

ENVIRONMENTAL IMPACT STATEMENT

FOR

THE PROPOSED RAMOGI-BIDIBIDI GREENFIELD TELECOM
MAST TO BE LOCATED IN BATULU VILLAGE, ONOKO PARISH,
RAMOGI SUB COUNTY IN YUMBE DISTRICT *AT COORDINATES*
N03.47897, E031.37064 at 850 m.a.s.l
(ETO/UG/40083/ARU)

Prepared for Submission to

On behalf of:



National Environment Management Authority
P.O. Box 22255,
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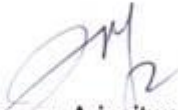
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LIST OF ACRONYMS AND ABBREVIATIONS

(U):	Uganda
BPEO:	Best Practicable Environmental Option
BTS	Base Transceiver Station
CAA:	Civil Aviation Authority
CFCs:	Chloro-fluoro-Carbons
CVs:	Curricula Vitae
dB:	Decibel
DEO:	District Environment Officer
EA:	Environmental Audit
EHS:	Environment Health and Safety
EIA:	Environmental Impact Assessment
EIRP:	Equivalent Isotropically Radiated Power
EIS	Environmental and Impact Statement
EIS:	Environmental Impact Study
EMF:	Electromagnetic Field
EMMP:	Environmental Management and Monitoring Plan
EMP:	Environmental Management Plan
EP:	Environmental Practitioner
ESM:	Environmental, Social and Management
FSR:	Final Scoping Report
GHG:	Green House Gas
HFCs:	Hydro-fluoro-carbons
ICNIRP:	International Commission on Non-Ionising Radiation Protection
IEA:	Independent Environmental Auditor
IFC:	International Finance Corporation
ITU:	International Telecommunications Union
Km:	Kilometres
l:	Litre
LC:	Local Council
Ltd:	Limited
m:	Metres
MoICT:	Ministry of Information and Communication Technology
MoWT:	Ministry of Works and Transport
MW:	Mega Watts
NEMA:	National Environment Management Authority
ODSs:	Ozone Depleting Substances
PCBs:	Polychlorinated Biphenyls
PPE:	Personal Protective Equipment
RF:	Radio Frequency
SAR:	Specific Absorption Rate
SOPs:	Standard Operating Procedures
ToR:	Terms of Reference
UCC:	Uganda Communications Commission
WHO:	World Health Organisation

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EXECUTIVE SUMMARY

Introduction

Eaton Towers is a leading, independent, Telecom Tower Company in Africa. Eaton Towers acquires, builds and manages shared telecom infrastructure, leasing it to mobile operators. The company intends to establish a Base Transceiver Station (BTS) in Batulu Village, Onoko Parish, Ramogi Sub County in Yumbe District. This infrastructure development like most other developments has the potential of impacting negatively on the environment and therefore in accordance with the requirements of the Third Schedule of the National Environment Act Cap 153 of the Laws of Uganda. The project falls under the category of activities out of character with the surrounding (Annex 3 1(a) of the Guidelines for Environmental Impact Assessment in Uganda, for which an Environmental Impact Assessment (EIA) is to be carried out.

The estimated total investment cost for the facility is currently estimated at **100, 000,000 (One Hundred Million)** Uganda shillings.

This, report called the Environmental Impact Statement (EIS), presents the findings of the Environmental Impact Study for Ramogi- Bidibidi Base Transceiver Station and has been produced in accordance with the requirements of Regulation 14(1) of the EIA Regulations (1998).

Objective, methodology and Scope of the EIA

The general objective of the EIA was to identify and assess the potential environmental and social impacts of the proposed project with a view to eliminate/minimize the negative impacts.

The scope of the EIA was guided by provisions in the first schedule of the EIA regulations for Uganda and the approved terms of reference for the study, as well as the local Ugandan legislation.

A number of methods were applied during the EIA. These included literature review, stakeholder consultations, field investigations, and impact analysis.

The potential positive and negative environmental and social impacts of the proposed project were identified, evaluated and their significance determined. Assessment of the impact significance was based on a combination of the extent and duration of the impact resulting in the magnitude of the potential impact. The magnitude of the potential impact was measured on a scale of Low, Medium or High. The significance level of the impact was then measured on a scale of Negligible, Minor, Moderate, Major.

Policy, Legal and Institutional Framework

A review of policies, laws and institutional framework was carried out. The national policy, legal, regulatory and institutional framework pertinent to the proposed project and to which the developer should comply, are discussed.

Project Description

The Ramogi- Bidibidi Base Transceiver Station (BTS) is to be located in Batulu Village, Onoko Parish, Ramogi Sub County in Yumbe District at coordinates N03.47897, E031.37064 at 850m.a.s.l (WGS 1984). The area to be occupied by the BTS is 15m X 15m.

The Base Transceiver Station (BTS) will consist of antennas mounted on top of a building that transmit and receive radio waves, back-up generator sets, an equipment room, a cooling system for the equipment, battery sets for powering the equipment, microwave units (for relaying and routing calls) and base load controllers.

The equipment and materials expected to be used during the implementation of the project shall include generators, batteries, microwave units, cooling fans, air conditioners and their associated refrigerants to energy (in form of mains electricity, diesel for running the generators, battery sets, and lubrication oil) that is required to power such equipment.

Project outputs: Key among these are emissions from the use of fossil fuels; chlorofluoro carbons (CFCs) and hydrofluorocarbons (HFCs) related emissions from the use of refrigerants; used oil; used battery sets along with the chemicals contained in them; oil filters from generator servicing; coolant from generators; air filters; and wastewater from cleaning and machine servicing operation.

Then project will employ approximately 10 casual and skilled workers during the construction phase During the operation phase, the workers will vary from security guards, care takers, maintenance engineers, etc.

Construction phase activities shall include site clearance, excavation, surfacing of cleared areas, and wiring, equipment installation, Testing and commissioning, among others.

Operation phase activities shall include BTS operation and equipment maintenance.

Environmental and social baseline

There was no significant animal population found at the site. However, a number of birds above the site. These included Pied Hornbill, .Hadada Ibis, Common Bulbuls, Grey headed Sparrows, and Black Kite.

Most of the natural vegetation in the proposed area is Savannah woodland. It is characterized by trees such as Isoberlinia doka, Daniehliveri and Afzelia Africana.

The population near the surrounding environment uses borehole water and protected spring sources.

Consultations were held with identified stakeholders among who included Civil Aviation Authority, Uganda Communications Commission, Yumbe District Environment Officer, and the Department of Occupational Safety and Health, and Local residents within 50m radius of the site. Findings from the consultations did reveal the need for proper landownership documents to be attained, ensuring that all construction works are kept away from the road reserve, and the need to minimise noise generated from standby generator.

Neighbours consulted also raised fears concerning their health as a result of long term exposure to Electromagnetic Field (EMF) radiations, although they welcomed the proposed development provided Eaton Towers implemented the mitigation measures suggested.

Impact assessment and mitigation measures

The construction and operation of Ramogi- Bidibidi BTS will create both positive and negative impacts. Positive impacts shall include better signal quality and strength for the network subscribers; greater network capacity, and overall improvement of Eaton Tower's infrastructure; employment opportunities during construction and supply of building materials; and increased tax revenues for the Government of Uganda.

The potential negative impacts of the proposed project are summarised in the table below:

Table 0.1: Summary of anticipated Negative Impacts and corresponding mitigation measures

Construction phase impacts	
Impact	Mitigation measures
Site acquisition for the BTS, and access road	Ensure that appropriate legal requirements have been met with regard to land occupancy, land ownership or usage rights, notice and compensation.
Noise and dust	<ul style="list-style-type: none"> Regularly wet the floor to limit dust generation Carry out construction works during day time Delivery of materials to the site should be strictly during day time
Occupational hazards	<ul style="list-style-type: none"> Personnel will be trained and sensitised about safety procedures for the construction activities. Guidelines and regulations on site safety will be communicated to all workers and contractors. Appropriate warning signage will be displayed around the construction site Appropriate Personal protective gear will be provided and a functional first aid kit kept on site throughout the construction stage; Daily tool box talks will guide works
Poor solid waste disposal	<ul style="list-style-type: none"> The contractor will be held accountable to remove all packaging material from the construction site as soon as it is generated; Waste materials will be collected and removed from the site by the contractor; Temporary storage will be constructed for the materials particularly cement and metals or substances that could be hazardous to health to prevent unauthorised access;
Possible Collapse of the antenna	<ul style="list-style-type: none"> Use qualified staff during construction; Ascertain the quality of materials to be used. Only trained and certified workers will be used to install, maintain, or repair electrical equipment, under supervision of the developer.
Operation Phase impacts	
Soil and Ground Water Pollution	<ul style="list-style-type: none"> Maintain Spill Kit at Base transceiver station; Establish and implement fill and leak prevention procedures. Carry out regular integrity testing on the tanks to detect leakages; Fit standard safety features on the tanks;
Impacts on public health	<ul style="list-style-type: none"> Use warning signage Have sanitary facilities in place at BTS;
Air Pollution (Greenhouse gas emissions from generator)	<ul style="list-style-type: none"> Minimise generator running time; Use fuel efficient generators; Ensure regular maintenance of the generator The generator exhaust should be raised to at least 7m from the ground.
Background Noise at the BTS	<ul style="list-style-type: none"> Ensure that the generator is fixed with a silencer and regularly serviced Carryout periodic noise measurements to ensure that the noise levels at the site are in conformity with National noise standards and control regulations.

Soil and underground water pollution due to accidental spillage on the surface during refueling and oil servicing.	<ul style="list-style-type: none"> House the generator in a sound proof structure, and ensure that its fitted above a double lined concrete bund Ensure drip trays are in place to collect leakage from connection and discharge points of the generator. Ensure spill contingency counter measures on-site;
Exposure to radio frequency (RF) and EMF	<ul style="list-style-type: none"> Ensure presence of warning signs related to RF and EMF exposure at the site. During implementation, carry out EMF measurements, keep records, and ensure that the levels are within permissible limits.
Hazardous wastes	<ul style="list-style-type: none"> Ensure existence of operational contracts with competent hazardous waste handling firms; Develop and implement waste management plan (WMP) that provides details of storage, handling and disposal methods particularly of hazardous wastes.
Lightning effects	<ul style="list-style-type: none"> Ensure Properly earthed site and equipment;
Air Quality; Generator fumes, dust, odour	<ul style="list-style-type: none"> Ensure proper maintenance and regular servicing of the generator to enable remove toxic substances (un-burnt hydrocarbons and oxides of carbon and nitrogen) before they are emitted to the atmosphere.
Aviation accidents	<ul style="list-style-type: none"> Ensure that the mast/tower is properly lit as per CAA specifications
Fire outbreaks	<ul style="list-style-type: none"> Avail well serviced fire extinguishers for the station Ensure NO cooking takes place in and around the BTS Generator should always be switched off when re-fuelling A strict "No Smoking" regulation should be put in place.
Decommissioning Phase Impacts	
Decommissioning accidents	<ul style="list-style-type: none"> Employ experienced BTS decommissioning personnel Develop and implement a decommissioning plan
Decommissioning wastes	<ul style="list-style-type: none"> Employ experienced BTS decommissioning personnel Develop and implement a decommissioning plan

An Environmental Management Plan for implementation by Eaton Towers has been designed. This embeds proposed mitigation measures for managing potentially adverse impacts, timing for monitoring and monitoring indicators (Table 7-1)

Conclusion and recommendations

Conclusion

The project will result into a number of impacts on the environment. These impacts will be both positive and negative. Measures to mitigate each of the identified the negative impacts have been recommended to ensure an environmentally sound development. Once these measures are implemented, the impacts will be minimized.

In compliance with EIA and Environmental Audit Regulations, regular environmental audits and environmental monitoring of the Ramogi- Bidibidi BTS operations should be carried by certified environmental auditors and reports submitted to NEMA for review to ascertain compliance.

Recommendations

The developer must ensure that the mitigation measures proposed in this report are implemented.

The developer should also ensure that the ESMP presented under this report is available to the relevant parties responsible for implementing it.

During construction, adequate supervision by a qualified structural engineer should be undertaken to ensure structural integrity of the BTS.

The mitigation plan and environmental monitoring if implemented will ensure that any other adverse impacts that come up in the course of implementing the project as well as its operation are addressed immediately. This should be carried out by the Company's EHS Officer.

An independent environmental assessment should be undertaken in case the developer wishes to introduce any other structure/activity which is not considered under this assessment.

Regular environmental audits of the facility will be carried out at least once every year preferably by a competent and NEMA certified environmental auditors and reports submitted to NEMA for review and ascertain compliance with terms of approval.

Eaton Towers should conduct regularly community sensitisation particularly with regard to the effects of EMF.

In the event of decommissioning the facility, an environmental audit will be undertaken to guide this activity. The site will be restored to as near as possible to its original state and as per the requirements of the National Environment Act, Cap 153, part IX, section 67.

To supplement the ESMP, all contractors should be called upon to develop the following Environmental management plans;

- a spill prevention and counter measure plan
- a waste management plan
- occupational health and safety plan
- environmental restoration plan

1. INTRODUCTION

1.1 Background to the Study

Uganda's telecommunication industry has experienced tremendous growth since the advent of cellular telephone operations in the country in 1995. According to the Uganda Communications Commission (UCC), it is now one of the most vibrant in Africa with close to 12 million subscribers and about 350,000 fixed lines (UCC, 2013). The growth rate in terms of penetration stands at 45%.

