

OPERATIONAL ENVIRONMENTAL MANAGEMENT PLAN

POWERCOM (PTY) LTD BASE TRANSCEIVER STATIONS

NAMIBIA (COUNTRY WIDE)

**FOR SUBMISSION TO THE ENVIRONMENTAL
COMMISSIONER**

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PROJECT INFORMATION

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**Proponent: POWERCOM (PTY) LTD
PO BOX 40799
WINDHOEK**

**Consultancy: URBAN GREEN CC
PO BOX 11929, KLEIN WINDHOEK
TEL: +264-61-300 820
CELL: +264-81 129 5759
E-MAIL: urbangreen3@jway.na
WEBSITE: www.urbangreenafrica.net**

TABLE OF CONTENTS

TABLE OF CONTENTS	I
LIST OF FIGURES AND TABLES	VI
ABBREVIATIONS AND ACRONYMS	VIII
GLOSSARY	X
APPENDICES	I
PART A - BASELINE INFORMATION	
1 BACKGROUND INFORMATION	1
1.1 INTRODUCTION	1
1.2 THE PROPONENT	2
1.3 TERMS OF REFERENCE	2
1.4 GENERIC OPERATIONAL ENVIRONMENTAL MANAGEMENT PLAN	5
1.5 PURPOSE OF THIS DOCUMENT	5
1.6 SCOPE OF THE OEMP	5
1.7 ASSUMPTIONS AND LIMITATIONS	6
1.8 FORMAT OF THE OEMP	7
1.9 AMENDMENTS TO THE OEMP	8
2 PROJECT TEAM	9
2.1 PROJECT ROLE PLAYERS	9
2.2 EXPERTISE OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER	9
3 STUDY APPROACH AND METHODOLOGY	11
3.1 SCREENING AND APPLICATION FOR ENVIRONMENTAL CLEARANCE CERTIFICATE	11
4 LEGAL FRAMEWORK	12
4.1 NAMIBIAN LEGAL FRAMEWORK FOR EIAs	12

4.1.1	THE CONSTITUTION OF THE REPUBLIC OF NAMIBIA (1990).....	12
4.1.2	ENVIRONMENTAL MANAGEMENT ACT NO. 7 OF 2007.....	12
4.2	NAMIBIAN SECTORIAL LEGISLATIVE REQUIREMENTS	13
4.2.1	ATOMIC ENERGY AND RADIATION PROTECTION ACT NO 5 OF 2005	14
4.2.2	GUIDELINES FOR LIMITING EXPOSURE TO TIME-VARYING ELECTRIC, MAGNETIC AND ELECTROMAGNETIC FIELDS (UP TO 300GHZ)	14
4.2.3	AVIATION ACT NO. 74 OF 1962, AS AMENDED.....	14
4.2.4	COMMUNICATIONS ACT NO. 8 OF 2009	15
4.2.5	LABOUR ACT NO. 11 OF 2007, AS AMENDED.....	16
4.2.6	OTHER NAMIBIAN LEGAL INSTRUMENTS APPLICABLE TO THE PROJECT	16
4.3	INTERNATIONAL LEGAL INSTRUMENTS	17
4.3.1	INTERNATIONAL STANDARDS AND HUMAN EXPOSURE LIMITS	17
4.3.2	INTERNATIONAL CIVIL AVIATION STANDARDS	19
4.3.3	RAMSAR CONVENTION ON WETLANDS OF INTERNATIONAL IMPORTANCE (1971).....	20
4.4	REGULATING AUTHORITIES.....	21
4.4.1	INTERNATIONAL TELECOMMUNICATION UNION	21
4.4.2	COMMUNICATIONS REGULATORY AUTHORITY OF NAMIBIA	21
4.4.3	NATIONAL RADIATION PROTECTION AUTHORITY	21
5	DESCRIPTION OF THE EXISTING ACTIVITY	22
5.1	POWERCOM NETWORK.....	22
5.2	NEED AND DESIRABILITY	22
5.3	SITE SELECTION.....	22
5.4	CELLULAR COMMUNICATION.....	23
5.4.1	WHAT IS A CELLULAR SYSTEM?.....	23
5.4.2	HOW A CELLULAR SYSTEM WORKS	24
5.5	RADIO FREQUENCY RADIATION.....	27
5.5.1	WHAT IS RF RADIATION?	27

5.5.2	TRANSMITTED ENERGY FROM MOBILE DEVICES AND BASE STATIONS...	29
5.6	HEALTH CONCERNS ASSOCIATED WITH RF RADIATION.....	30
5.7	BASE TRANSCEIVER STATIONS	31
5.7.1	DESIGN AND SPECIFICATIONS	31
5.7.2	HEALTH AND SAFETY STANDARDS.....	35
5.7.3	INFRASTRUCTURE REQUIREMENTS.....	36
5.7.4	BTS SHARING	36
5.7.5	OPERATION AND MAINTENANCE	36
5.7.6	DECOMMISSIONING ACTIVITIES.....	38
6	GENERIC IMPACTS AND MITIGATIONS.....	39
6.1	HEALTH STANDARDS AND EXPOSURE LIMITS TO RADIO FREQUENCY RADIATION.....	39
6.1.1	OPERATIONAL PHASE IMPACTS.....	39
6.1.2	DECOMMISSIONING PHASE IMPACTS	40
6.2	SAFETY STANDARDS	40
6.2.1	OPERATIONAL PHASE IMPACTS.....	41
6.3	VISUAL IMPACT	42
6.3.1	OPERATIONAL PHASE IMPACTS.....	42
6.3.2	DECOMMISSIONING PHASE	42
6.4	IMPACTS ON BIODIVERSITY.....	43
6.4.1	OPERATIONAL PHASE IMPACTS.....	43
6.4.2	DECOMMISSIONING PHASE	44
6.5	CO-LOCATION / SHARING OF SITES.....	44
6.5.1	OPERATIONAL PHASE IMPACTS.....	45
6.6	CIVIL AVIATION SAFETY	45
6.6.1	OPERATIONAL PHASE IMPACTS.....	45

