environmentally friendly way far from the site. The impacts are similar to those during project construction and will include possibility of high noise and radiation levels, solid waste generation and occupational health and safety risks. These impacts are however rated low and will be mitigated appropriately by the proponent.

10.1. Purpose and Objectives of Decommissioning

The generally accepted purpose of decommissioning is to allow for release of valuable assets and sites for alternative use, recycling and reuse of materials and the restoration of environmental amenity. In all cases, the basic objective is to achieve an end-point that is sensible in technical, social and financial terms, that properly protects workers, the public and the environment and, in summary, complies with the basic principles of sustainable development.

10.2. Social Aspects

The long-term safety, environmental and social implications of the decommissioning activity need to be carefully considered. In Kenya, there are well-developed mechanisms for involving stakeholders in the planning of activities that affect such social and environmental issues. Developers are bound by the terms of directives of EMCA CAP 387 and Environmental (Impact Assessment and Audit) Regulations 2003 that require an Environmental Impact Assessment in circumstances like this. This requires detailed assessment of a wide range of factors including impact on amenities, communication systems, infrastructural development, noise, transport provisions, general nuisance, effects of accidents or untoward events and contribution to promotion of sustainable development as well as more specific issues of waste management and impact on the environment as such. Most importantly, they make specific provision for informing and involving the public and neighbouring communities.

Table 7: Decommissioning Management Plan

Activity	Environmental issues/Impact	Remarks	Mitigation measure	Responsibility	Time frame	EMP Budget
Site Decommissioning						
• Power disconnection • Dismantling the mast • Structure demolition • Removal of the equipment from site • Disposal of waste materials. • Rehabilitation of site to its original status	Noise Pollution	Noise pollution is expected from the involved machinery	• Demolition works should take place during daylight hours (8.00am-5.00pm. • Sensitize drivers and machine operators to switch off Engines when not in use. • Use quiet equipments with noise control elements • Consult surrounding community on permissible noise levels and best working hours • Ensure demolition takes the shortest time possible	Decommissioning contractor	During decommissioning period	30,000.00
	Oil spills	Accidental spillages of oil and grease used in the machines may result to contamination of surface water.	Use serviceable machinery Avoid oil spills	Decommissioning contractor	During decommissioning period	

Activity	Environmental issues/Impact	Remarks	Mitigation measure	Responsibility	Time frame	EMP Budget
	Occupational safety	Operation may result to work related injuries/ accidents	Provide safety helmets and protective clothing. Minimise occupational health and safety impacts	Decommissioning contractor	During decommissioning period	40,000.00
	Solid wastes	Demolition of the BTS will generate solid waste	• Use integrated solid waste management system i.e. through hierarchy of options including source reduction, recycling, re-use and disposal • All foundations must be removed and recycled where practicable • All structures and materials must be removed and recycled where practicable • Where recycling and re use is not practicable, the materials should be ferried to a licensed waste disposal site.	Decommissioning contractor	On decommissioning	75,000.00

Chapter Eleven: Conclusion and Recommendations

11.1. Conclusions

The result of this Environmental Impact Assessment has indicated that there are no significant negative impacts likely to be generated by the activities of the proposed project. Most of the potential negative impacts to be generated have been rated low (-1) and those rated high are of positive nature and beneficial to all the affected stakeholders and Kenya at large. In conclusion, this EIA study has established that the construction of the rooftop BTS by American Tower Operation Kenya Limited will improve mobile communication capacity in Juja area and its environs and will not generate significant negative impacts that will compromise the ecological and environmental well-being of the project area as well as health and safety of the area residents.

11.2. Recommendations

We therefore recommend that the ATC Operation Kenya Limited be given a license to implement this project subject to adherence to the environment and Social Management plan proposed in this report and other statutory requirements.

We also recommend the following;

- The proposed project should be implemented in compliance with relevant legislations and planning requirements.
- Install cooling and fire suppression systems that are CFC free.
- The tower should be installed with an anti-climb device to prevent unauthorised climbing.
- The contractor should follow good engineering practice in construction of the BTS site.
- An emergency preparedness and response plan should be put in place during all phases of the project.
- ATC and maintenance contractor should adopt transport safety practices across all aspects of project operations with the goal of preventing traffic accidents and minimizing injuries suffered by project personnel and the public. Measures should include:

    a) Emphasis on safety aspects among drivers
    b) Improvement of driving skills and licensing requirements for drivers.
    c) Adopt limits for trip duration and arrange driver rosters to avoid overtiredness.
    d) Avoid dangerous routes and times of day to reduce the risk of accidents
    e) Use of speed control devices (governors) on vehicles, and remote monitoring of driver actions
    f) Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure

- Inspect the tower at least twice a year and service the Base Transceiver Station as frequently as may be necessary to maintain the tower in a safe and weather withstanding condition
- Attach warning signs indicating DANGER, HIGH VOLTAGE and NO TRESPASSING permanently on the fence or wall surrounding the base station.
- Use licensed construction/personnel during construction phase and licensed /maintenance technicians for maintenance of the site during operation phase.
- Ensure maintenance technicians are trained on radio frequency exposure safety.
- Service the generator regularly to reduce noise.