Eaton Towers is a leading, independent, telecom Tower Company in Africa

Founded in 2008 by Sanjiv Ahuja (ex CEO Orange), Alan Harper (ex-Vodafone UK MD) and Terry Rhodes (ex Celtel co-founder), Eaton Towers acquires, builds and manages shared telecom infrastructure, leasing it to mobile operators. The company is focused exclusively on Africa with more than 5000 towers in 7 countries. Operational since 2010, Eaton Towers is majority owned by the sixth global emerging markets private equity fund (\$3billion) of Capital Group Private Markets (www.thecapitalgroup.com/pe) and minority shareholders including a private equity fund advised by DPI (www.dpi-llp.com) and management.

Network build and operating costs are significantly higher in Africa, yet revenues per customer are falling and regulators are seeking additional rural coverage and improvements in quality of service. Therefore mobile network operators are actively seeking to reduce capital and operating costs by sharing infrastructure.

Eaton Towers' customers include major African mobile operators such as Airtel, MTN, Africell, Tigo, Vodacom and Vodafone.

Eaton Towers Uganda Limited intends to establish a Base transceiver station in Batulu Village, Onoko Parish, Ramogi Sub County in Yumbe District to be collocated by MTN.

This infrastructure development, like most other developments is likely to have negative impacts on the environment though very negligible, in accordance with the requirements of the Third Schedule of the National Environment Act Cap 153 of the Laws of Uganda, the establishment and operation of a transceiver station site falls into the category of projects for which an Environmental Impact Assessment (EIA) is required at time of establishment.

1.2 Objectives of the Environmental Impact Assessment

- Identify and assess impacts of the proposed development or project;
- Provide a comprehensive assessment of impacts that are resulting from the project, in accordance with the specified impact assessment methodology;
- Where alternatives have been assessed, make recommendations for the best practicable environmental option (BPEO);
- Recommend actions to mitigate negative impacts or enhance benefits; and
- Provide recommendations for monitoring programmes.
- Consult all stakeholders of the project

1.3 Scope of the Environmental Impact Study

The geographical scope was limited to the site boundaries and the surrounding that will or may be affected by the establishment. The study also utilised the information that was provided by the developer (Eaton Towers) and as was sourced from other sources (primary and secondary).

1.4 Estimated cost of the facility

The total facility cost is currently estimated at Ugx 100,000,000 (One hundred Million Uganda Shillings only).

1.5 Study Methodology

The study was conducted in line with the 1997 NEMA Guidelines for Environment Impact Assessment in Uganda. This EIA was conducted with Particular attention given to issues listed in the First Schedule of the Environmental Impact Assessment Regulations (NEMA 1998), approved terms of reference for the EIA (Appendix I). Literature review, subject site visits, consultations with institutional and community stakeholders and experts, field activities including direct observations and photography were used.

Review of relevant literature- Literature including the national legislation, Yumbe District Development Plan, among others was reviewed to obtain the regulatory and institutional context relevant to the project, and the communication sector in Uganda. The project schematic drawings provided by the developer, showing project spatial relationship with the neighbourhood infrastructure and utilities were also referred to.

Consultations with stakeholders: Consultative meetings were held with major stakeholders and regulatory institutions to ensure public participation in the EIA process as required by the National Environmental Act, CAP 153, EIA Regulations 1998, and Conduct of Environmental Practitioners Regulations, 2001 and Guidelines for EIA in Uganda. The aim of these consultations was to identify and take note of environmental concerns and views of the stakeholders at an early stage so that appropriate mitigations are incorporated into the final implementation of the project. The key stakeholders consulted included the LC1 of the village, the members of the immediate community around the proposed site

Chapter 5 presents concerns raised by stakeholders and proposed actions to address them.

Onsite Assessments: Direct observations and photography were also used to obtain information on the subject site and the neighborhood.

1.6 The Facility Operator/Developer/ Project Proponent

The facility is operated and fully owned by;
Eaton Towers Uganda Limited
Plot 4, Katonga Road Nakasero
P. O. Box 300, Kampala, Uganda

2. POLICY, LEGAL AND INSTITUTIONAL FRAMEWORK

This section provides an overview of the relevant policy, legal and institutional framework in Uganda including those specific to the telecommunications sector.

2.1 Policy Framework

2.1.1 *The National Environment Management Policy (1994)*

This policy aims to promote sustainable economic and social development. The policy provides a framework for EIA to be conducted for any policy or project that is likely to have adverse impacts on the environment. This statement is further embedded in the National Environment Act, Cap 153, which makes EIA a legal requirement for eligible projects and policies.

Eaton towers is conducting this study in line with this policy.

2.1.2 *Communications Policy*

The Policy was established in 1996 and has since been reviewed to meet the rapidly evolving telecommunications sector and market in Uganda. Some of the key elements of the Policy included: The creation of an independent regulator for the sector; Implementation of a limited competition period especially for the first players to venture into the Cellular telephony market in the country; and unbundling the state of the then government owned Uganda Posts and Telecommunication Corporation. These include:

- Increasing telecommunication Density from 0.26 lines per 100 persons to 2.0 lines per 100 persons;
- Improving telecommunications facilities and service quality;
- Meeting un-served customer demand for telecommunication services; and
- Increasing the geographical coverage of telecommunication services throughout the country, ensuring a balanced and coordinated telecommunications network through licensing, regulation and standardisation.

Eaton towers aim at achieving and increasing coverage in relation to the communication objectives.

2.2 Legal Framework

2.2.1 *The Constitution of the Republic of Uganda, 1995*

This is the most supreme legislation in the Country and contains a number of articles, one of which is aimed at addressing environmental issues. Article 39 of the constitution states that, “Every Ugandan is entitled to a Clean and Healthy Environment”. *Eaton towers is conducting this study in line with this policy.*

2.2.2 *Uganda Communications Act, Cap 106 and its related Regulations*

The Uganda Communications Act established the Uganda Communications Commission (UCC) and also led to the liberalisation of the Telecommunications sector thus opening the sector to competition. The Act is the principal law governing the activities in the Communications sector and telecommunications in particular. Section 43 (3) of the Act addresses land use issues in as far as telecommunications installations are concerned by stating that: “an operator shall do as little damage as possible to the land and to the environment and shall pay fair and adequate compensation to all interested persons for any damage or loss sustained”. *The developer acquired the land taking into consideration the regulation above, all the necessary compensations were covered.*

2.2.3 The Telecommunications (licensing) Regulations, 2005:

- Regulation 5 (4a) states that: a telecommunications licence may be a facility based licence issued to an operator who owns and operates a telecommunications network, system or facility that offers telecommunications switching or transmission capacity or services to other licensed telecommunications providers, businesses, consumers or end-users.
- Regulation 17 (1) also states that: a telecommunication licence shall be subject to approval by the commission, of all telecommunications equipment, apparatus or devices forming part of, connected to, operated or used in a network or system for the provision of telecommunications service in accordance with the equipment type approval regulations.
- Regulation 18 (1) states that: “a telecommunications licence shall authorise the commission to do the following in respect of every telecommunications system, network or equipment that require any form of construction or installation before operation or use;
 - approve the location and manner of installation of a system or network;
 - approve the installation, apparatus and spare parts, necessary;
 - prescribe additional equipment that may be necessary for the proper functioning of a network or system;
 - specify the operating and technical characteristics of an installation; and
 - Issue a construction or installation permit signifying the approval of the Commission to commence installation or construction.
- *The Communications (telecommunications and Radio Communications equipment type approval) Regulations, 2005:*
 - Regulation 19 (1) of these regulations states that: before carrying out any installation of a facility, an operator shall obtain from the Commission a facility installation permit.

Eaton towers has applied for the installation permit as attached in appendix IV

2.2.4 The Environment (Waste Management) Regulations, 1999

Those Regulations made in accordance with Section 54 (2) of the National Environment Act (CAP 153) were meant for management of waste that NEMA may consider necessary. Under Regulation 5(1); a person who owns or controls a facility or premises, which generate waste, shall minimize the waste generated by adjusting the following cleaner production methods;

- Improvement of the production process thoroughly,
- Conserving raw materials and energy,
- Eliminating the use of toxic materials,
- Reducing toxic emissions and waste,
- Monitoring the production cycle from beginning to end.

Under Regulation 11(1), no person shall discharge any hazardous substances, chemicals, oil or mixture containing oil in any water or any other segment of the environment except in accordance with guidelines prescribed by the Authority in consultation with the Lead Agency. Under subsection 4: the owner or operator of a production or storage facility, motor vehicle or vessel from which a discharge occurs shall mitigate the impacts of the discharge by giving immediate notice of the discharge to NEMA and other Government officials: and immediately beginning cleanup operations using the best available methods. Until that person has undertaken mitigation measures, NEMA may seize the Production or storage facility, motor vehicle or vessel.

Eaton Towers will outsource a NEMA registered waste management company at the BTS to manage and collect all wastes generated including both hazardous and non-hazardous wastes.

2.2.5 *The Nationals Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, 1999*

The Standard for Effluents or Wastewater before it's discharged into water is prescribed in the First Schedule to these Regulations. Under section 4 General Obligations to mitigate pollution the following points are emphasized.

Every Industry or establishment shall install at its premises, anti-pollution equipment for the treatment of effluent chemical discharge emanating from the Industry or establishment. Anti-pollution equipment installed shall be based on the best practicable means environmentally sound practice or other guidelines as the Executive Director may determine. It is an offence if person contravenes these Regulations and is liable, on conviction, to imprisonment for term not exceeding eighteen months or to fine not less than 180,000/= and not more than 18 million shillings or both.

2.2.6 *Town and Country Planning Act, Cap 30*

The Act establishes the Town and Country Planning Board, which is charged with the duty of planning and orderly development of towns and rural areas. The 1995 Constitution of the Republic of Uganda provides that, *"the Government may, pursuant to laws made by parliament and government policies, regulate the use of land"*.

The architectural plans, drawings and site layout plans of this BTS have been submitted to Yumbe District Local Government for approval (see appendix VI) in accordance with this policy.

2.2.7 *National Environment Act, Cap 153*

The Act is the most important piece of environmental legislation and it among other things established the National Environment Management Authority (NEMA) as a statutory body that is charged with the coordination, monitoring and supervision of environmental management issues. The Act sets out a number of regulations and standards that have to be complied with if there is to be effective environmental management. With reference to the project the relevant ones include;

- The *EIA Regulations of 1998*, which specify the types of projects for which an EIA should be carried out. An EIA should be conducted for planned activities that may, are likely to, or will have significant adverse impacts on the environment;
- *Waste Management Regulations of 1999*, for addressing all types of waste (non-hazardous and hazardous) and its storage and eventual disposal;
- *Management of Ozone Depleting Substances and Products Regulations 2001*, guide in the use and handling of Ozone depleting substances. The operation of Telecommunication Base stations particularly use refrigerants in the air conditioning Limited with some of them being potentially hazardous to the ozone layer.

Commercial refrigeration and air conditioning equipment are listed in the First Schedule of the regulations among some of the controlled products.

Part 1(a) and (b) of the Sixth Schedule (Records to be maintained for controlled substances and products) of the regulations require that Dated records be kept of;

- ✓ Actual quantity of each controlled substance/product purchased from a Uganda supplier, wholesaler or distributor; and
- ✓ Actual quantity of each controlled substance/product used and the end use category or purpose.
- *The Standards for Discharge of Effluent into Water or on Land Regulations of 1999*, provide for standards (maximum permissible limits) for effluent or waste water before its discharged into water or on land; a general obligation to mitigate pollution; and a duty to keep records of the amount of waste generated and parameters of the discharges;
- *Mountainous and Hilly areas Management Regulations 2000*, restricts the use of mountainous and hilly areas by a person who desires to carry out any development activity thus the need for an environmental impact assessment; makes it a duty of every land owner or occupier whose land is situated in a mountainous and hilly area to take measures to reduce water runoff through the grassing of medium and steep slopes; and also makes it an offence for a person to dispose of hazardous wastes on a mountainous or hill area;
- *Noise standards and control Regulations of 2003*, which aim to ensure that people of Uganda are able to enjoy a healthy and tranquil environment through regulation of noise levels; and
- Regulation 32(2) of the National Environment (Environmental Impact Assessment) Regulations, 1998, requires that a developer carries out an environmental audit within a period of 12 months and not more than 36 months after the completion of a project or the commencement of operations. The audit may be required sooner if the lifecycle of the project is shorter than the afore-mentioned periods.

By undertaking this EIA, Eaton towers is in line with the provisions in the NEA.

2.2.8 Occupational Safety and Health Act, 2006

Among the key issues it addresses is the protection of employees by employers in as far as safety in the work place issues are concerned. Section 13 of the Act states that, *"it is the duty of an employer to take, as far as is reasonably practicable, all measures for the protection of his or her workers and the general public from the dangerous aspects of the employer's undertaking at his or her own cost"*.

Section 18 requires employers to monitor and control the release of dangerous substances into the environment, where there is a major handling of chemicals or any dangerous substance which is liable to be airborne or to be released into rivers, lakes or soil and which are a danger to animal and plant life.

Eaton towers shall ensure that EHS measures are put in place during both construction and operation of the mast.