PART B - OPERATIONAL MANAGEMENT GUIDELINES

7 ROLES AND RESPONSIBILITIES 46

7.1 ENVIRONMENTAL MANAGER 47

7.2 CONTRACTOR 47

7.3 ENVIRONMENT HEALTH AND SAFETY OFFICER (EHSO) 48

7.4 ENVIRONMENTAL CONTROL OFFICER (ECO) 48

8 ADMINISTRATION OF ENVIRONMENTAL OBLIGATIONS 49

8.1 INTERNAL REVIEW AND AUDITING..... 49

8.2 IMPLEMENTATION OF THE OEMP 49

8.3 OEMP MONITORING RESPONSIBILITIES..... 49

8.4 DISPUTES AND DISAGREEMENTS..... 49

8.5 EMERGENCY PREPAREDNESS..... 49

8.6 ENVIRONMENTAL AWARENESS TRAINING..... 50

8.7 INFORMATION BOARD(S) 50

9 ENVIRONMENTAL MONITORING..... 51

9.1 OVERVIEW 51

9.2 PROCESS AND TIME FRAME..... 51

9.2.1 OPERATIONAL PHASE MONITORING 51

9.2.2 DECOMMISSIONING PHASE 52

9.3 ON-SITE MONITORING 52

10 OPERATIONAL SPECIFICATIONS 53

10.1 MANAGEMENT OF INFRASTRUCTURE AND SERVICES..... 53

10.2 MANAGEMENT OF WASTE..... 55

10.3 MANAGEMENT OF HAZARDOUS MATERIALS 56

10.4 MANAGEMENT OF NOISE 56

10.5	MANAGEMENT OF WORKER AND PUBLIC SAFETY.....	57
10.5.1	GENERAL	57
10.5.2	RADIATION	58
10.5.3	CIVIL AVIATION	60
10.6	VISUAL IMPACT	60
10.7	MANAGEMENT OF BIODIVERSITY.....	61
10.7.1	GENERAL	61
10.7.2	AVIFAUNA.....	61
10.8	DEALING WITH COMPLAINTS.....	62
11	DECOMMISSIONING SPECIFICATIONS.....	63
11.1	GENERAL CONSTRUCTION SITE MANAGEMENT	63
11.2	FINALISATION OF DECOMMISSIONING AND REHABILITATION.....	65
12	REFERENCES	66

LIST OF FIGURES AND TABLES

LIST OF FIGURES

Figure 1-1: Locality Map (national).....	4
Figure 5-1: Theoretical Modelling of a Network	23
Figure 5-2: Example of a Base Station’s coverage area.....	23
Figure 5-3: Illustration of Signal Strength	24
Figure 5-4: Example of BTS (Monopole).....	24
Figure 5-5: RF Radiation from a 100W Effective Radiated Power (ERP) from a low-gain Antenna on a 15 meter tower	25
Figure 5-6: Emission strength with reference to the distance from the BTS (Wayne and Newell 2000).....	26
Figure 5-7: Electromagnetic Radiation (NoRad Corporation 1997).....	27
Figure 5-8: The electromagnetic spectrum.....	28
Figure 5-9: Example roof top BTS.....	31
Figure 9-1: Decommissioning monitoring phase’s activities	52

LIST OF TABLES

Table 1-1: Structure of the OEMP 7

Table 2-1: Role players responsible for various aspects of the existing activity..... 9

Table 2-2: Qualifications and expertise of the environmental consultant 9

Table 4-1: Listed activities as per Government Notice 29 of 2012 applicable to the existing activity..... 13

Table 4-2: International exposure limits of permissible RF radiation of antennae operating in the 900MHz frequency range 18

Table 4-3: Summary of the ICNIRP Exposure Guidelines for different sources of radiation at different frequencies (ICNIRP 1998) 19

Table 5-1: Typical public RF radiation exposure levels by a given source (WHO 2012).. 28

Table 5-2: Typical maximum public RF radiation exposure per source (WHO 2012)..... 29

Table 5-3: Key descriptive information and typical design specific potential impacts..... 33

Table 7-1: Role players responsible for various aspects of the existing activity..... 46

ABBREVIATIONS AND ACRONYMS

ANSI	America National Standards Institute
BTS	Base Transceiver Station
CENELEC	European Committee for Electrotechnical Standardization (Comité Européen de Normalisation Electrotechnique Europäisches Komitee für elektrotechnische Normung)
CV	Curriculum Vitae
DCA	Directorate of Civil Aviation
DEA	Department of Environmental Affairs
EA	Environmental Assessment
EAP	Environmental Assessment Practitioner
ECC	Environmental Clearance Certificate
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
ELF	Extremely Low Frequency
EMA	Environmental Management Act
EMF	Electromagnetic Field
EMR	Electromagnetic Radiation
ERP	Effective Radiated Power
I&AP	Interested and Affected Party
ICAO	International Civil Aviation Organisation
ICASA	Independent Communication Authority of South Africa
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICT	Information and Communication Technology
IEEE	Institute for Electrical and Electronics Engineers

ITU	International Telecommunication Union
IF	Intermediate Frequency
MET	Ministry of Environment and Tourism
NAM-CATS	Namibian Civil Aviation Technical Standards
NPRA	National Radiation Protection Authority
OEMP	Operational Environmental Management Plan
OLS	Obstacle Limitation Surface
RF	Radio Frequency
SAR	Specific Absorption Rate
WHO	World Health Organisation

GLOSSARY

Antenna – exterior apparatus attached to a tower or other structure designed for telephonic, radio, television, personal communications service, pager network, or other communications through the sending and/or receiving of electromagnetic waves of any bandwidth.