- There should be proper management of waste oil to prevent pollution of water sources in the area.

11.2.1. Site Operation

It is recommended that the firm comply with the following:

- Maintenance technicians carry out monthly repairs and maintenance of the communication equipment and generator set and submit all completed maintenance reports to Maintenance Departmental Manager.
- Implement internal audit to ensure that environmental conditions at the site is maintained.
- Conduct annual environmental audits as required by the law and ensure the BTS complies with all environmental requirements.
- Provide Personal protective Equipments to maintenance technicians.
- Occupational EMF exposure should be prevented or minimized through the preparation and implementation of an EMF safety program including the following components:

  (i) Identification of potential exposure levels in the workplace,
  (ii) Including surveys of exposure levels in new projects
  (iii) The use of personal monitors during working activities;
  (iv) Training of workers in the identification of occupational EMF levels and hazards;
  (v) Establishment and identification of safety zones to differentiate between work areas with expected elevated EMF levels compared to those acceptable for public exposure,
  (vi) Limiting access to properly trained workers;
  (vii) Implementation of action plans to address potential or confirmed exposure levels that exceed reference occupational exposure levels developed by ICNIRP, and the Institute of Electrical and Electronics Engineers (IEEE).
- Maintenance technicians should always use the safety harness when doing repairs on top of the tower.
- Maintenance technicians should avoid working on the tower during strong winds.
- Train technicians in identification of occupational EMF levels and hazards.
- Provide personal exposure monitors to maintenance technicians.
- Put in place an action plan to address occupational exposure. This may include,

  a) Deactivation of transmission equipment during maintenance activities,
  b) Limiting exposure time through work rotation,

  c) Increasing the distance between the source and the worker,

  d) Where feasible, use of shielding materials;

Chapter Twelve: References

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2. CAK Guidelines for siting of communications infrastructure, towers, (masts) and safe use of the mobile telephones and other wireless terminals.
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4. Government of Kenya: Policy Paper on Environment and Development
5. Government of Kenya: National Policy on Water Resources Management and Development
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7. The National Environment and Coordination Act (1999)
8. Kenya Communications Act of 1998.
9. The Water Act 2002 (Cap 372)
10. Public Health Act (Cap 242)
11. The Local Government Act (Cap 265)
12. The Building Code 2000
13. UNEP, 1988: Environmental Impact Assessment- Basic Procedures for Developing Countries
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15. World Health Organization, Fact Sheet no. 193: Electromagnetic fields and public health: Mobile telephones and their base stations
16. Royal Society of Canada (1999): A review of potential Health Risks of Radio frequency fields from wireless telecommunication devices
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18. Radio Communication Agency UK, Stewart Audit Report Online: Available: www.rad.gov.uk/ (RA website)

Chapter Thirteen: Annexes

Annex 1: Radio Frequencies and Safety Limits

NRPB Basic Restrictions on BTS RF Exposure in the Frequency Range 10 MHz to 10 GHz for different parts of the body (NRPB, 1993b)

		Averaging parameters	
Tissue region	SAR Limit (W/kg)	Mass (g)	Time (Minutes)
Whole body	0.4	-	15
Head, Foetus	10	10	6
Neck, Trunk	10	100	6
Limbs	20	100	6

BTG RF Exposure Safety limits by NRPB, ICNIRP, ACA and ANSI/FCC

Parameters	ANSI/FCC	NRPB	ICNIRP	ACA
Power Density	0.5 m W/cm^2	3.32 mW/cm^2	0.45m W/cm^2	0.2m W/cm^2
SAR	0.08W/Kg	0.4W/Kg (whole body exposure)	0.4W/Kg (whole body exposure)	0.08W/Kg (whole body exposure)
Electric field strength	-	112.5 V/m	41.25 V/m	27.5V/m
Magnetic field strength	-	0.297A/m	0.111A/m	0.073A/m

Proposed RF Safety Limits for Adoption in Kenya

Parameters	BTS Safety Limit	Handset Safety Limit
Power Density	0.2 m W/cm2	-
SAR	0.08W/Kg	1.6W/Kg
Electric field strength	27.5V/m	-
Magnetic field strength	0.073A/m	-