2.2.9 The National Environment (Noise Standards and Control) Regulations, 2003

Under sections 23 and 107 of the Environment Act these regulations are aimed at ensuring the maintenance of a healthy environment for all people in Uganda, the tranquility of their surroundings and their psychological well-being by regulating noise levels (*Table 3.1*). This is done through prescribing the maximum permissible noise levels from a facility or activity to which a person may be exposed and the provision for control of noise and for mitigating measures for the reduction of noise. Under regulation 8, it is the duty of the owner of a facility or premises to use the best practicable means to ensure that the emission of noise from his/her premises does not exceed the permissible noise levels.

Section 6(1) of these regulations requires that the maximum noise levels from a facility in the general environment specified in Part I of the First Schedule as “mixed residential (with some commercial and entertainment)”, shall not exceed 55dBA and 45dBA during day and night time respectively. This regulation has a direct influence on daytime or night time noise levels generated at the facility during operational phase.

Table 3.1 Maximum Permissible noise levels at the BTS site

Facility	Noise limits dB (A) (Leq)	
	Day	Night
Any building used as a hospital, convalescence home, home of the aged, sanatorium, institutes of higher learning, conference rooms, public library, environmental or recreational sites	45	35
Residential Buildings	50	35
Mixed residential (with some commercial and entertainment)	55	45
Residential = industry or small scale production + Commerce	60	50
Industrial	70	60
Time Frame: Day – 6:00am – 10:00pm; Night 10:00pm – 6:00am. The time frame takes into consideration human activity.		

The generator to be used shall be fitted with an acoustic muffler/silencer to reduce on the noise emitted.

2.2.10 Employment Act, 2006

The Act revises and consolidates the laws governing individual employment relationships, and provides for other connected matters. Section 5(1) of the Act addresses the issues of forced labour. It states that, “No person shall use or assist any other person, in using forced or compulsory labour”.

2.2.11 Workers Compensation Act, 2000

The Act provides for compensation to workers for injuries suffered and scheduled diseases incurred in the course of their employment. Section 3(1) of the Act sets out the employer’s liability in as far as compensation for injury to an employee is concerned. It states that, “if personal injury by accident arises out of and in the course of a worker’s employment, the injured worker’s employer shall be liable to pay compensation in accordance with the Act”.

Eaton Towers shall observe the act above during both construction and operational phases of the project.

2.2.12 Civil Aviation Authority Act, Cap 354

The Act provides for the establishment of the Civil Aviation Authority (CAA), its duties, powers and management for other matters connected therewith.

Of particular relevance to the proposed project is regulation 46(1) of the Act on “zoning and land use control” which states that the line Minister on the recommendations of the authority, may by order impose prohibitions or restrictions on the use of any areas of land or water in the vicinity of an aerodrome as may be necessary to ensure safe and efficient civil aviation; and without limiting the generality of the foregoing may give directions:

- for restricting the height of trees and other natural and man-made structures upon any land and within the vicinity of an aerodrome; and
- For extinguishing any private right of way over land within the vicinity of an aerodrome, among others.

In this regard, the BTS has been approved by CAA, see appendix III

2.3 Institutional Framework

2.3.1 The Ministry of Water and Environment

The Ministry of Water and Environment is the line ministry responsible for the formulation and enforcement of environmental related policies, laws and regulations in Uganda. Its main functions include:

- Mobilisation of resources required to run and implement environmental related projects and related issues;
- Overall responsibility for environmental policy formulation and implementation;
- Introduction of new draft laws and regulations to Parliament and draft amendments of existing laws and regulations; and
- Coordination with local governments on environmental related issues.

The Developer shall ensure continual coordination with the Local Governments Authorities throughout the operational phase of the project

2.3.2 National Environment Management Authority (NEMA)

The National Environment Management Authority was established by the National Environment Act as a statutory body responsible for the coordination, monitoring and supervision of all environmental activities.

Eaton towers shall ensure carrying out regular audits as a way to monitor all the activities during operation and after construction.

2.3.3 Ministry of Information and Communication Technology

This Ministry is tasked with overseeing communication and broadcasting Limited related matters in Uganda. The mission of the Ministry is to promote the development of Information and Communications Technology infrastructure and services throughout the entire country.

2.3.4 Uganda Communications Commission

Established in 1997 by the Uganda Communications Act, Cap 106, the Uganda Communications Commission (UCC) is solely responsible for regulating and promoting development of the communications sector in the Country. Its vision is, a Uganda in which development is facilitated through universal access to communications services largely delivered through the private sector.

2.3.5 Civil Aviation Authority

The Civil Aviation Authority (CAA) was created by an Act of Parliament in 1994 as a state agency of the Ministry of Works and Transport (MoWT). The mandate of the CAA is to coordinate and oversee Uganda's aviation industry, including licensing; regulation; air search and rescue; air traffic control; ownership of air ports and aerodromes; Ugandan and international aviation law; representing Uganda in an international capacity to the aviation community; and to all other aviation matters. ([en.wikipedia.org/wiki/Civil Aviation Authority of Uganda](https://en.wikipedia.org/wiki/Civil_Aviation_Authority_of_Uganda)). With regards to the proposed project, the CAA is responsible for checking and ensuring that the proposed Base Transceiver Station is not located in a known flight path where it may pose a danger to aircrafts. /

3. PROJECT DESCRIPTION

According to regulation 14 (1) of the EIA Regulations (1998), the environmental impact statement shall provide a description of-

- (a) The project and of the activities it is likely to generate
- (b) The proposed site and reasons for rejecting alternative sites
- (c) Material inputs into the project
- (f) Technology and processes to be used
- (g) The products and by-products of the project

3.1 Location of the proposed project

The Ramogi- Bidibidi base Base Transceiver Station is to be located in Batulu Village, Onoko Parish, Ramogi Sub County in Yumbe District at coordinates N03.47897, E031.37064 at 850m above sea level. The area coverage of BTS is 15m*15m.



Figure 3.1 Google aerial view of the proposed area for Ramogi- Bidibidi BTS its environs

3.2 Project components

The Base Transceiver Station (BTS) will consist of antennas mounted on top of a building that transmit and receive radio waves. Other components at the BTS will include back-up generator sets, antennas, an equipment room that forms the major component of Base Transceiver Station operations, a cooling system for the equipment, battery sets for powering the equipment, microwave units (for relaying and routing calls) and base load controllers.

The BTS works by transmitting radio signals from mobile phones (*a mobile phone is a low-powered two-way radio - converting human voice and data messages into radio waves*) when a call is made to the nearest base transceiver station. Once a signal reaches the base transceiver station, it is transmitted to the main telephone network where it is transferred to the network of the person receiving the call.

In order to send and receive calls, a mobile phone must be within range of a transmitter mast/tower with each mast only able to handle a fixed number of calls. Therefore, if there are several mobile phone users in different areas there is need to ensure that there are masts within their geographical range.

3.2.1 Inputs

A number of inputs form the operations of the BTS. They range from, among others, equipment such as generators, batteries, microwave units, cooling fans, air conditioners and their associated refrigerants to energy (in form of mains electricity, diesel for running the generators, battery sets, and lubrication oil) that is required to power such equipment.

3.2.2 Outputs

The various inputs that go into BTS operations are solely geared at ensuring that the station runs efficiently and effectively so that there is good network coverage (key output) available for mobile phone communication. It has to be emphasised that there are also some non-product outputs (wastes) that emanate from the operations. Key among these are emissions from the use of fossil fuels; chlorofluoro carbons (CFCs) and hydrofluorocarbons (HFCs) related emissions from the use of refrigerants; used oil; used battery sets along with the chemicals contained in them; oil filters from generator servicing; coolant from generators; air filters; and wastewater from cleaning and machine servicing operation.

3.2.3 Project workers

The number and category of workers to be employed during the construction phase shall include about 10 workers both casual and skilled workers for example electrical engineers, porters, among others. The number and category of workers to be employed during the operation phase shall include both contractual and permanent workers for example the security guards, care takers, Engineers among others.

3.2.4 Planned activities

Construction Phase

- Site clearing
- Excavation
- Backfilling the foundation
- Building construction
- Grounding wire /earthling
- Construction of guard house, control building and fence
- Erection of equipment
- Testing and commissioning

Operation and Maintenance

- BTS and equipment maintenance

4. BASELINE ENVIRONMENTAL AND SOCIAL CONDITIONS

Regulation 14 (1) of the EIA Regulations (1998) requires that an environmental impact statement shall provide a description of-

(c) The potentially affected environment

In line with the above-mentioned legislative requirement, this Chapter of the Environmental Impact Statement provides a description of the biological, physical and socio-economic environment that could potentially be impacted by the proposed establishment of a base transceiver station in Batulu Village.

The description of the affected environment is based on a review of relevant literature, as well as on-site investigations undertaken by the EIA team.

4.1 Biophysical environment

4.1.1 Surroundings of the project site

The BTS site is situated in an environmentally sensitive area; that is to say within residential area with permanent and well planned structures. Below is the pictorial view of the proposed project area and its surroundings.



Figure 4.1: pictorial view of the project site and its surroundings

4.1.2 Climate

District level information has been used while describing the climate of the subject area. Aspects of Climate that are of particular concern to the proposed site are the amount, incidence and duration of rainfall, temperature, wind, humidity and others. The district experiences a two seasonal rainfall, light rains between April and October. The wettest months are usually August-September with >120 mm/month. The period December-February is dry with less than 60 mm/month. The mean annual rainfall is 1,250 mm. The Mean monthly evaporation ranges from 130mm-180mm.

The prevailing wind is from the east to the west with frequent windstorms during the dry season. Temperatures are generally high during the nights of dry seasons (Dec-March) similar to those during day hours whereas during wet seasons, temperatures remain high during day and fairly low during the night hours.

4.1.3 Vegetation

About 80 percent of the total area of Yumbe is for agriculture, most of it is cultivated. Forestry and woodlands cover a very small part i.e. only 17.1 percent of the total area. The district has three central forest reserves; Mt Kei natural forest reserve which is also a conservation area, Lodonga forest reserve, and Koloa forest reserve. The remaining part is either ungazetted community forests or woodlands. Most of the natural vegetation in the proposed area is Savannah woodland. It is characterized by trees such as Isoberlinia doka, Daniehliveri and Afzelia Africana. [The proposed site is not located in any forest reserve.](#)

4.1.4 Fauna

There was no significant animal population found at the site. However, a number of birds above the site. These included Pied Hornbill, .Hadada Ibis, Common Bulbuls, Grey headed Sparrows, and Black Kite.

4.1.5 Topography

The district is generally flat, although in the eastern part there are several hills, and in the north there are two hills called Midigo and Kei. Most parts of the District are agriculturally productive except the eastern part of Romogi, Kuru and Odravu sub counties. The district has loamy soil. Gravels are evident in some isolated parts of Kuru, Romogi and Odravu sub counties. While towards the eastern part of the district along the Nile basin is sandy. [The site is located on a relatively flat area.](#)

4.1.6 Soils

The District has loamy soil. Gravels are evident in some isolated parts of Kuru, Romogi and Odravu sub counties. While towards the eastern part of the district along the Nile basin is sandy. Most parts of the District are agriculturally productive except the eastern part of Romogi, Kuru and Odravu sub counties.

4.1.7 Mineral resources

Kei and Midigo have qualitative clay for making bricks, tiles and pots and all clay products. Neptune petroleum carried aerial survey in the south western part of the District. This revealed potential for the presence of petroleum products. However, the proposed site is not located in the southern areas of the district that revealed petroleum prospects.

4.2 SOCIAL ECONOMIC ENVIRONMENT

4.2.1 Demographics

According to the 2002 Uganda Population and Housing Census, Yumbe District population is projected to be 504,500 people, where there are 259,600 males (51.5%) and 244,900 females (48.5%). About 94 % of the population live in rural areas where as only about 6% live in the urban areas. The population growth rate is 7.9%, one of the highest in Uganda. This is attributed to high fertility rate of 7.1 and low mortality rates. To date, the district population is predominantly children and the elderly population (65 years +) constitute a meagre 3%. This makes the district total dependency ratio very high 1.24. Population density in 2011 is estimated to be 208persons /square KM. The district is predominantly comprised of Muslims (77%) followed by Catholics who constitute 14 %, Anglicans 8%, Pentecostals 0.7% and others 0.3%. [Source \(Yumbe District five year Development Plan 2010/11-2014/2015\)](#)

4.2.2 Physical Infrastructure

All the mobile telecommunication networks available in the country are accessible in the project location. There is availability of electricity in the area which will easily be connected to the base station to avoid running the generator during operation. The site shall also be easily accessible due to the existing good road network in the area.

4.2.3 Land Tenure

The largest proportion of land in the district is under freehold land tenure system which co-exists with leasehold forms of ownership. [The proposed site is located on land under free hold land tenure system.](#)

4.2.4 Economic Activities

Agriculture is the dominant economic activity of the district. The sector provides employment for 72 percent of the labour force. However, most of the agricultural activity is of subsistence nature. Various agricultural activities take place in the district including amongst others, crop farming (Cassava, sweet potatoes, sorghum, ground nuts, simsim, beans, rice tobacco and cotton). Farmers also do engage in fish farming and livestock husbandry which includes pigs, goats, local poultry, sheep, pets and cattle although its often than not less than 5 per household. [The proposed site surrounding environment is basically has subsistence agriculture as the main economic activity.](#)

4.2.5 Water Supply and Sanitation

The district entirely relies on exploitation of underground water to provide fresh water to the communities. The predominant technological option used is deep borehole drilling followed by shallow well construction. Due to climatical changes there has not been potentials for development of protected springs from the last three years. [The population near the surrounding environment uses bore holes and protected spring wells.](#)

4.2.6 Cultural Factors.

Yumbe district is largely inhabited by one major ethnic tribe (Aringa speaking Lugbara). They have a unified historical origin dating as far back as 1000 A. D. Although in the mid 21st Century, there has been a mix through intermarriages. The majority of the people in Yumbe District are of Nilo-hamites origin (99%) which includes Lugbara, Kuku, Kakwa and Madi. The Aringa speaking Lugbara constitute 93 percent of the population.