Aerodrome – means a defined area on land or water, including any buildings, installations and equipment, intended to be used either wholly or in part for the arrival, departure and surface movement of aircraft, includes a heliport i.e. also referred to as an airport.

Assessment – The process of identifying, predicting and evaluating the significant effects of activities on the environment; and the risks and consequences of activities and their alternatives and options for mitigation with a view to minimise the effects of activities on the environment.

Audit – Regular inspection and verification of construction activities for implementation of the EMP.

Base Station – The primary sending and receiving site in a wireless telecommunications network. More than one base station and/or more than one variety of telecommunications providers can be located on a single tower or structure, depending on the load capacity of the structure.

Bund – Enclosure under/around a hazardous substance storage facility to contain spillage.

Capacity – Ability of system to handle a number of calls simultaneously.

Competent Authority – An organ of state, which is responsible, under any law, for granting or refusing an authorisation.

Contractor – The principal person or company, including all subcontractors, undertaking the operation or decommissioning of the development as appointed by the Proponent.

Contractor's camp – Refers to all storage stockpiles sites, site offices, container sites, other areas required to undertake decommissioning activities and rest areas for the contractor's staff or management.

Coverage – The surface area a BTS provides with a signal.

Elevation – The measurement of height above sea level.

Emergency Situation – An incident, which potentially has the ability to significantly impact on the environment, and which, could cause irreparable damage to sensitive environmental features. Typical situations entail amongst others the:-

- Spill of petroleum products and lubricants into the aquatic system;

- Potential damage, erosion and slumping of unstable river embankments or drainage channels;
- Potential event of impeding the continuous flow of water to downstream water users dependant on the flow; and
- Dangerous situation where livestock and children can be injured by any activity emanating from the construction or rehabilitation of the project implementation.

Equipment Shelter – An enclosed structure, cabinet, shed, vault, or box near the base of the telecommunication facility within which equipment for those facilities such as battery and electrical equipment are housed.

Environment – The complex of natural and anthropogenic factors and elements that are mutually interrelated and affect the ecological equilibrium and the quality of life, including -

- the natural environment that is the land, water and air, all organic and inorganic material and all living organisms; and
- the human environment that is the landscape and natural, cultural, historical, aesthetic, economic and social heritage and values.

Environmental Assessment Practitioner – A person designated by a proponent to manage the process of applying for an Environmental Clearance Certificate.

Environmental Clearance Certificate – An environmental clearance certificate issued in terms of Section 34 or 37 of the Environmental Management Act (No. 7 of 2007), authorising a listed activity to be undertaken.

Environmental Control Officer – It is a suitably qualified independent environmental assessment practitioner who oversees the environmental responsibilities of the Contractor.

Environmental Impact – An impact or environmental impact is the change to the environment, whether desirable or undesirable, that will result from the effect of a construction activity between the limits that define the development site. An impact may be the direct or indirect consequence of a construction activity.

Environmental Impact Assessment – The process of examining the environmental effects of a development as prescribed by the Environmental Impact Assessment Regulations (GN. No. 30 of 2012) for List of Activities which may not be undertaken without an Environmental Clearance Certificate from the Environmental Commissioner (GN. No. 29 of 2012).

Environmental Management Plan – plan describing how activities that may have significant environments effects on the environment are to be mitigated controlled and monitored.

Environmental Site Manager – The person who represents the Proponent and is responsible for the technical and contractual implementation of the works to be undertaken.

Gigahertz: One billion Hertz.

Hazardous Substance – A substance that, in the reasonable opinion of the Environmental Site Manager and/or ECO, can have a harmful effect on the environment.

Height of Tower – The vertical distance measured from the average elevation of the finished grade surrounding the tower or other structure to the highest point on the tower or other structure, including antennae.

Hertz – One Hertz is the frequency of an electric or magnetic field, which reverses polarity once each second, or one cycle per second.

Listed Activity – An activity listed in terms of Section 27(1) or 29 of the Environmental Management Act, 7 of 2007.

Location – References to site location as the exact longitude and latitude, to the nearest tenth of a second with bearing or orientation referenced to true North.

MegaHertz: One million Hertz.

Mobile Device – small computing device, typically, small enough to hold and operate in the hand and in some instances having an operating system capable of running mobile apps.

Proponent – A person who proposes to undertake a listed activity.

Significant Effect – Means having, or likely to have, a consequential qualitative or quantitative impact on the environment, including changes in ecological, aesthetic, cultural, historic, economic and social factors, whether directly or indirectly, individually or collectively.

Site – The land area, which is, or will be, temporarily or permanently altered during the construction and/or operation and/or decommissioning of any telecommunications tower or facility. These alterations include all construction activities, fencing, landscaping, screening, structures, parking facilities, etc. Access roads and utility lines shall not be considered part of the site, except where specified in these regulations.

Solid Waste – All waste, including operational/decommissioning related debris, chemical waste, excess cement/concrete, wrapping materials, timber, tins and cans, drums, wire, nails, food and domestic waste.

Tower – A structure that is designed and constructed primarily for supporting one or more antennae, including self-supporting lattice or monopole towers and including guyed towers. The term includes radio and television transmission towers, microwave towers, common carrier towers, cellular telephone towers, alternative tower structures, and the like.

Watt – A collective unit of power in the International System of Units (SI). The unit is defined by one joule per second and is a measurement of energy conversion or transfer.

APPENDICES

Appendix A: CV of EAP who compiled the Operational Environmental Management Plan

Appendix B: Proof of submission of application registration for an ECC

Appendix C: Exemption request approval from Environmental Commissioner

Appendix D: Regional maps displaying each of the 298 towers (alphabetically by region)

Appendix E: Site information for each of the 298 towers (alphabetically by region)

PART A - BASELINE INFORMATION

This Operational Environmental Management Plan (OEMP) consists of two parts – Part A and Part B. Part A of this OEMP provides generic baseline information pertaining to the existing operation of 298 telecommunications towers (referred to as the “existing activity” hereafter). Part B provides the operational environmental management guidelines for the operation and decommissioning of the existing activity.