ICNIRP Limits for general Public exposure

Frequency	Electric Field	Magnetic Field
3-150KHz	87	6.25
10-400MHz	28	0.092
2-300GHz	61	0.20

ICNIRP Limits for Occupational Exposure

Frequency	Electric Field	Magnetic Field
0.82-65KHz	610	30.7
10-400MHz	61	02
2-300GHz	137	0.45

Annex 2: Lease Agreement and Ownership

Annex 3: Site Plan and Design of the Tower

Annex 4: ATC CAK Certificate

Annex 5: Firm and Lead Expert NEMA Practicing License

FORM 7 (r.15(2))

nema

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/11724

Application Reference No: NEMA/EIA/EL/15821

M/S **Earthcare Services Limited**
(individual or firm) of address

P.O. Box 22433-00100, Nairobi

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Firm of Experts**
registration number **1799**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **1/27/2020** Expiry Date: **12/31/2020**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001: 2008 Certified

FORM 7 (r.15(2))

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY(NEMA)

THE ENVIRONMENTAL MANAGEMENT AND CO-ORDINATION ACT

ENVIRONMENTAL IMPACT ASSESSMENT/AUDIT (EIA/EA) PRACTICING LICENSE

License No : NEMA/EIA/ERPL/11722

Application Reference No: NEMA/EIA/EL/15819

M/S **John Damascene Mabala Kuloba**
(individual or firm) of address

P.O. Box 22433-00100, Nairobi

is licensed to practice in the

capacity of a (Lead Expert/Associate Expert/Firm of Experts) **Lead Expert**
registration number **1018**

in accordance with the provision of the Environmental Management and Coordination Act Cap 387.

Issued Date: **1/27/2020** Expiry Date: **12/31/2020**

Signature.....

(Seal)
Director General
The National Environment Management Authority

P.T.O.

ISO 9001: 2008 Certified

Annex 6: EMF

EMF MEASUREMENT REPORT FOR THE PROPOSED MOUNT KENYA UNIVERSITY THIKA BASE TRANSCEIVER STATION

DOCUMENT RELEASE INFORMATION

Client	**ATC (K) OPERATIONS LIMITED**
Project Title	**EMF MEASUREMENT REPORT FOR THE PROPOSED MOUNT KENYA UNIVERSITY THIKA BASE TRANSCEIVER STATION**
Purpose of Measurement	**BASELINE ENVIRONMENTAL MEASUREMENT**
Site ID	**MOUNT KENYA UNIVERSITY THIKA**
Revision Status	**FINAL**
Date	**JUNE 2020**

TABLE OF CONTENTS

Abbreviations

BTS	Base Transmission Station
ISO	International Standard Organization
WHO	World Health Organization
ICNIRP	International Centre for Non-Ionizing Radiation Protection
NIR	Non-Ionizing Radiation
F	Frequency
Exp.	Exposure
EQ	Exposure Quotient
TEQ	Total Exposure Quotient

EXECUTIVE SUMMARY

As part of an Environmental Assessment of the BTS, the proponent contracted Earthcare Services Limited to undertake Electromagnetic frequency measurement at the proposed BTS site.

Earthcare Services Limited carried out EMF on the forementioned locations within the site and approximatley 100m from the site (at specific receptors) to determine and evaluate the NIR exposure levels.

INTRODUCTION

Mobile telephony is now common place around the world. This wireless technology relies upon an extensive network of fixed antennas, or base stations, relaying information with radiofrequency (RF) signals. Over 1.4 million base stations exist worldwide and the number is increasing significantly with the introduction of third generation technology.

In Kenya there is growing realization by players in telecommunications industry including the government that effects on the environment by electromagnetic radiation need to be properly addressed as infrastructure continues to develop. It is therefore important to evaluate the electromagnetic radiation to the community and the staff working within the BTS.

The work reported here therefore had been commissioned by the proponent to evaluate the existing NIR levels of the proposed site.

Scope of Work

The scope of work was as follows:

- Undertake radiation (EMF) measurements at the proposed BTS site
- Compile the findings of the EMF survey in a final report

legislation and guidelines

WHO

A number of national and international organizations have formulated guidelines establishing limits for occupational and residential EMF exposure The World Health Organisation (WHO) formally recognised the International Commission on Non-Ionising Radiation Protection (ICNIRP) to develop the international EMF exposure guidelines. The acceptable guidelines have been set at 1% public exposure and five times more for occupational exposure. The main conclusion from the WHO reviews is that EMF exposures below the limits recommended in the ICNIRP international guidelines do not appear to have any known consequence on health.