5 ANALYSIS OF ALTERNATIVES AND PROJECT NEED

Analysis of alternatives in Environmental Impact Assessments evaluates available options to the proposed action, so as to arrive at the most environmentally friendly alternative which maximises economic, social and environmental benefits resulting into minimal or insignificant environmental impacts.

5.1 Need for alternatives

“Alternatives” are defined as different means of meeting the general purpose and requirements of the activity, which may include alternatives to:

- (a) The property on which or location where it is proposed to undertake the activity;
- (b) The type of activity to be undertaken;
- (c) The design or layout of the activity;
- (d) The technology to be used in the activity; and
- (e) The operational aspects of the activity.

However, a range of alternatives exist, not all, which are appropriate for each EIA.

5.2 Project Need

Uganda's mobile sector has witnessed a huge growth since 2006. The number of registered subscribers has been steadily increasing since 2002. Despite the considerable growth in the sector, Uganda still lags behind the rest of Africa in terms of penetration. There is need to increase the infrastructure to tap into the latent market and boost telecommunications network in various areas of the country; hence the need to install more base and Base transceiver stations.

Establishment and operation of the BTS in Batulu Village will increase mobile telecommunication network coverage and signal strength. It will create employment thus improving the wellbeing and standards of living of a number of people.

5.3 Analysis of alternatives

This EIA study identifies and evaluates two alternatives to the proposed action.

- The “No – action” alternative; and
- The proposed “Action”.

5.3.1 The No Action alternative

The “no action” alternative ensures maintenance of the existing environmental characteristics and land use. Analysis of no action alternative is important in EIA studies because it allows decision makers to take an informed decision. This alternative means that the proposed development will not take place, but rather maintain the site under the present state or activity.

At the time of study, the no activity had yet been done regarding the construction of the BTS. The community in Batulu village will continue to face difficulties with accessing telecommunication signals due to network congestion. The “no action” alternative means that the roof top of the building will remain in its current state and the social and economic benefits associated with the presence of the BTS will not be attained.

5.3.2 The Action Alternative

The action alternative would see the implementation of the project as proposed by the developer and as described in this EIA report. A number of positive impacts such as increase in mobile telecommunication network coverage have been proposed.

It is commendable to consider the action alternative for enhancement of positive impacts and given that the developer will take all necessary mitigation measures as presented in this report and implement all measures as stated in the EMP to address the negative impacts brought about by this project implementation as well as engaging the respective stakeholders to ensure sustainable project operations

5.4 Conclusion

Basing on the above explanation and justification, it is appropriate to consider the project action alternative. In general, the associated impacts of project implementation would not be irreversible as discussed in chapter 8. With the implementation of mitigation measures and putting into consideration the EMP as presented in this report, the project would be environmentally and economically viable and thus the action alternative preferred.

However, the developer is advised to seek the necessary approvals from responsible authorities to guide development and monitoring by authorities is highly recommended

6 EVALUATION OF SIGNIFICANT ENVIRONMENTAL IMPACTS

This chapter identifies and evaluates significant environmental impacts related to the implementation of Ramogi- Bidibidi BTS in Batulu Village. While positive attributes of this project should be enhanced, mitigation measures should be put in place to minimize or eliminate the likely negative environmental impacts.

6.2 Impact assessment methodology

During the course of the EIA study, a number of likely impacts on the biophysical and socio-economic environment were identified and evaluated and appropriate mitigation measures were suggested. The predicted impacts have been categorized and assessed using the following criteria:

- Extent: Within limited area (<200m from site), local (200m up to 5 km) or wide up to 10km and Regional or Global.
- Duration: Temporary (1 year or less), Short term (1-3 years), Medium term (3 -5 years), long term (5 - 10 years) or Permanent;
- Magnitude of impact – Low, Medium or High
- Overall Assessment of impact/impact significance: Negligible, Minor, Moderate, Major

The description of the impact in relation to impact significance rating has been provided in Table 7.1 below.

Table 6.1 : Criteria for rating impact severity

Impact significance rating	Description of Impact
Very high	<ul style="list-style-type: none"> - Highly noticeable, irreparable effect upon the environment - Significant, widespread and permanent loss of resource - Major contribution to a known global environmental problem with demonstrable effects - Causing mortality to individuals of a species classified as globally or regionally endangered - Major exceedance of water/air quality and noise guidelines representing threat to human health in long and short term - Causing widespread nuisance both on and off site
High	<ul style="list-style-type: none"> - Highly noticeable effects on the environment, difficult to reverse - Widespread degradation of resources restricting potential for further usage - Significant contribution to a known global environmental problem when compared with the industry world-wide - Sub-lethal effects upon a globally or regionally endangered species compromising reproductive fitness and/or resulting in long-term disruption/disturbance to normal behaviour - Air quality/noise approaching occupational exposure limits. Water quality parameters approaching maximum stipulated values - Periodic widespread nuisance both on and off site
Moderate	<ul style="list-style-type: none"> - Noticeable effects on the environment, reversible over the long term - Localised degradation of resources restricting potential for further usage - Sub-lethal effects upon a globally or regionally endangered species with no effect on reproductive fitness and/or resulting in disruption/disturbance to

	normal behaviour but returning to normal in the medium term - Elevated contribution to global air pollution problem partly due to preventable releases - Frequent breaches of water/air quality and noise guidelines - Causing localised nuisance both on and off site
Minor	- Noticeable effects on the environment, but returning naturally to original state in the medium term - Slight local degradation of resources but not jeopardising further usage - Disruption/disturbance to normal behaviour of a globally or regionally endangered species returning to normal in the short term - Small contribution to global air problem through unavoidable releases - Elevation in ambient water/air pollutant levels greater than 50% of guidelines - Infrequent localised nuisance
Negligible	- No noticeable or limited local effect upon the environment, rapidly returning to original state by natural action - Unlikely to affect resources to noticeable degree - No noticeable effects on globally or regionally endangered species - No significant contribution to global air pollution problem - Minor elevation in ambient water/air pollutant levels well below guidelines - No reported nuisance effects

In order to systematically evaluate the impacts associated with this development, an impact matrix has been constructed and provided in Table 7.2 below. A discussion of the impacts follows, including their evaluation in terms of extent, duration, and magnitude, as well as proposed mitigation measures to the identified impacts.

Table 6.2 Impact Matrix for the Construction, Operations and Decommissioning phases

Activity / Impact	Nature of Impact	Duration	Extent of impact	Magnitude	Overall assessment
Positive impacts					
Employment	Positive	Long term	Limited area	Medium	Major
Income for the building owner	Positive	Permanent	Limited area	Medium	Moderate
Increased government revenue	Positive	Permanent	Regional	Medium	Moderate
Enhancement of telecoms market competitiveness	Positive	Permanent	Regional	High	Major
Negative impacts					
Construction phase					
Dust and noise	Negative	Temporary	Local	Medium	Minor
Traffic increase	Negative	Temporary	Local	Medium	Minor
Effects of generated solid waste	Negative	Temporary	Limited area	Low	Negligible
Effects of poor sanitation	Negative	Temporary	Limited area	Medium	Minor
Effects on air quality from vehicles and dust	Negative	Temporary	Limited area	Medium	Minor
Occupational health and safety hazards	Negative	Temporary	Limited area	Medium	Minor
Impacts on the Visual and aesthetic quality	Negative	Permanent	Limited area	Medium	Minor

Job creation	Positive	Temporary	Local	Medium	Medium
Site acquisition for BTS	Positive	Permanent	Local	Low	Medium
Operation phase					
Effects of solid waste generated	Negative	Long term	Limited area	High	Moderate
Effects of human waste/sanitation	Negative	Long term	Local	High	Moderate
Noise nuisance	Negative	Long term	Limited area	Medium	Minor
Poor house keeping	Negative	Long term	Limited area	Medium	Minor
Occupational health and safety hazards	Negative	Long term	Limited area	Medium	Moderate
Possibility of fire out breaks	Negative	Medium term	Limited area	High	Moderate
Poor air quality due to emissions	Negative	Long term	Limited area	Moderate	Minor
Poor hazardous waste management	Negative	Long term	Limited area	High	Moderate
Aviation accidents	Negative	Long term	Limited area	High	Minor
Radio frequency emissions	Negative	Permanent	Limited area	Low	Moderate
Electro Magnetic Waves	Negative	Permanent	Limited area	Low	Moderate
Soil and ground water contamination	Negative	Long term	Local	Medium	Moderate
Bird mortalities from colliding with the antennas	Negative	Long term	Limited area	Low	Minor
Lightning strikes	Negative	Long term	Limited area	High	Major
Vandalism	Negative	Long term	Limited area	Low	Minor
Improved network coverage	Positive	Permanent	Wide area	High	Major
Decommissioning accidents	Negative	Temporary	Limited area	Medium	Minor
Decommissioning waste	Negative	Temporary	Limited area	Minor	Negligible

6.3 Evaluation of construction phase impacts

6.3.1 Site acquisition for BTS

A site will be required for the BTS development of an area of 50 sq metres. The proposed site is in Batulu village with a well -developed access road thus no need for construction of access to site. The site is in a trading centre; therefore the traffic in this trading centre will be relative.

Mitigation measures

- Ensure that appropriate legal requirements have been met with regard to land occupancy, land ownership or usage rights, notice and compensation.

The overall impact with mitigation is negligible.

6.3.2 Noise and dust from construction works

The proposed construction of the Base transceiver station might result in generation of noise and raising dust during installation of the BTS components. Installation of components will expose loose cement particles and facilitate dispersal of dust within the immediate environment.

Noise emissions will be expected from construction trucks, excavations phase and compaction works. Delivery of materials, civil works, the labourers and thermal electric power generator will all emit noise. The impact of noise might be felt by the nearest homesteads which is that of the land owner.

Mitigation

- Water boozing during construction should be done to limit dust generation;
- Noise generating construction works will be carried out during day time; and
- Delivery of materials to the site should be strictly during day time.

Overall impact with mitigation is minor

6.3.3 Impacts of solid waste disposal

Prior to commencement of construction activities, materials will be transported to the site for the Base transceiver station. Temporary storage of materials such as murrum, rocks/ hard core among others will be at the site. Other construction materials will include cement, steel bars and sand. It is probable that packaging and some of these materials might be poorly disposed of if adequate waste management measures are not in place. Other waste that could be generated during the construction phase includes waste plastic bottles, polystyrene, food containers, paper and sanitary waste.

Mitigation

- The contractor will be held accountable to remove all packaging material from the construction site as soon as it is generated;
- Waste materials will be collected and removed from the site by the contractor; and
- Temporary storage will be constructed for the materials particularly cement and metals or substances that could be hazardous to health to prevent unauthorised access.
- Sanitary facility should be constructed at the site for proper disposal of human waste.

Overall impact with mitigation is Minor

6.3.4 Occupational Impacts

Construction activities will include manual handling, use of machinery, vehicles, delivery of materials, antenna installations, electrical wiring, among others. All these pose some level of health and safety risk to workers. Occupational impacts may include workers falling off the tower/building, head injuries due to falling objects (bolts, nuts, steel bars), exposure to bright light during welding, cuts and bruises, and vehicle related accidents, among others.

Mitigation

- Personnel will be trained and sensitised about safety procedures for the construction activities;
- Guidelines and regulations on site safety will be communicated to all workers and contractors;
- Appropriate warning signage will be displayed around the construction site;
- Appropriate Personal protective gear will be provided and a functional first aid kit kept on site throughout the construction stage; and
- Daily tool box talks will guide works.

Overall impact with mitigation is Minor

6.3.5 Impacts from poor sanitation

There are currently no sanitary facilities at the proposed site for the Base transceiver station. It is recommended that a permanent toilet structure is constructed for use during the construction and operations phase of the BTS. The workers may use the toilet facilities present in the building. Poor sanitation at the BTS could result in increased spread of waterborne diseases and other diarrhoeal-associated illnesses.

Mitigation

- Construct a sanitary facility with shower room for use by the Base transceiver station staff; and
- Eaton should consider the option of sharing toilet facilities with the land owner where possible.

Overall impact with mitigation is Minor

6.3.6 Traffic accidents

There will be increased traffic flow to the area as a result of vehicular traffic ferrying construction equipment and materials to the project site. The increased volume of traffic to the site is likely to lead to increased potential for accidents along the access road to the project site.

Mitigation

- Traffic warning signage should be put at convenient points along the road leading to the site to warn community members about the movement of heavy traffic;
- Traffic calming measures in form speed humps should be put in place along the road leading to the site and close to the project site;
- Environmental Health and Safety tool box talks should be part of the construction drivers' induction. The speed limits near the construction site should not exceed 5KPH.