1 BACKGROUND INFORMATION

This chapter of the report provides; a background to the existing operation of 298 telecommunications towers (referred to as the “existing activity” hereafter), an overview of the existing activity’s location, the terms of reference for the compilation of this Operational Environmental Management Plan (OEMP), purpose of this document; the assumptions and limitations which influenced the compilation of this OEMP; and an outline of the remainder of this document.

1.1 INTRODUCTION

The Namibian Government’s Vision 2030 document stipulates that Information and Communication Technology (ICT) must be the most important sector in the economic development of the country by 2030. Core to the achievement of Vision 2030 is a demand driven need to transform Namibia into a knowledge-based economy.

The establishment of an environment conducive to the growth of telecommunications and ICT in Namibia is a national imperative. Namibia has a large unmet demand for ICT which will be satisfied quicker by the deregulation and liberalisation of the market as part of a managed programme of reform. The transition to a liberalised ICT environment (with a commensurate increase in institutional capacity to develop, regulate and implement policy) is also paramount if broader national development goals and the growth in the Namibian ICT industry is to be achieved. The recent establishment of a single Ministry of Information and Communication Technology (in line with international trends) is an important first step on this journey.

This however brings an ever-increasing demand for Base Transceiver Stations (BTS) sites. These are base stations and tower structures for antennae that facilitate mobile telecommunication services. These stations may have visual impacts, environmental and socio-economic impacts, as well as public health concerns associated with radiation (radio frequency energy) emitted from the antennae.

PowerCom (Pty) Ltd (hereafter the Proponent) is currently responsible for the operation and maintenance of 298 BTS sites throughout Namibia. The construction of telecommunication infrastructure, according GN. No. 29 of 2012 (listed under the Environmental Management Act (EMA) 7 of 2007), is an activity, which may not be undertaken without an Environmental Clearance Certificate (ECC).

The majority of these sites were constructed before the promulgation of the EMA’s Environmental Impact Assessment (EIA) Regulations (2012) and List of Activities (GN. No. 29 of 2012).

As part of their corporate responsibility and compliance to national legislation, the Proponent commissioned the drafting of this operational EMP (OEMP) with the intention of submitting it as part of application for an ECC.

1.2 THE PROPONENT

“PowerCom has been in operation since 2007 and became a subsidiary of Telecom Namibia Group in October 2013. Since its acquisition, the principle nature of business changed from a mobile telecommunications operator to an ICT infrastructure and equipment provider” (PowerCom, 2017).

It is PowerCom’s mission “to become the market leader in Passive Infrastructure by providing a unified one stop solution for telecommunications towers and other ICT infrastructure” (PowerCom, 2017).

1.3 TERMS OF REFERENCE

The Proponent required the following services from the EAP:

- (i) compile an Operational Environmental Management Plan (including decommissioning) for the existing activity, which the Proponent intends to submit as part of an application for an Environmental Clearance Certificate.

The Operational Environmental Management Plan (OEMP) is a standalone report, which will be compiled as per the requirements as set out in Regulation 8(j) of the EIA Regulations (GN. No. 30 of 2012), as indicated below.

(j) a draft management plan, which includes -

(aa) information on any proposed management, mitigation, protection or remedial measures to be undertaken to address the effects on the environment that have been identified including objectives in respect of the rehabilitation of the environment and closure;

(bb) as far as is reasonably practicable, measures to rehabilitate the environment affected by the undertaking of the activity or specified activity to its natural or predetermined state or to a land use which conforms to the generally accepted principle of sustainable development; and

(cc) a description of the manner in which the applicant intends to modify, remedy, control or stop any action, activity or process which causes pollution or environmental degradation remedy the cause of pollution or degradation and migration of pollutants.

Environmental Impact Assessment Regulations, GG. No. 30 of 2012

Section 57(1) of the EMA states that “A person who, on the date of commencement of this Act, undertakes a listed activity under an authorisation may continue to undertake such activity for a period not exceeding one year, or such longer period as the Minister may on application approve.” Even though most of the BTS sites were constructed prior to the promulgation of the EIA Regulations, the Proponent is required, in accordance with Section 57(1) of the EMA to apply for an ECC for these sites retrospectively.

1.4 GENERIC OPERATIONAL ENVIRONMENTAL MANAGEMENT PLAN

A generic OEMP forms a basic general guide according to which the operation phase of a particular type development can be implemented. A generic OEMP is therefore not specific to a particular development at a particular site, due to the fact that a generic OEMP has not considered the outcome of an EIA (i.e. Scoping Assessment or Detailed Assessment), for whatever reason.

This generic OEMP will form part of the Proponent's guidance and management tool during operational and decommissioning activities. Generic mitigation and management measures are provided for consideration and implementation, in order to ensure that common impacts as identified in this document are either avoided or minimised.

1.5 PURPOSE OF THIS DOCUMENT

The purpose of the OEMP is to provide specifications for "good environmental practice" for application during the operational and decommissioning phases.

As such, the OEMP provides specifications that the Proponent must adhere to in order to minimise adverse environmental impacts associated with the operational phase. The Proponent to which authorisation might be granted, is ultimately responsible for overall environmental performance.

The guidelines for the execution of an OEMP include the following:

- Responsibilities for the environmental performance of the existing activity are communicated to the operating staff;
- Communication channels to report on environmental performance, problems and priorities are in place;
- A monitoring schedule is established to identify potential negative environmental impacts associated with the operation of the existing activity;
- Mitigation measures are implemented to avoid or minimise the identified negative environmental impacts (biodiversity impacts, operational waste, noise and dust, etc.) as well as to enhance the positive impact on the environment (continuous and improved ICT service provision); and
- Monitoring programme or schedule is developed to track the plans that have been implemented so as to ensure the effectiveness of the plans.