EMF Measurement methodology

The area was divided into two environments:

1. Un-controlled environments which refer to areas of exposure which are accessible to general public who may not be aware of the radiation and therefore unlikely to take precautions i.e. residential.
2. Controlled environments on the other hand refer to restricted areas of exposure that are only accessible to workers, who are aware of the radiation and therefore have taken precaution i.e. within the BTS site.

Exposure is measured in terms of the electric or magnetic field strength, or power density incident on the body. Measurements for this site were taken from a near-field zone of approximately 100m from the source.

Instrumentation

Only instruments that are designed for operation in the frequency range required shall be used. Earthcare Services Limited made use of the spectrum HF-6065 Spectrum analyser Serial number 33234 for this assessment.

HEALTH AND SAFETY

Prior to commencement of work, health and safety measures were implemented to prevent any incidents while on site. These included communication with the company representative on site access using their laid down protocols.

Results

Coordinates Latitude -1.06951 S Longitude 37.05656 E

NIR MESUREMENT RESULTS

DATE OF MEASUREMENT: 25.06.2020

TIME OF MEASUREMNTS

0809HRS

SITE ID: MOUNT KENYA UNIVERSITY THIKA

Within the site

System	Dist.(m)	f (MHZ)	Level(dBm)	Esig (exp. (µWm-2))	ICNIRP %	Eref	EQ(Esig/Eref)	Electric strength (V/m)
GSM900	0	942	-56	0.14024	0.02	24.5	8.24745E-09	9.4212584
GSM1800	0	1834	-78	0	0.01	44.9	0	122.4457117
					0.03	**TEQ**	**9.34745E-09**	

within 100M North of site

System	Dist.(m)	f (MHZ)	Level(dBm)	Esig (exp. (µWm-2))	ICNIRP %	Eref	EQ(Esig/Eref)	Electric strength (V/m)
GSM900	100	932.8	-64	0.02424	0	4.95	5.33234E-09	42.12328458
GSM1800	100	1835	-5	0	0.05	8.165	0	54.06843746
					0.05	**TEQ**	**5.23134E-09**	

100m East of site

System	Dist.(m)	f (MHZ)	Level(dBm)	Esig (exp. (µWm-2))	ICNIRP %	Eref	EQ(Esig/Eref)	Electric strength (V/m)
GSM900	100	93.4	-65	0.06281	0.01	4.527	1.44014E-08	421.14324531

GSM1800	100	1838	-76	0	0.01	8.19	0	5.94886555
					0.02	**TEQ**	**1.55014E-08**	

100M West of Site

System	**Dist.(m)**	**f (MHZ)**	**Level(dBm)**	**Esig (exp. (µWm-2))**	**ICNIRP %**	**Eref**	**EQ(Esig/Eref)**	**Electric strength (V/m)**
GSM900	100	936.5	-68	0.0638	0.01	4.3974	1.57105E-08	42.14548834
GSM1800	100	1534	-76	0	0.01	9.182	0	58.93282723
					0.02	**TEQ**	**1.56105E-08**	

within 100M South of site

System	**Dist.(m)**	**f (MHZ)**	**Level(dBm)**	**Esig (exp. (µWm-2))**	**ICNIRP %**	**Eref**	**EQ(Esig/Eref)**	**Electric strength (V/m)**
GSM900	100	932.1	-68	0.00603	0	4.6005	1.48559E-09	41.14894404
GSM1800	100	173.9	-65	0	0.05	7.195	0	55.98489952
					0.05	**TEQ**	**1.52644E-09**	

Uncertainty of Measurement

Uncertainty level of measurement is ± 3.14dB for a confidence level of 95% which does not significantly affect the reported results

- **CONSULTANT'S OBSERVATIONS & CONCLUSIONS**

Conclusion

From the evaluation results of the baseline NIR, the summation of the exposure quotient was within the ICNIRP recommended ratio of less than 1%. Hence these measurements indicate that the EMF NIR emissions at the proposed base transceiver station site are within the safety range, an annual EMF measurement should be carried once a full operation of the BTS station begins to ensure the exposure are within the ICNIR limits.

ICNIRP LIMITS

Worst-case horizontal safety-distances & cumulative exposure

Transmission system	GSM 900	GSM 1800	UMTS 2100
Frequency (MHz)	900	1800	2100
ICNIRP limit, power density (W/m2)	4.75	9	10.00
ICNIRP limit, field strength (V/m)	41.30	58.3	61.00
Specific field strength at 50m, ICNIRP ratio	0.08		0.10
Cumulative field strength ration (mV/m)	0.08		0.13
Cumulative ICNIRP (%)	1		

Annex : Questionnaires Administered