Overall impact with mitigation is Minor

6.4.7 Impacts on the Visual and aesthetic quality

The proposed site is located within a residential area and will therefore be a modification to the neighbourhood aesthetics.

The BTS will be a permanent structure. The location at the proposed site raises the possibility of presenting some risk to low flying aircraft. The proposed antenna design will therefore include aviation lights and the conventional red and white markings on the antennas. Consultations will be held with the Civil Aviation Authority prior to construction of this site to ensure that the proposed location is not within the flight path for aircraft.

Mitigation

- Aviation lights will be installed on the tower to ensure visibility;
- The antenna will be painted and maintained with white and red colours; and
- Civil Aviation Authority clearance will be acquired prior to the construction phase.

Overall impact with mitigation is Minor

6.4 Evaluation of operational phase impacts

6.4.1 Improved Network coverage

The presence of the Base transceiver station will improve Telecommunication network coverage in the area especially Airtel. The impact is considered to be positive and of high significance.

6.4.2 Employment

There will be direct employment opportunities for a security guard (where possible), and a network engineer that will be responsible for the network systems at the site among others. The guard(s) should be from the local area and the local leadership should be consulted as part of the recruitment process, especially for background security checks on any potential candidates. Although only a few people will be employed, the impact is positive.

6.4.3 Noise

The main source of noise at the Base transceiver station will be the power generator that is used to provide energy to run the equipment at the facility. This kind of noise is a continuous nature throughout the operation of the generator. Generators are known to emit sound pressure levels of up to 70 - 100dB. However the generator should be installed with acoustic suppressors which help maintain the noise level within permissible standards. The site is connected to the national electricity grid thus the generator will be used in case of hydropower shortage.

Mitigation measures

- The generator should be directed away from sensitive receptors;
- Carryout periodic noise measurements to ensure that the noise levels at the site are in conformity with National noise regulations, the occupational exposure limit being 85dB(A);
- Ensure that the generator is fixed with a silencer and regularly serviced in order to minimise noise generation;
- Telecommunication operators should invest in solar systems that do not generate noise.

The overall impact with mitigation is minor

6.4.4 Poor air quality due to emissions

Operation of the backup generator will generate greenhouse gases that comprise of carbon-monoxide, oxides of nitrogen, lead, hydrocarbons, suspended particulate matter and sulphur-dioxide, among others. These have a negative impact on the air quality around the base transceiver station site.

Mitigation measures

- Minimise generator running time;
- Use fuel efficient generators;
- Ensure that there is a good preventative maintenance regime for the generator; and
- The generator exhaust should be raised to at least 7m from the floor.

The overall impact with mitigation is minor.

6.4.5 Operational accidents

These occur during routine maintenance work by service personnel or could also be attributed to equipment malfunction or failure. These accidents can cause severe injuries or death of the workers.

Mitigation measures

- Standard Operating Procedures (SOPs) should be adhered to during maintenance work including a permit-to-work system;

- According to the UCC document relating to communications equipment and related potential environment aspects entitled, “Technical Advice on EIAs”, it is stated that, “for secondary equipment such as mains powered equipment used during installation and operation and maintenance phase, in addition to protection measures like fire extinguishing systems, adequate breakers and fuses, it is important to also include restriction to access measures like warning signs or indication of effects that may emanate from mains powered or battery powered equipment like electric shocks and other energy hazards to alert both the service personnel (occupational workers i.e. guards and the maintenance crew) and the general public”;
- Carrying out Environment, Health and Safety (EHS) induction for all workers and contractors before commencing maintenance work at the site;
- Provision of adequate Personal Protective Equipment (PPE) to all workers;
- Ensuring that emergency preparedness measures are in place at the site;
- Carrying out safety audits on all the equipment at the site including the tower and earthing systems; and
- The recording of any incidents, accidents and near misses as part of emergency preparedness measures.
- Provide workers with safety belts/ harnesses whenever they are ascending the tower.

With mitigation, the impact is considered to be minor and of low significance.

6.4.6 Pollution resulting from poor management of hazardous wastes

Waste attributed to operations and maintenance of the BTS will be generated with most of it being hazardous and potential pollutants. Some of the pollutants include; used oil, use oil filters, used battery sets from battery banks and Polychlorinated Biphenyls (PCBs). Also to be considered is the Styrofoam packaging for new equipment components.

Mitigation measures

- Installation of non-PCB containing transformers should be considered;
- The electronic equipment installed and used at the station should conform to international phase out requirements for hazardous materials;
- Hazardous wastes should be well contained on-site and taken away by licensed hazardous waste collectors; and
- Contractors should be obliged to take their waste away with them after completion of their respective assignments.

With mitigation, the impact is considered minor and of low significance.

6.4.7 Income for the landowner

The owner of the land on which the BTS will be located has earned and will still earn rental lease income as part of the lease agreement. This income will improve his/her wellbeing.

The payment to the land owner should be executed in a timely and transparent manner. Where possible, Eaton Towers should do a follow up to ascertain to what extent the landowner's livelihood has been enhanced as a result of the transaction.

With enhancement, the impact is considered to be major and of HIGH significance.

6.4.8 Aviation accidents

Placement of antennae at such a high altitude raises the possibility of accidental risk to low flying aircraft. Following consultations with the CAA, it was ascertained following a site visit by the CAA to the proposed project site, that the site does not fall within a designated flight path and clearance/permission to this effect has since been obtained (refer to Appendix III).

Mitigation measures

- The mast/tower should be marked and proper lighting specifications put in place as per the CAA regulations.

With mitigation, this impact is considered minor and of low significance as the proposed base transceiver station is not located in a designated flight path as determined by the CAA. Nevertheless as per the clearance certificate, Eaton Towers must “ensure that marking and lighting specifications of the masts are fully complied with” (see Appendix III).

6.4.9 Bird mortalities from colliding with the Base structures

There is a possibility of birds colliding with the Base structures or associated infrastructure such as overhead power lines leading to direct mortality of birds particularly if these towers are located in their flight paths. Without mitigation, the impact is considered to be negative and of high significance.

Mitigation measures

The following mitigation measures can be used to minimise the effects of bird mortalities from collision with the mast/tower and its associated infrastructure:

- Reduce the number of perches available to birds on the tower;
- Where possible cabling and/or power lines should be marked with a suitable marking device for collision-prone species; and
- Monitoring of bird mortalities at the tower should be done.

With mitigation, the impact is considered to be minor and of low significance.

6.4.10 Radio Frequency Emissions

The radio tower has antennae and a microwave dish as part of the base station installations. Radio frequency (RF) beams emitted from these antennae are typically very narrow in the vertical direction but broad in the horizontal direction. They can be reflected or diffracted and vary in intensity depending on their surroundings, and distance from source. Radio frequencies have potential to penetrate the human body for up to 1cm. However, they are non-ionising and their effect is not mutagenic or carcinogenic although they have been known to create an increase in temperature.

Uncertainty abounds about the possible adverse effects on human health due to radiation from cellular towers. However, available scientific evidence does not show any health problems associated with the use of this technology.

The international community, principally the International Commission on Non-Ionizing Radiation Protection (“ICNIRP”) has identified a whole-body Specific Absorption Rate (“SAR”) value of 4 watts per kilogram (4W/kg) as a threshold level of exposure at which harmful biological effects may occur. Without mitigation, the impact is considered to be negative and of medium significance.

Mitigation measures

- Ensure that the Base transceiver station is fenced off to limit access to authorised persons only;
- Place hazard warnings for maintenance personnel to ensure they power down the Base station prior to maintenance works; and
- Maintain radio frequency emissions within Government National Guidelines of 1993.

With mitigation, the impact is considered to be minor and of low significance.

6.4.11 Electro Magnetic Fields (EMFs)

Electric and magnetic fields (EMF) are invisible lines of force emitted by and surrounding any electrical device, such as power lines and electrical equipment. Electric fields are produced by voltage and increase in strength as the voltage increases. Magnetic fields result from the flow of electric current and increase in strength as current increases. Radio waves and microwaves will be one form of electromagnetic energy emitted by transmitting antennas at the base transceiver station. The UCC document relating to communications equipment and related potential environmental aspects entitled, “*Technical Advice on EIAs*”, states that, it is important to note that the level of EMF exposure is dependent on duration and proximity to the main source of these signals.

According to the World Health Organisation (WHO) as stated in the Draft EIA and Environmental Audit (EA) Guidelines specific to the telecommunication Sub-Sector (NEMA), although there is public and scientific concern over potential health effects associated with exposure to EMF, there is no empirical data demonstrating adverse health effects from exposure to EMF levels. Much as there is limited evidence of adverse health risk, there is sufficient need for concern. Without mitigation, this impact is considered negative and of medium significance.

Mitigation measures

- Evaluating the potential exposure of occupational workers e.g. guards and maintenance personnel as well as the general public against the reference levels – guidelines and exposure limits - developed by the International Commission on Non-Ionization Radiation Protection (ICNIRP) which are internationally acceptable and have been recommended by the International Telecommunications Union (ITU-T-Recommendation K-52) and endorsed by the World Health Organisation (WHO). Table 4-2 indicates the ICNIRP EMF limits as taken from the Draft EIA and EA Guidelines specific to the telecommunications Sub-Sector (NEMA).

Table 7-3: ICNIRP EMF limits

Note: These limits apply to exposure averaged over a 6 minute period

- **Whole Body : SAR:** 0.4 W/kg, **Power density:** 10-400 Mhz: 10 W/m², 400-2000 Mhz: $f/40$ W/m² (f = transmitter frequency in Mhz), 2-300Ghz: 50 W/m²

Exposure Characteristics	ICNIRP limits		
	Whole Body Averaged SAR	Local SAR Averaged over 10 g of tissue	
Workers' exposure limits	0.4 W/kg	10 W/kg (Head and Trunk)	20 W/kg(Limbs - arms and legs)
General Public exposure limits	0.08 W/kg	2 W/kg (Head and Trunk)	4 W/kg(Limbs - arms and legs)

Source: Draft EIA and EA Guidelines specific to the telecommunications Sub-Sector

- According to the UCC the following needs to be conducted:-

- *“The Equivalent Isotropically Radiated Power (EIRP) measured in watts (the product of the power supplied to the antenna and the maximum antenna gain relative to an isotropic antenna) of the different types of antennas should be calculated and or measured. For EIRP less than 2MW, no further calculations or assessments are necessary as the source will be inherently compliant.*
- *Measurements or evaluations of power density (W/m) and / of Electric Field Strength, E in V/m in the far field region (region of the field of the antenna where the angular field distribution is essentially independent of the distance of the antenna) as per each location or similar installations conditions especially for those locations where people are likely to be exposed to EMFs or have reasonable access to (e.g. in residential areas, school playgrounds, office premises etc). The far field region is considered to be the region where the general population is most likely to be exposed to EMF”;*
- Following good engineering practice in the siting and installation of directional links to avoid building structures;
- For occupational workers such as guards and the maintenance crew, precautionary steps should be undertaken to limit exposure of signals being transmitted. This should include basic information on the risks and any health hazards related to equipment installed at the site and they can also be provided with body worn field monitors to monitor EMF levels;
- Periodic examination of workers that frequent the installation for accumulated exposure to EMF;
- Taking into account public perception about EMF issues by consulting with the local community in which the antenna tower is to be located;
- Limiting public access to antennae tower locations by installing a security fence around the tower; and
- Occupational EMF exposure should be prevented or minimised through the preparation and implementation of an EMF safety program.

With mitigation, the impact is considered minor and of low significance.

6.4.12 Fire outbreaks

The storage and handling of highly combustible liquids such as diesel for the generator are a potential fire hazard. Without mitigation, this impact is considered to be of high significance.

Mitigation measures

- Labelling the generator area and the fuel containers with appropriate warning signage such as “NO SMOKING” and “HIGHLY FLAMMABLE” signs respectively;
- Ensuring that working and serviced fire extinguishers are present at the site at all times;
- Installing a smoke detector in the equipment room and ensuring that its activation can be relayed to the site engineer or the central network control room;
- There should be a designated fire assembly point at the station; and
- Wherever possible, personnel (the guard) at the station should be trained and equipped with fire fighting skills.

With mitigation, the impact is considered to be negative and of LOW significance.

6.4.13 Soil and groundwater contamination due to fuel spillage

A fuel storage tank to enable continuous running of the generator should be part of the installations at the BTS. In the event of a spillage due to loss of containment, not only will the soil be contaminated but also oil might be conveyed to low lying areas by runoff. The same is likely to be the case with any fuel spillages from the generator. However the fuel tank should have a secondary containment (Bunding) to hold all the fuel spillages from the tank and be connected to a manhole in which the spilled fuel and oil can be collected. Without mitigation, this impact is considered to be of medium significance.

Mitigation measures

- All Incidents of oil/fuel spillages should be reported, and a system for preventing and detecting potential leaks put in place; and
- A spill response plan should be devised and spill kits stationed on site.

With mitigation, the impact is considered to be of low significance.

6.4.14 Lightning strikes

The height of the tower renders it susceptible to attracting electric charge especially during lightning events. The electric charge could be transferred to the bottom of the tower resulting in lightning striking generators and other equipment at the site. The tower should have a lightning conductor and all installations earthed at the BTS. *Without mitigation, lightning strikes are considered to be negative and of high significance.*

Mitigation measures

- Work at the site during bad weather (stormy weather) should be discouraged.
- All installations at the BTS should be earthed.
- A lightning conductor should be placed on the building and tower.