1.6 SCOPE OF THE OEMP

In order to ensure a holistic approach to the management of environmental impacts during the operational phase, this OEMP sets out the methods by which proper environmental controls should be implemented by the Proponent and all other parties involved.

This OEMP intends to guide and manage the operational phase for the existing activity and surrounding areas as they relate to the biophysical and social environment. It describes mitigation measures and is prescriptive in identifying specific people or organisations to undertake specific tasks. This document must further be seen as open-ended, requiring regular review and updating via the correct channels in order for it to effectively guide environmental management of the existing activity.

The provisions of this OEMP are binding on the Proponent until such time that ownership is transferred to any other stakeholder, if it is the case. Any third party appointed by the Proponent in terms of operational management must comply with the conditions of this OEMP.

This OEMP has been designed to suit the operational activities and needs of the existing activity, and addresses the following:

- General operational mitigation measures;
- Operational activities that could impact on the environment;
- Operational environmental aspects with which the operator shall comply in order to protect the environment from the identified impacts.

The OEMP is a dynamic document subject to similar influences and changes as are created by alterations to the specifications of the existing activity. Any substantial changes shall require approval from the Proponent.

1.7 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations apply to the existing activity:

Assumptions:

- It is assumed that the information provided by the Proponent is accurate and discloses all information necessary for the ECC application process;
- It is assumed that all formal approvals and permits with regards to the radio frequency spectrum use and licensing have been obtained by the Proponent before commencement of the existing activity. All other approvals, licenses or permits are the responsibility of the Proponent.

Limitations:

- Some site-specific information was not available from the Proponent;
- No baseline assessment nor any specialist assessment (i.e. avifauna; International Civil Aviation Organisation (ICAO) Annex 14, radiation) was done for the 298 sites;
- No site visit was conducted to any of the BTSs;
- Neither the EMA nor the EIA Regulations provides any guidance concerning the process of applying for an ECC with an OEMP, or the content of such an OEMP;

- No formal legislation exists in Namibia regulating non-ionising radio frequency radiation and exposure levels. In the absence of these, the National Radiation Protection Authority (NRPA) endorses the radiation exposure limits as recommended by the World Health Organisation (WHO) and the guidelines of the International Commission on Non-Ionising Radiation Protection (ICNIRP). NRPA requires that all service providers (government, the industry or the public) adhere to these limits. As a result, the ICNIRP exposure limits have been used to inform mitigation measures with regard to health and safety.

1.8 FORMAT OF THE OEMP

This document consists of two parts with a total of 11 chapters as outlined below.

Table 1-1: Structure of the OEMP

CHAPTER	CONTENTS
PART A: BASELINE INFORMATION	
Chapter 1	Background Information Provides an introduction and background information on the existing activity; Terms of Reference; the study assumptions and limitations; overview of the study area and outlines the purpose, goals and structure of the report.
Chapter 2	Project Team Provides an overview of the role-players participating in the existing activity as well as the experience of the environmental management consultant.
Chapter 3	Study Approach and Methodology Describes the process and methodology followed as part of the ECC application.
Chapter 4	Legal Framework Summarises the framework for environmental management in Namibia and provides an overview of the key legislation having implications for the existing activity.
Chapter 5	Description of Existing Activity Provides a description of the need for the existing activity, examples of the physical appearance of the existing activity, general description of the technology currently being used, design and specifications, service infrastructure and operational activities.
Chapter 6	Generic Operational Impacts and Mitigations Describes the potential impacts of the existing activity. Mitigation measures relevant to the operational and decommissioning phases of the existing activity as appropriate are

CHAPTER	CONTENTS
	recommended.
PART B: OPERATIONAL MANAGEMENT GUIDELINES	
Chapter 7	Roles and Responsibilities Describes the roles and responsibilities of the key role players involved in the environmental management of the operation of the existing activity
Chapter 8	Administration of Environmental Obligations Describes the arrangements and procedures necessary for the effective administration of the environmental management obligations.
Chapter 9	Environmental Monitoring Lays out the schedule for monitoring of activities during the operational phase and decommissioning phase.
Chapter 10	Operational Specifications Outlines environmental management actions pertaining to operational activities
Chapter 11	Decommissioning Specifications Outlines environmental management actions pertaining to decommissioning activities
References	References Provides a list of all the documents that were referenced during the report.

1.9 AMENDMENTS TO THE OEMP

Any party involved with the existing activity can suggest changes to the OEMP via the DEA and Competent Authority. Approved changes will be minuted and drafted into this existing OEMP in the form of an appendix or amendments. This should be clearly stipulated in the OEMP to avoid confusion (see Section 8.1 – INTERNAL REVIEW AND AUDITING).

2 PROJECT TEAM

This chapter presents the different role players, their respective roles on the project and the expertise of the Environmental Assessment Practitioner.

2.1 PROJECT ROLE PLAYERS

The role players responsible for the various aspects of the existing activity are presented Table 2-1

Table 2-1: Role players responsible for various aspects of the existing activity

ORGANISATION	EXISTING ACTIVITY ROLE
Directorate of Civil Aviation (Ministry of Works and Transport)	Competent Authority (within the obstacle limitation surface of any aerodrome – see
Communications Regulatory Authority of Namibia	Regulates telecommunications licensing in Namibia
Department of Environmental Affairs	Decision-making authority for environmental authorisation
PowerCom (PTY) Ltd.	Proponent
Urban Green cc	Independent Environmental Assessment Practitioner (EAP)

2.2 EXPERTISE OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER

The qualifications and expertise of the environmental consultant are set out in Table 2-2 below. The CV of the Environmental Assessment Practitioner who compiled this OEMP is attached as Appendix A.