With mitigation, the impact is of low significance.

6.4.15 Vandalism

The Base transceiver station could attract wrong elements that could vandalise equipment and siphon fuel from the fuel reservoir. Prohibitive signs preventing entry of unauthorized persons should be placed at the fence and a guard always present at the site. Without mitigation, this impact is considered to be of medium significance.

Mitigation measures

- Signage restricting access to the site premises by unauthorised personnel should be clearly posted at the site;
- Having a guard at the Base transceiver station at all times;
- Installing surveillance systems and intruder alarms that monitor personnel that access the station; and
- Collaborating with the local leadership so that the site can benefit from a “neighbourhood watch” scheme.

With mitigation, the impact is considered to be of low significance.

6.5 Indirect Impacts

6.5.1 Indirect Employment

The establishment of the BTS will create indirect employment opportunities for several members of the local community. These include; vending airtime (Airtel), providing Airtel, mobile money services, operating public pay phones, provision of internet services, maintenance of the access road to BTS, to mention but a few. The fore-mentioned opportunities are likely to in turn to enhance household incomes in the area.

Without enhancement, the impact is considered to be positive and of low significance.

Enhancement measures

Airtel should run promotional campaigns of their products and services in the area as a catalyst for the above mentioned business opportunities to flourish.

With enhancement, the impact is considered to be positive and of medium significance.

6.5.2 Increased Government Revenue

The local government will gain from the operations of the base station in form of taxes and permit fees. Presence of a Base transceiver station and resultant availability of a telecommunication network results in growth of businesses such as mobile telecommunication sales, phone-credit sales and telephone booths. These businesses present opportunities for increased revenue to the local government.

Without enhancement, the impact is considered to be positive and of low significance.

Enhancement measures

- A transparent tax collection system.

With enhancement, the impact is considered to be positive and of medium significance.

6.6 Cumulative Impacts

These are impacts that are individually limited but cumulatively considerable or for which the incremental effects of an individual project are considerable when viewed in connection with past projects, current projects and probable future projects

6.6.1 Enhancement of telecoms market competitiveness

The project will enhance the level of competitiveness that is currently being experienced in the telecommunications sector.

Without enhancement, the impact is considered to be positive and of high significance.

Enhancement measures

- Offering call tariffs that are more competitive.

With enhancement, the impact is considered to be positive and of high significance.

6.7 Decommissioning Phase Impacts

These impacts will only occur if Eaton Towers decommissions the Base transceiver station by dismantling them rather than by renting and/or selling them to another service provider.

6.7.1 Decommissioning Accidents

Decommissioning of the Base transceiver station will require specialised personnel to disassemble the equipment and installations at the site. Accidents may occur whilst disassembling the components. The exposure to localised RF emissions whilst removing antennae is also a possibility if the base station is not powered down during their removal.

Without mitigation, this impact is considered negative and of high significance.

Mitigation measures

- Conducting an EHS tool box talk prior to decommissioning;
- During dismantling utmost care be taken while working at height;
- Only authorised persons should be allowed to work;
- Proper tools should be used for a particular job;
- Proper signals should be given to the crane operator when carrying out lifting work;
- No person should walk underneath loads that are being lifted; and
- Provision of adequate PPE to personnel.

With mitigation

This impact is considered to be negative and of low significance.

6.7.2 Decommissioning Waste

This will consist of debris, obsolete equipment, hazardous wastes such as used oils etc. Some of these also have the potential of contaminating the environment.

Without mitigation, the impact is considered to be negative and of medium significance

Mitigation measures

- The abandonment of any obsolete equipment and machinery should be avoided;
- Used equipment and waste fuel and oil should be handled by designated companies;
- The fuel reservoir should be emptied before loading for dispatch;
- All debris and contaminated soil will have to be treated onsite or off-site;
- Top soil to be re-spread;
- Natural drainage patterns should be restored; and
- The access route to the site should be blocked or handed back to the community where possible;

With mitigation, the impact is considered to be negative and of low significance.

7 ENVIRONMENTAL AND SOCIAL MANAGEMENT PLAN (ESMP)

7.2 Introduction

To ensure sustainable development and operation of the proposed BTS, an environmental and social management plan has been developed. Monitoring regimes will be put in place to check progress and the resulting effects on the environment by the planned project activities. The process begins during the site preparation and construction stages and continues through the operation phase. It will also include regular reviews of the impacts that cannot be adequately assessed before the beginning of the project, or which arise unexpectedly. In such cases, appropriate new actions to mitigate any adverse effects should be undertaken.

Eaton Towers Uganda Limited is committed to the implementation of these measures and will carry out regular monitoring to ensure their implementation and effectiveness.

7.3 Structure of the ESMP

The ESMP lists the requirements to ensure effective mitigation for all proposed development activities, operations and future decommissioning. For each of these activities, the following information is presented:

- Likely impacts and their indicators;
- A description of the mitigation measures (actions) that the proposed hotel management will implement;
- Monitoring indicators; and
- The party responsible for ensuring full implementation of that action.

7.4 Stakeholders' roles

- **The developer:** The developer (Eaton Towers Uganda Limited) will ensure that all mitigation measures recommended in the EMP are implemented through on-going monitoring.
- **The contractor(s):** The contractor(s) will be responsible for the relevant training of their staff during the construction phase and implementation of recommended mitigation measures.
- **Lead Agencies:** Yumbe District Local Government especially the District Engineer and Health Inspector, the Environment Officer and NEMA, and other relevant lead agencies will ensure approval of project components; undertake monitoring of project activities and implementation of the site environmental management plan.

Table 7.1 presents the proposed EMP to ensure effective implementation of the proposed project in an environmentally sound manner

7.5 Environmental and Social Management Plan

Table 7-1: Environmental and Social Management Plan for the proposed BTS

<i>Impact</i>	<i>Indicators</i>	<i>Mitigation measures</i>	<i>Time frame</i>	<i>Responsibility</i>
CONSTRUCTION PHASE				
Site acquisition for the BTS, and access road	Documents showing legal land ownership and usage rights	<ul style="list-style-type: none"> • Ensure that appropriate legal requirements have been met with regard to land occupancy, land ownership or usage rights, notice and compensation. 	Immediate before construction	Eaton towers Contractor
Noise and dust	Complaints from community about occurrences of dust emissions and noise during construction	<ul style="list-style-type: none"> • Wetting the floor should limit dust generation • Noise generating construction works will be carried out during day time • Delivery of materials to the site should be strictly during day time 	Throughout construction phase	Eaton towers Contractor
Occupational hazards	<ul style="list-style-type: none"> • Record of personnel training; • Presence of safety guidelines and warning signage; • Presence of a first aid box; and • Documented tool box 	<ul style="list-style-type: none"> • Personnel will be trained and sensitised about safety procedures for the construction activities. • Guidelines and regulations on site safety will be communicated to all workers and contractors. • Appropriate warning signage will be displayed around the construction site • Appropriate Personal protective gear will be provided and a functional first aid kit kept on site throughout the construction stage; • Daily tool box talks will guide works 	During construction phase	Eaton towers Contractor
Poor Solid waste disposal	Presence of debris or packaging waste around the site	<ul style="list-style-type: none"> • The contractor will be held accountable to remove all packaging material from the construction site as soon as it is generated; • Waste materials will be collected and removed from the site by the contractor; • Temporary storage will be constructed for the materials particularly cement and metals or substances that could be hazardous to health to prevent unauthorised access; 	During construction	Eaton towers Contractor
Possible Collapse of the antenna	<ul style="list-style-type: none"> • The communities around the proposed site may be exposed injuries that could be fatal in the event of structural failure of the antenna 	<ul style="list-style-type: none"> • Use qualified staff during construction; • Ascertain the quality of materials to be used. • Only trained and certified workers will be used to install, maintain, or repair electrical equipment, under supervision of the developer. 	During construction	Eaton towers Contractor

Soil and Ground Water Pollution	<ul style="list-style-type: none"> • Small concentrate spills during construction and operation 	<ul style="list-style-type: none"> • Maintain Spill Kit at Base transceiver station; • Establish and implement fill and leak prevention procedures. • Carry out regular integrity testing on the Tanks to detect leakages; • Fit standard safety features on the tanks; 	During construction	Eaton towers Contractor
Impacts on public health	<ul style="list-style-type: none"> • Record of accidents; • Presence of sanitary facilities; 	<ul style="list-style-type: none"> • Ensure that works are concentrated over day time • Use warning signage Ensure that construction areas are isolated from regular paths; • Have sanitary facilities in place at BTS; 	Throughout construction phase	Eaton towers Occupational Safety and Health Department
OPERATION PHASE				
Air Pollution (Greenhouse gas emissions from generator)	Minimal air pollution	<ul style="list-style-type: none"> • Minimise generator running time; • Use fuel efficient generators; • Ensure regular maintenance of the generator • The generator exhaust should be raised to at least 7m from the ground. 	Throughout the operational phase	Eaton towers NEMA
Background Noise at the BTS	Records of noise related complaints from nearest receptor or any other sensitive receptors	<ul style="list-style-type: none"> • The generator should be directed away from sensitive receptors • Ensure that the generator is fixed with a silencer and regularly serviced • Carryout periodic noise measurements to ensure that the noise levels at the site are in conformity with National noise regulations 	Throughout operational phase	Eaton towers NEMA
Soil and underground water pollution due to accidental spillage on the surface during refueling and oil servicing.	Incidences of oil related pollution prevented or minimised	<ul style="list-style-type: none"> • Ensure drip trays are in place to collect leakage from connection and discharge points of the generator. • Ensure spill contingency counter measures on-site; 	Throughout operational phase	Eaton towers Maintenance contractor NEMA
Exposure to radio frequency (RF) and EMF	Record of radiation related health effects reported among workers and members of community members	<ul style="list-style-type: none"> • Ensure presence of warning signs related to RF and EMF exposure at the site. 	Throughout operations	Eaton towers Occupational health and safety Department
Hazardous wastes	Records of pollution / contamination at the site	<ul style="list-style-type: none"> • Ensure existence of operational contracts with competent hazardous waste handling firms; • Develop and implement waste management plan (WMP) that provides 	Throughout the operational period	Eaton Towers

	Waste generation records;	details of storage, handling and disposal methods particularly of hazardous wastes.		NEMA Contracted firm
Lightning effects	Instances of fatal lightening incidents at the site	• Ensure Properly earthed site and equipment;	Throughout operations	Eaton towers UCC
Air Quality; Generator fumes, dust, odour	Soot on the generator exhaust pipe and on the generator cabin.	• Ensure proper maintenance and regular servicing of the generator to enable remove toxic substances (un-burnt hydrocarbons and oxides of carbon and nitrogen) before they are emitted to the atmosphere.	Throughout the operational period	Eaton towers
Aviation accidents	Impact on Aircraft at the site	• Ensure that the mast/tower is properly lit as per CAA specifications	Throughout the operational period	Eaton towers CAA
Fire outbreaks	Risks of fire outbreaks at the BTS	<ul style="list-style-type: none"> • Avail well serviced fire extinguishers for the station • Ensure NO cooking takes place in and around the BTS • Generator should always be switched off when re-fuelling • A strict "No Smoking" regulation should be put in place. 	Throughout the operational period	Eaton towers Maintenance contractor Security personnel.
DECOMMISSIONING PHASE				
Decommissioning accidents	Zero accidents registered	<ul style="list-style-type: none"> • Employ experienced BTS decommissioning personnel • Develop and implement a decommissioning plan 	Decommissioning phase	Eaton towers UCC and Occupational Safety and Health Department
Decommissioning wastes	Site restored to as near its original condition as possible	<ul style="list-style-type: none"> • Employ experienced BTS decommissioning personnel • Develop and implement a decommissioning plan 	Decommissioning phase	Eaton towers NEMA

8 CONCLUSION AND RECOMMENDATIONS

8.2 Conclusion

The project will result into a number of impacts on the environment. These impacts will be both positive and negative. Measures to mitigate each of the identified the negative impacts have been recommended to ensure an environmentally sound development. Once these measures are implemented, the impacts will be minimized.

In compliance with EIA and Environmental Audit Regulations, regular environmental audits and environmental monitoring of the Ramogi- Bidibidi BTS operations should be carried by certified environmental auditors and reports submitted to NEMA for review to ascertain compliance.

8.3 Recommendations

The developer must ensure that the mitigation measures proposed in this report are implemented.

The developer should also ensure that the ESMP presented under this report is available to the relevant parties responsible for implementing it.

During construction, adequate supervision by a qualified structural engineer should be undertaken to ensure structural integrity of the BTS.

The mitigation plan and environmental monitoring if implemented will ensure that any other adverse impacts that come up in the course of implementing the project as well as its operation are addressed immediately. This should be carried out by the Company's EHS Officer.

An independent environmental assessment should be undertaken in case the developer wishes to introduce any other structure/activity which is not considered under this assessment.

Regular environmental audits of the facility will be carried out at least once every year preferably by a competent and NEMA certified environmental auditors and reports submitted to NEMA for review and ascertain compliance with terms of approval.

Eaton Towers should conduct regularly community sensitisation particularly with regard to the effects of EMF.

In the event of decommissioning the facility, an environmental audit will be undertaken to guide this activity. The site will be restored to as near as possible to its original state and as per the requirements of the National Environment Act , Cap 153, part IX, section 67.

To supplement the ESMP, all contractors should be called upon to develop the following Environmental management plans;

- a spill prevention and counter measure plan
- a waste management plan
- occupational health and safety plan
- environmental restoration plan

9 REFERENCES

1. Environmental legislation of Uganda Handbook
2. IFC (2007), Environmental, Health and Safety Guidelines for Telecommunications.
3. NEMA (2003), Environmental legislation of Uganda
4. NEMA (2010), Draft Environmental Impact Assessment and Environmental Audit guidelines specific to Telecommunication subsector.
5. NEMA (2004/2005), Yumbe District state of Environmental Report
6. Yumbe District five year Development Plan 2010/11-2014/2015
7. New Vision (2010), Business Vision: interview (Thursday, October 21, 2010); *Interconnection Fees to Go Down*.
8. <http://www.internetworldstats.com/af/ug>, Internet, ICT, Broadband and Consumer E-Commerce in Uganda- June 2008 Review.

APPENDICIES

Appendix I; Letter of Approval of Terms of Reference by NEMA – *No. 1 on the list*

NATIONAL ENVIRONMENT MANAGEMENT AUTHORITY (NEMA)

NEMA House
Plot 17,19 & 21, Jinja Road.
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NEMA/4.5

17th May, 2017

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RE: REVIEW OF SCOPING REPORT AND TERMS OF REFERENCE FOR CARRYING OUT ENVIRONMENTAL IMPACT ASSESSMENT FOR THE PROPOSED EATON TOWERS BASE TRANSCEIVER STATIONS IN YUMBE DISTRICT.

This is in reference to the Scoping Report and Terms of Reference (TOR) for carrying out the Environmental Impact Assessment (EIA) for the above mentioned proposed project, which you submitted to this Authority, on 12th May, 2017, for review and approval. This Authority has finalized the review and grants formal APPROVAL of the said TOR.

Please note that the approval of the Scoping Report and TORs DOES NOT give you permission to start implementing any of the proposed project activities. This is not a Certificate of approval.

However, this approval is granted only for the base stations whose TORS were submitted to this Authority as indicated below:

NO.	SITE NAME	SITE ID	CORDINATES	LOCATION
1.	RAMOGI_BI DIBIDI	ETO/UG/4008 3/ARU	N03.47897, E03137064	Batulu Village, Onoko Parish, Ramogi Sub-county, Yumbe District.
2.	AKPOKOA	ETO/UG/4008 4/ARU	N03.24941, E031.37052	Akpokoa, charanga LC1, Ikafe Parish, Ariwa Sub-county, Yumbe District.
3.	LANGI	ETO/UG/4008 5/ARU	N03.39001, E031.33385	Langi, Jomorogo Village, yoyo Parish, Kululu Sub-county, Yumbe District.
4.	LANGI-2	ETO/UG/4008 6/ARU	N03.37157, E031.30823	Langi, Aniti Village, Bangatuti Parish, Odravu Sub-county, Aringa County in Yumbe District.

In addition, you are advised to consider the aspects below during the conduct of the environmental impact study and the preparation of the EIA report.

- (i). Carry out comprehensive consultations with all the relevant key stakeholders including the Uganda Communication Commissions, Civil Aviation Authority, Yumbe District Local Government, Occupational Safety and Health Department (Ministry of Gender, Labour and Social Development) , the local community in the project area; and the views of the stakeholders consulted should be well documented and appended to the EIA report.
- (ii). Ensure that a detailed description of project components and activities are provided detailed description of project components and activities covering both the construction and operational phases of the project are provided, including the size of the workforce.
- (i). Provide detailed baseline information and data on the project area, as well as, a set of coloured photographs depicting the current status of the project site.
- (ii). Provide clear and well labeled location and google maps that are coloured (preferably *each covering A-4 size paper*) that shows clear boundaries of the project site in relation to its environs.
- (iii). Conduct a geo-technical investigation study for the project site; and, append the results of the geo-technical investigation to the EIA report.
- (iv). Provide a clear and legible copy of the site lay-out plan (*preferably on A-3 sized paper*).
- (v). Carry out a comprehensive evaluation of negative environmental impacts associated with the proposed project activities; and, propose mitigation measures to minimize the identified negative impacts.
- (vi). Provide detailed mitigation and environmental management and monitoring plans that relate to the identified environmental impacts of the proposed project.
- (vii). Append to the EIA report authentic copies of land ownership and acquisition documents.
- (viii). Consider any other critical environmental concerns that were not initially foreseen during the preparation of the Scoping Report and TOR, and include an evaluation of such concerns, in the EIA report.
- (ix). Include the total project (investment) cost, covering all aspects of the project components.

This is, therefore, to recommend that you proceed with carrying out the EIA for the above listed Base Transceiver Stations.

We look forward to your cooperation and receipt of comprehensive copies of EIA, for our further action.





Edward A. Odipio
FOR: EXECUTIVE DIRECTOR.

Appendix II; Proof of ownership for the proposed site for the BTS

EatonTowers

Site Identification Number:	ETO/UG/40083/ARU
Site Identification Name:	RAMOGI_BIDI BIDI

EatonTowers

LICENSE AGREEMENT FOR COMMUNICATIONS BASE STATION

BETWEEN

Alli Noah
Tel: 0774216456(Registration No.)
TIN 1010221578

(hereinafter referred to as the "Licensor")

and duly authorized thereto

AND

Eaton Towers Uganda Limited
(Registration No 139296)

(hereinafter referred to as the "Licensee")

and duly authorized thereto

Page 1

Please initial

Eaton Towers

FOR THE LICENSOR:

SIGNED at KAMPALA on 15th APRIL 2017

LICENSOR:

(Who warrants his authority)

Name in block letters:

ALLI NOAH

WITNESS:

Name in block letters:

ANAKU KOCHIGA

FOR THE LICENSEE:

SIGNED at EATON TOWERS, KAMPALA on 3rd MAY 2017

LICENSEE:

(Who warrants his authority)

Managing Director:

S. PASHA

3/5/17

WITNESS:

Name in block letters:

SSAMULA GEORGE ARTHUR

EATON TOWERS UGANDA
LIMITED

★ 03 MAY 2017 ★

COMPANY SECRETARY
P. O. BOX 300, KAMPALA

Appendix III: CAA Approval of the site- *No. 1 on the list*

CIVIL AVIATION AUTHORITY

Our Ref: **DSSER/2901**Head Office Building
Entebbe International Airport
P.O. Box 5536, Kampala, Uganda

Your Ref:

20 June 2017Operations Director
Eaton Towers Uganda Limited
Plot No. 4, Katonga Road, Nakasero
P. O. Box 300
Kampala**APPROVAL FOR THE ESTABLISHMENT OF BASE STATIONS IN UGANDA**

Reference is made to your letters dated 11 April 2017 and 4 May 2017 seeking approval to establish Base Transceiver Stations.

Physical inspections were conducted on 19 and 20 May 2017 and coupled with the evaluation of the information submitted in your application confirm that the developments on the sites listed below were in compliance with the Civil Aviation (Aerodromes) Regulations requirements. The Authority has no objection to the proposed construction at the mentioned locations.

N o	Site Name	Site ID	District	Latitude	Longitude	Ht (m)
1	Bidi Bidi Ramogi	ETO/UG/40083/ARU	Yumbe	N 03° 28' 44.15"	E 031° 22' 14.13"	60
2	Okpokoa	ETO/UG/40084/ARU	Yumbe	N 03° 16' 21.43"	E 031° 21' 46.30"	60
3	Langi - 2	ETO/UG/40086/ARU	Yumbe	N 03° 22' 17.69"	E 031° 17' 41.28"	60
4	Langi	ETO/UG/40085/ARU	Yumbe	N 03° 23' 24.11"	E 031° 20' 01.86"	60

The Authority's approval is subject to:-

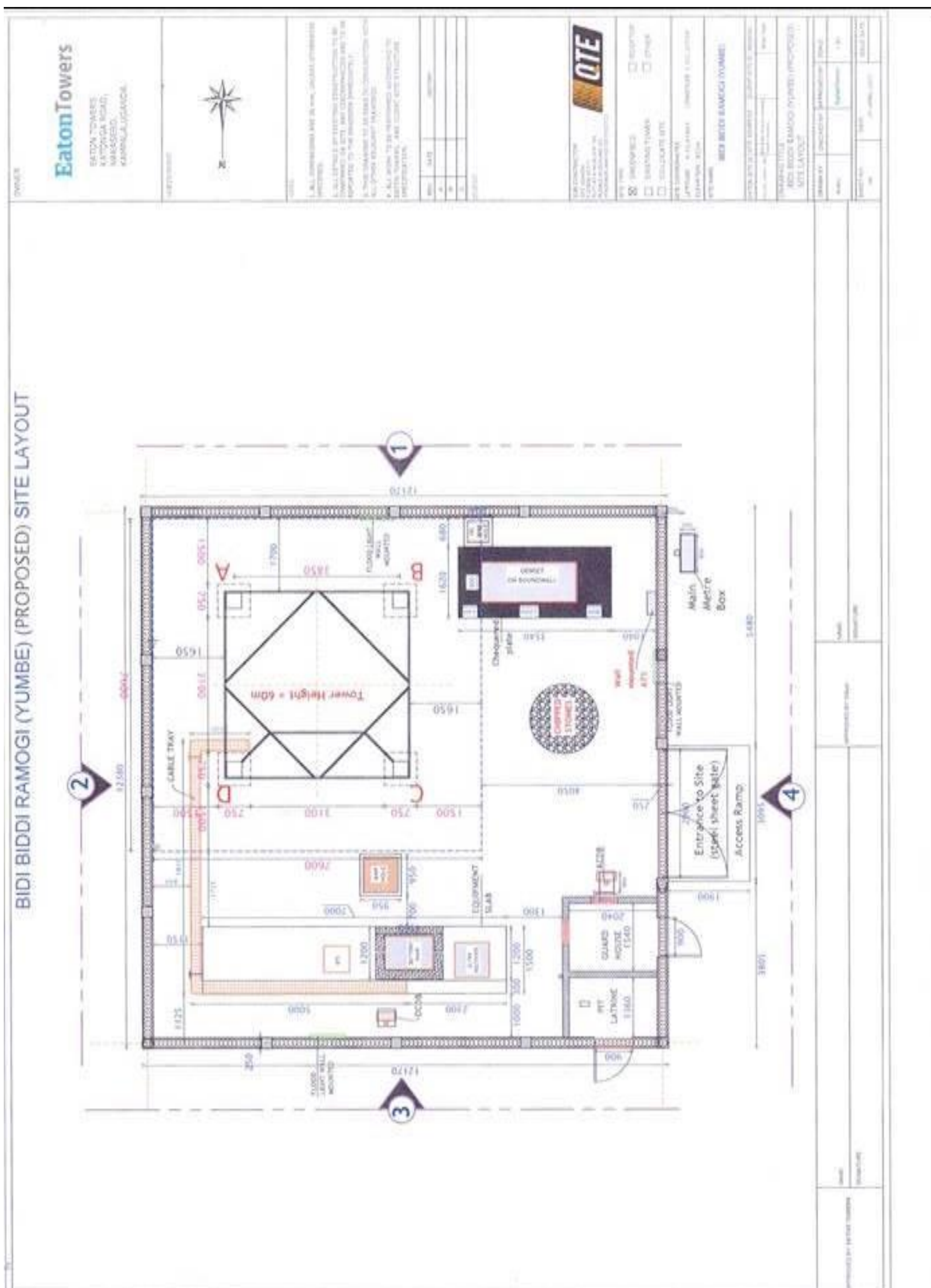
- (1) Your obtaining approvals from relevant State regulatory agencies,
- (2) Marking and lighting the mast as follows:-
 - The mast should be marked by alternating coloured bands of orange and white or red and white. The bands shall be horizontal and have a width 1/7 of the height of the mast. The bands on the extremities of the mast shall be of the darker colour.
 - The lights used should be of medium-intensity and shall be located as close as possible to the top of the mast.

S. S. Muneeza
DIRECTOR SAFETY, SECURITY AND ECONOMIC REGULATIONHead Office Tel : 256-41-4352000, 31-2352000
Airport Tel : 256-41-4353000, 31-2353000
Fax : 256-41-4321401, 256-41-4320571 or 4320964E-mail: aviation@caa.co.ug
Telex : 61508 CAA UGA
Website: www.caa.co.ug
Telex : 61182, 61460For Aircraft / Flight Clearance requests
Fax : 256-41-4321452, Tel: 256-41-4321173, 4321016

Appendix IV: License from UCC for the year 2017-2018



Appendix VI; Site layout plans for the proposed BTS.



Appendix VII; Google aerial view of the proposed site and its environs



Appendix VII. Literature on Mobile Communications and Health

Radio waves

Radio waves and microwaves are forms of electromagnetic energy that are collectively described by the term "radiofrequency" or "RF". Radio Frequency emissions and associated phenomena can be discussed in terms of "energy," "radiation" or "fields."

Radiation is defined as the Propagation of energy through space in the form of waves or particles. Electromagnetic radiation can best be described as waves of electric and magnetic energy moving together (i.e., radiating) through space as illustrated in Figure 4.4. below

These waves are generated by the movement of electrical charges such as in a conductive metal object or antenna. For example, the alternating movement of charge (i.e., the "current") in an antenna used by a radio or television broadcast station or in a cellular base station antenna generates electromagnetic waves that radiate away from the "transmit" antenna and are then intercepted by a "receive" antenna such as a rooftop TV antenna, car radio antenna or an antenna integrated into a hand-held device such as a cellular telephone.