Table 2-2: Qualifications and expertise of the environmental consultant

NAME	URBAN GREEN CC (MR SHEDON HUSSELMANN)
RESPONSIBILITY ON THE PROJECT	Lead EAP Project management and client liaison; public and stakeholder consultation; impact assessment and mitigation formulation; reporting and application for ECC
QUALIFICATIONS	MSc Environmental and Geographical Science (EGS); Bachelor of Science EGS
PROFESSIONAL REGISTRATION	None

NAME	URBAN GREEN CC (MR SHEDON HUSSELMANN)
EXPERIENCE IN YEARS	5 +
EXPERIENCE	Sheldon Husselmann has been involved in various applications for ECCs associated with projects of various kinds located throughout Namibia.

3 STUDY APPROACH AND METHODOLOGY

The approach and methodology followed – i.e. compiling an OEMP to be included as part of an application for an ECC, is not regulated and/or guided by any legislation.

The EMA and/or EIA Regulations (GN. No. 30 of 2012), do not stipulate the methodology to be followed in compiling an EMP, only the content (i.e. information) that should be reflected in an EMP (Regulation 8(j)), as indicated under Section 1.3 – TERMS OF REFERENCE above.

The Environmental Management Plan will therefore be compiled to reflect the information as stipulated by Regulation 8(j) of the Environmental Impact Assessment Regulations (GN. No. 30 of 2012), which according to our opinion does not require any site specific investigations, but can be drawn from past experiences and examples from similar sites.

3.1 SCREENING AND APPLICATION FOR ENVIRONMENTAL CLEARANCE CERTIFICATE

The first stage undertaken as part of this ECC application was an impact screening stage during which the potential environmental impacts of the existing activity were considered.

During the initial screening stage, two *listed activities* (see Section 4.1.2 – ENVIRONMENTAL MANAGEMENT ACT NO. 7 OF 2007 below) associated with the existing activity, requiring an ECC were identified. Potential environmental impacts identified at the time included, but were not limited to, the following –

- Impacts of the existing sites' on civil aviation safety and aircraft flying procedures to and from existing aerodrome;
- Impacts on avifauna (mortality owing to collisions with guy-wires);
- Health impacts associated with exposure to non-ionising radiation;
- Visual impact (i.e. structural appearance, height of the tower structure) expected.

Following the screening stage, an application for an ECC was submitted on 12 October 2016 with the Environmental Commissioner (see Appendix B), as prescribed by Regulation 6 (Form 1 of Annexure 1) of the EIA Regulations (GN. No. 30 of 6 February 2012) of the EMA.

In light of the fact that all 298 sites are existing BTSs and are in operation (i.e. existing listed activities), as part of the application for an ECC, exemption was requested from the office of the Environmental Commissioner to have to conduct a scoping-level EA for each site (see Appendix B). Subsequent to the submission of the aforementioned exemption request, the Environmental Commissioner granted approval for the exemption request (see Appendix C). Instead of applying for an ECC based on the findings of a scoping-level assessment, the application will be made by the Proponent based on a generic OEMP only.

4 LEGAL FRAMEWORK

For the purpose of environmental protection and sustainable renewable resource management to the benefit of all, legislation from different spheres under control of various ministries have been adopted and enacted by the Namibian parliament. In support to the goal of sustainable renewable resource management, various international treaties and conventions have also been agreed to by Namibia.

There are a number of sectoral laws that fall under the general rubric of environmental laws. Sectoral laws are generally specific and apply to sectors such as forestry, water, mining and so forth. Any development, such as a Base Transceiver Station (BTS), having certain impacts would therefore have to comply with some or other legislative requirement/s.

This chapter of the OEMP presents: (i) first the legal framework for environmental management in Namibia; (ii) secondly the national sectoral legislative requirements applicable to the activities of the existing activity; (iii) international legal instruments; and (iv) lastly, the details pertaining to the authorities responsible for regulating activities pertaining to BTS sites.

4.1 NAMIBIAN LEGAL FRAMEWORK FOR EIAs

4.1.1 THE CONSTITUTION OF THE REPUBLIC OF NAMIBIA (1990)

Namibia's environmental policies are based on the requirements of the Namibian Constitution to endorse the concept of sustainable development. The Constitution of the Republic of Namibia (1990) is the principal and guiding supreme legislation whereby the country commits itself to sustainable development through environmental protection and wise resource management.

Article 95 (1), Promotion of the Welfare of the People, puts forward this intention as follows:

“...the State shall actively promote and maintain the welfare of the people by adopting, inter alia, policies aimed at... maintenance of ecosystems, essential ecological processes and biological diversity of Namibia and utilization of natural resources on a sustainable basis for the benefit of all Namibians both present and future.”

In accordance with the constitution, the National Government of Namibia has formulated policies, development plans (such as Vision 2030, NDP's, Harambee Prosperity Plan etc.) and legislation directed at sustainable development and socio-economic development.

In accordance with the constitution, it is therefore necessary and important that the existing activity support these national goals.

4.1.2 ENVIRONMENTAL MANAGEMENT ACT NO. 7 OF 2007

The Environmental Management Act (No 7 of 2007) (EMA) was promulgated in December 2007 and commenced on 6 February 2012 (Government Notice 28 of 6 February 2012) along with the promulgation of the EIA Regulations (GN. No. 30 of 2012). The EMA and its EIA Regulations are administered by the Ministry of the Environment and Tourism's (MET's) Department of Environmental Affairs (DEA).

The EMA’s main objectives capture the essence and importance of this particular legislation, which are to:

- Ensure that the significant effects of activities on the environment are considered in time and carefully;
- Ensure that there are opportunities for timeous participation of interested and affected parties throughout the assessment process; and
- Ensure that the findings of an assessment are taken into account before a decision is made in respect of activities.