The term "electromagnetic field" is used to indicate the presence of electromagnetic energy at a given location. The RF field can be described in terms of the electric and/or magnetic field strength at that location.

Like any wave-related phenomenon, electromagnetic energy can be characterized by a wavelength and frequency. The wavelength is the distance covered by one complete electromagnetic wave cycle, as shown in Figure 4.4.

The frequency is the number of electromagnetic waves passing a given point in one second. For example, a typical radio wave transmitted by an FM radio station has a wavelength of about three (3) meters and a frequency of about 100 million cycles (waves) per second or "100 MHz." One "hertz" (abbreviated "Hz") equals one cycle per second. Therefore, in this case, about 100 million RF electromagnetic waves would be transmitted to a given point every second.

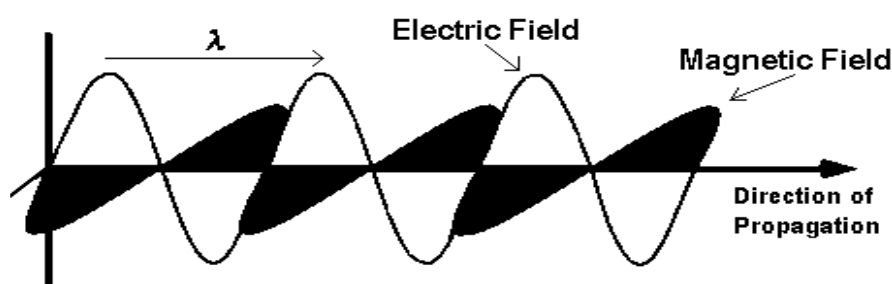


Figure III . Electromagnetic Wave

The electromagnetic spectrum

Since the speed of light in a given medium or vacuum does not change, high frequency Electromagnetic waves have short wavelengths and low-frequency waves have long Wavelengths. The electromagnetic "spectrum" (Figure 4.5) includes all the various forms of electromagnetic energy from extremely low frequency (ELF) energy, with very long Wavelengths, to X-rays and gamma rays, which have very high frequencies and Correspondingly short wavelengths. In between these extremes are radio waves, microwaves, infrared radiation, visible light, and ultraviolet radiation, in that order.

Electromagnetic waves with frequencies higher than ultraviolet light are called ionizing radiation and this has sufficient energy to break molecular bonds and hence the potential to cause damage a biological tissue. This process requires interaction with photons containing high energy levels, such as those of X-rays and gamma rays

The radio waves belong to the lower frequency part of the electromagnetic spectrum which is called Non ionizing radiation with the energy too low to break molecular bonds The photon energies of RF electromagnetic waves are not great enough to cause the ionization of atoms and molecules bonds. RF energy is, therefore, characterized as non-ionizing radiation, along with visible light, infrared radiation and other forms of electromagnetic radiation with relatively low frequencies

The RF part of the electromagnetic spectrum is generally defined as that part of the spectrum where 2 electromagnetic waves have frequencies in the range of about 3 kilohertz to 300 gigahertz.

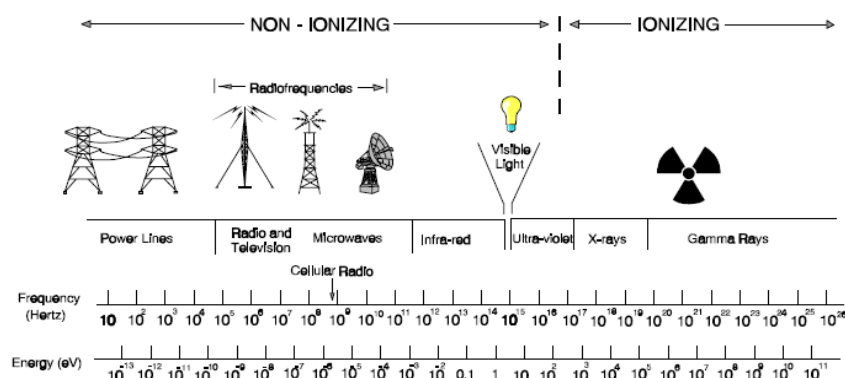


Figure 4. 5. The Electromagnetic Spectrum

Use of Radio frequency energy

Probably the most important use for RF energy is in providing telecommunications services to the public, industry and government. Radio and television broadcasting, cellular telephones, personal communications services (PCS), pagers, cordless telephones, business radio, radio communications for police and fire departments, amateur radio, microwave point-to-point radio links and satellite communications are just a few of the many applications of RF energy for telecommunications.

Microwaves are also widely used for telecommunications purposes such as for cellular radio, personal communications services (PCS), microwave point-to-point communication, transmission links between ground stations and orbiting satellites, and in certain broadcasting operations such as studio-to-transmitter (STL) and electronic news gathering (ENG) radio links.

Biological effects that can be caused by RF energy

A biological effect occurs when a change can be measured in a biological system, after the introduction of some type of stimuli. However, the observation of a biological effect, does not necessarily suggest the existence of a biological hazard.

A biological effect only becomes a safety hazard when it "causes detectable impairment of the health of the individual or of his or her offspring". There are many published reports in the scientific literature concerning possible biological effects resulting from animal or human exposure to RF energy. Biological effects that result from heating of tissue by RF energy are often referred as "thermal" effects. It has been known for many years that exposure to high levels of RF Radiation can be harmful due to the ability of RF energy to heat biological tissue rapidly.

According to research by the FCC body, Tissue damage in humans could occur during exposure to high RF levels because of the body's inability to cope with excessive heat that could be generated. Under certain conditions, exposure to RF energy at power density levels of 100mW/cm² and above can result in measurable heating of biological tissue and an increase in body temperature exposure to RF energy at power density levels of 1-10MW/cm² and above can result in measurable heating of biological tissue. The extent of this heating would depend on several factors including radiation frequency; size, shape, and orientation of the exposed object; duration of exposure; environmental conditions; and efficiency of heat dissipation.

The eyes and the testes are known to be particularly vulnerable to heating by RF energy because of the relative lack of available blood flow to dissipate the excessive heat load (blood circulation is one of the body's major mechanisms for coping with excessive heat).

Studies have shown that environmental levels of RF energy routinely encountered by the general public are far below levels that are necessary to produce significant heating and increased body temperature. However, there may be situations, particularly workplace environments near high-powered RF sources, where recommended limits for safe exposure of human beings to RF energy could be exceeded.

The majority of the studies have not indicated major health impacts caused by exposure to radio frequency energy and the FCC website states that; "At relatively low levels of exposure to RF radiation, for example field intensities lower than those that would produce significant and measurable heating, the evidence for production of harmful biological effects is ambiguous and unproven". Such effects have sometimes been referred to as "non-thermal" effects.

According to FCC some studies have also examined the possibility of a link between RF and microwave exposure and cancer. Results to date have been inconclusive. While some experimental data have suggested a possible link between exposure and tumor formation in animals exposed under certain specific conditions, the results have not been independently replicated. In fact, other studies have failed to find evidence for a causal link to cancer or any related condition.

Levels safe for exposure to RF energy

Exposure standards and guidelines have been developed by various organizations and Countries over the past several decades. Safety factors are then incorporated to arrive at specific levels of exposure to provide sufficient protection for various segments of the population. The world health organization and several other independent research organizations like ICINRP among others recommend exposure limits that are adopted by several governments.

For general population/uncontrolled exposures, say in a residential neighbourhood, it is seldom possible to have sufficient information or control regarding how long people are exposed, and averaging of exposure over the designated time period (30 minutes) is normally not appropriate. For such public exposure situations, the MPE limits normally apply for continuous exposure. In other words, as long as the absolute limits are not exceeded, indefinite exposure is allowed.

FCC Limits for Maximum Permissible Exposure (MPE)

Table 4.1 Limits for Occupational/Controlled Exposure.

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (MW/cm ²)	Averaging Time $\sqrt{E^2}, \sqrt{H^2}$ or S (Minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	(900/f ²)*	6
30-300	61.4	0.163	1.0	6

300-1500 -- --	f/300	6
1500-100,000 -- --	5	6

Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure.

General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

During exposure of radio waves from base stations to human beings, most of the energy is reflected by the body but some energy is absorbed in the tissues at the surface of the body, and if the intensity of the radio wave is high then the heating may be potentially damaging. However the energy used by base stations and mobile phones is relatively low and tissue heating due to absorption of radio waves is too small and insignificant.

Table 4.2 FCC Limits for Localized (Partial-body) Exposure

Specific Absorption Rate (SAR)	
Occupational/Controlled Exposure (100 kHz - 6 GHz)	General Uncontrolled/Exposure (100 kHz - 6 GHz)
< 0.4 W/kg whole-body < 8 W/kg partial-body	< 0.08 W/kg whole-body < 1.6 W/kg partial-body

FCC's policies with respect to environmental RF fields are designed to ensure that FCC-regulated transmitters do not expose the public or workers to levels of RF radiation that are considered by expert organizations to be potentially harmful.

Health effects

RF fields penetrate exposed tissues to depths that depend on the frequency up to a centimeter at the frequencies used by mobile phones. Accumulated evidence does not establish the existence of adverse short or long-term health effects from the signals produced by base station and local wireless networks. The human body absorbs 5 times more radiofrequency energy from FM radio and televisions than it does from radio base stations. Televisions and radio stations have been in use for over 50 years within Uganda and worldwide and health statistics have not indicated any adverse health effects associated with them.

RF energy is absorbed in the body and produces heat, but the body's normal thermoregulatory processes carry this heat away. All established health effects of RF exposure are clearly related to heating. While RF energy can interact with body tissues at levels too low to cause any significant heating, all studies conducted have shown that there are no adverse health effects at exposure levels below international guideline limits. Scientific tests reveal that even intense exposure to RF radiation at base stations caused no mutation (Mittler 1977).

Mobile Phones

Mobile phones are designed to be used at the ear or near the body. Mobile users sometimes experience a heating sensation after a long phone call. This is not caused by radio waves heating, the output power is too low for this rather it is because the phone itself may get warm during a call.

The use of a personal hands free device or headset offers additional convenience and personal choice in the use of a mobile phone. These devices are designed for convenient, personal hands free operation of the phone and not for safety reasons. However if individuals are concerned, they might to limit radio wave exposure by using hands-free equipment to keep the mobile phones away from the head and body.

Compliance with Exposure Limits

New mobile phone models are designed and tested to be in compliance with SAR (specific Absorption Rate) limits specified in relevant national and international radio frequency safety standards and regulations. The SAR tests are performed according to international standards.

Mobile phone Power levels

Mobile phones send radio waves at certain standardized power levels. The power is as low as the power of a small flashlight. Mobile phones adjust their transmitted power to the lowest level needed to reach a base station. Hence the average power is considerably lower than the maximum level in many cases. Less power is normally needed to operate a mobile phone the closer the user is to the base station. Less power levels are needed when there is a free path between the phone and the base station, compared to when buildings or other obstacles are in the pathway.

Mobile phones do not transmit radio waves continuously. When the user is silent during a phone call, the power level is reduced, in standby mode the phone only transmits occasionally in order to maintain contact with the network, and when the phone is turned off, no signals are sent at all.

Radiation and base stations

Several considerations must be reflected upon whilst evaluating possible health effects of RF

The frequency of operation

Current mobile phone systems operate at frequencies between 800 and 1800MHz. Radio frequency (RF) fields are different from ionizing radiation, such as X-rays or gamma rays. Unlike ionizing radiation (e.g X-rays), radio frequency (RF) fields cannot cause ionization or radioactivity in the body. This is why RF fields are called non-ionizing.

Exposure levels

Exposure levels from mobile phone handsets and base stations are different. RF exposure to a user of a mobile phone is far higher than RF exposure to a person living near a cellular base station. The handset transmits RF energy only while a call is being made or whilst linking to infrequent at a base station, whereas base stations are continuously transmitting signals. Base stations transmit power levels from a few watts to 100 watts or more, depending on the size of the region or "cell" that they are designed to service. Each base station can only serve a limited number of users at a time and as the number of subscribers to the network grows, more base stations are needed in within shorter distances of each other.

Base stations direct radio signals away from the mast to obtain coverage thus the intensity of the radio waves is drastically reduced with the increasing distance from the base station antenna. On the ground, in houses, and other places where people reside, the exposure levels from the radio base station will be below 1% of the safety limits

Uganda's case

A study conducted by Ericsson group on some base stations within Uganda revealed that they were all well below the internationally set exposure limits. The results for the study are displayed below.

Power Density

Inside the Fence 6.138 0.123% of the exposure limit

Radial distance (m) 0.786 0.079% of the exposure limit

Source: Ericsson Kampala.

Further research is needed to determine the generality of such effects and their possible relevance, if any, to human health. In the meantime, standards-setting organizations and government agencies continue to monitor the latest experimental findings to confirm their validity and determine whether alterations in safety limits are needed in order to protect human health

Links/ sources

Information and statements on radio waves and health:

<http://www.kathrein.com>

Information from the Mobile Manufacturers Forum on radio communications and health

<http://www.mmfa.org>

World Health Organization (WHO) International EMF Project

<http://www.who.int/emf>

International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines on radio wave exposure.

<http://www.icnirp.org>