In Section 3(2) of the EMA, a set of principles are established which give effect to the provisions of the Constitution for integrated environmental management. Although these principles are not enforceable, it is incumbent upon decision makers to consider them when deciding on the approval of a project.

The EMA stipulates that no party, whether private or governmental, can conduct a listed activity without an ECC to be obtained from the Environmental Commissioner (Section 27(3)). Depending on the type of activity/ies being applied for, the Commissioner may request that an Environmental Impact Assessment be conducted. Section 27(1) of the EMA refers to the *List of activities that may not be undertaken without an Environmental Clearance Certificate* (GN. No. 29 of 2012). The following listed activities are applicable to the existing activity.

Table 4-1: Listed activities as per Government Notice 29 of 2012 applicable to the existing activity

ACTIVITY NO.	ACTIVITY DESCRIPTION
INFRASTRUCTURE	
Section 10.1(g)	The construction of- communication networks including towers, telecommunication and marine telecommunication lines and cables.
Section 10.1(j)	The construction of- masts of any material or type and of any height, including those used for telecommunication broadcasting and radio transmission.

4.2 NAMIBIAN SECTORIAL LEGISLATIVE REQUIREMENTS

A number of Namibian legislative instruments and policies have environmental considerations in respect of operations to be carried out in most development initiatives in Namibia, as listed below.

4.2.1 ATOMIC ENERGY AND RADIATION PROTECTION ACT NO 5 OF 2005

This act provides predominantly for the adequate protection of the environment and of people against the harmful effects of radiation by controlling and regulating the production, processing, handling, use, holding, storage, transport and disposal of radiation sources and radioactive materials, and controlling and regulating prescribed non-ionising radiation sources.

However, the act currently does not have regulations promulgated specific to sources of non-ionising radiation, including radio frequency radiation emitted by BTSs. The National Radiation Protection Authority (NRPA) within the Directorate of Atomic Energy and Radiation Protection (Ministry of Health and Social Services) was established under the Act (Regulation 33) to monitor and control activities involving the use of ionising and non-ionising radiation for protection of the public, workers and the environment against the harmful effects of radiation and to ensure meaningful contribution of nuclear technology for socio-economic development by promoting applications of nuclear technology. The Atomic Energy Board, a national advisory board was established under this act to advise on all matters relating to radiation sources and nuclear energy.

No formal legislation exists in Namibia regulating non-ionising radio frequencies and exposure levels. In the absence of these, the NRPA endorses the radiation exposure limits as recommended by the World Health Organisation and the guidelines of the International Commission on Non-Ionising Radiation Protection (ICNIRP 1998 guidelines). NRPA requires that all service providers (government, the industry or the public) adhere to these limits as a precautionary measure to protect the public health from potential long-term effects to radiation exposure. **As a result, the ICNIRP exposure limits (ICNIRP 1998) have been used in the formulation of mitigation measures for health and safety related impacts associated with continued operation of the existing activity.**

4.2.2 GUIDELINES FOR LIMITING EXPOSURE TO TIME-VARYING ELECTRIC, MAGNETIC AND ELECTROMAGNETIC FIELDS (UP TO 300GHZ)

The ICNIRP has developed 'Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic, and Electromagnetic Fields (up to 300GHz)' (ICNIRP 1998), as amended during 2010. These guidelines were established for limiting exposure to electro-magnetic fields and provide protection against known adverse health effects by stipulating exposure limits associated with BTSs. The guidelines released in 1998 were amended in 2010 that covered exposure up to 100kHz (ICNIRP 2010).

It is important to note that this is an internationally accepted guideline and not a Namibian legal instrument. They are however applicable in this section as these guidelines are endorsed by the National Radiation Protection Authority under the Atomic Energy and Radiation Protection Act (No. 5 of 2005).

4.2.3 AVIATION ACT NO. 74 OF 1962, AS AMENDED

The Aviation Act No. 74 of 1962 (as amended) aims to consolidate the laws enabling effect to be given to certain International Aviation Conventions and making provision for the control, regulation and encouragement of flying within Namibia and for other matters incidental thereto.

The Directorate of Civil Aviation (DCA) is a regulatory body in the Ministry of Works and Transport and is tasked with enforcing the Act. The goal of the DCA is to ensure a safe, secure and efficient civil aviation system which contributes to Namibia's national economy by fostering the planning and development of air transport so as to secure the safe and orderly growth of civil aviation, development of airways, aerodromes and air navigation facilities, and to meet the needs of the public for safe, secure, efficient, and economical air transport. The DCA also honours Regional and International obligations and conventions.

The Namibian Civil Aviation Regulations (GN. No. 1 of 2001) were promulgated to update the Aviation Act of 1962. There are two main reasons for updating the aviation legislation, namely, the current legislation does not adequately reflect the policies of Namibia for the aviation sector and does not reflect recent developments within SADC. These regulations further aim to enhance the safety of civil aviation by ensuring that the Namibian legislation complies with the minimum standards prescribed by the International Civil Aviation Organization.

The charter of International Civil Aviation Organization (ICAO) is the Convention on International Civil Aviation, to which each ICAO contracting state is a party. Namibia is a contracting state obliged to ensure civil aviation safety in accordance with the prescribed standards and recommended practices. ICAO creates and modernises standards and recommended practices on international aviation to ensure the safe, efficient and orderly evolution of international civil aviation. Annex 14 to the Convention defines the airspace around aerodromes to be maintained free from obstacles so as to permit the intended aeroplane operations at the aerodromes to be conducted safely, to prevent the aerodromes from becoming unusable by the growth of obstacles around the aerodromes. This is achieved by establishing a series of obstacle limitation surfaces that define the limits to which objects may project into the airspace.

In accordance with Part 139 of the Namibian Civil Aviation Regulations, as regulated by the Aviation Act (No. 74 of 1962), no obstacle (e.g. a telecommunication tower) higher than 150 feet (45 m) above the mean level of the landing area and fall within a distance of 8 km (measured from the aerodrome reference point of any aerodrome), shall be erected without the written approval from the Director of the Directorate of Civil Aviation.

As stated in Section 1.7 it is assumed that approval for the applicable site, if not obtained already, will be obtained from the DCA.

4.2.4 COMMUNICATIONS ACT NO. 8 OF 2009

This act provides for the regulation of telecommunications services and networks, broadcasting, postal services and the use and allocation of radio spectrum use.

The Communications Regulatory Authority of Namibia (CRAN) was established under this act to regulate the communications industry in Namibia in accordance with the provisions of this act, in particular the licensing and spectrum use, which falls under the jurisdiction of the Ministry of Information and Communications Technology (MICT).

The CRAN has promulgated several regulations as provided for under this act which apply to the existing activity:

- Regulations regarding Telecommunications Service Licenses (GG No. 4785, GN No. 272, 29 August 2011).
- Regulations in respect of Type Approval and Technical Standards for Telecommunications Equipment (GG No. 5659, GN No. 22, 30 January 2015).

4.2.5 LABOUR ACT NO. 11 OF 2007, AS AMENDED

Under this act, occupational health and safety of employees is covered under the Regulations relating to the Health and Safety of employees at work (GN. No. 156 of 1997).

Chapter 4 of this act stipulates that all employees have the right to health and safety at the workplace. Part 1 F of Chapter 4 details provisions pertaining to goods hoists. Chapter 6 A details provisions pertaining to non-ionising radiation. Chapter 6 C details provisions for protective equipment, including protection against falling. Chapter 9 provides details pertaining to electrical safety. The OEMP should make provision for a Health and Safety Officer in order to maintain a healthy and safe environment for all workers.

4.2.6 OTHER NAMIBIAN LEGAL INSTRUMENTS APPLICABLE TO THE PROJECT

The following are legal instruments and policies relevant to the existing activity, however it should be noted the this list is not necessarily exhaustive:

- **Town Planning Scheme (TPS).** A TPS is a statutory document which is compiled for a local authority in terms of the regulations of the Town Planning Ordinance, 1954 (Ordinance 18 of 1954), as amended. The general purpose of a TPS is the coordinated and harmonious development of the relevant local authority area, including where necessary the redevelopment of any part thereof which has already been subdivided and built upon, in such a way as will most effectively tend to promote health, safety, order, amenity, convenience and general welfare as well as efficiency and economy and conservation of the existing character of the town, in the process of such development. Many of the BTS sites are located within the jurisdictional boundary various local authorities with existing TPSs.
- **Structure Plan.** A structure plan is a policy document, approved by the relevant local authority, which indicates present land uses, provides an analysis on the expected urban growth and its associated requirements as well as includes recommendations on how the local authority is to achieve the goals and targets set out by the structure plan. Based on the fact that a structure plan is a flexible and not a rigid document, it is revised (usually every five years) in order to reflect the existing situation and foreseeable changes. Many of the BTS sites are located within the jurisdictional boundary various local authorities with existing structure plans.
- **Local authority policies pertaining the erection and operation of telecommunication facilities.** Some local authorities affected by the existing activity have policies, legally enforceable within their jurisdictional area, which regulate the erection and operation of telecommunication infrastructure.

- **Atmospheric Pollution Prevention Ordinance (No. 11 of 1976), as amended**, generally provides for the prevention of the pollution of the atmosphere and dust control. Part 4 deals with control of dust and provides for the proclamation of dust control areas. The entire area of Namibia, with the exception of the east Zambezi Strip (previously Caprivi) is classified as a controlled area, as laid out in section 4(1)(a) of the Ordinance (GN. No. 309 of 1976). Developers should thus limit dust pollution in the construction and operation phases of developments.
- **The Public Health Act (No. 36 of 1919)** deals with general public health and safety. However, no reference is made to minimum allowable exposure levels of non-ionising radiation associated with wireless telecommunication systems.
- **Nature Conservation Ordinance (No. 4 of 1975), as amended**, provides for the conservation of nature, including the protection of ecosystems and protected species of plants and animals as listed in the Schedules of the Ordinance. It is administered by the Ministry of Environment and Tourism. If any protected plant or animal may be affected by the operations associated with the existing activity, a permit would need to be obtained.
- **Soil Conservation Act (No. 76 of 1969), as amended** focuses on combating and preventing soil erosion, the conservation, protection and improvement of soil, vegetation and water sources and resources. The existing activity should thus not impact negatively on the soil, vegetation and water resources within, adjacent or underneath the existing BTS sites during operations.
- **Forestry Act (Act 12 of 2001), As Amended**, the Act deals with forests in general and matters incidental thereto. Of importance to the existing activity is that the Act affords general protection of the environment (Part IV). Permits are required for the removal of specified protected plant species.
- **National Heritage Act (No. 27 of 2004)** ensures the protection of cultural and archaeological sites. The Act requires the identification of cultural and archaeological sites within the footprint of the existing BTS sites, registration and protection thereof.

4.3 INTERNATIONAL LEGAL INSTRUMENTS

4.3.1 INTERNATIONAL STANDARDS AND HUMAN EXPOSURE LIMITS

To protect human health from exposure to and potential impacts of radio frequency radiation, international safety guidelines have been developed by various organisations to establish exposure limits from transmitting antennae.

The most widely accepted standards are those developed by the ICNIRP, the Institute of Electrical and Electronics Engineers (IEEE) and American National Standards Institute (ANSI) and the National Council on Radiation Protection and Measurements (NCRP). The ICNIRP is an international non-governmental, independent scientific organisation that provides guidance and scientific advice on the health hazards of non-ionising radiation exposure. The overall objective of the ICNIRP is to revise and formulate guidelines on permissible exposure limits. It

also contributes to environmental health criteria and is accepted by the World Health Organisation.

As there is an increase in demand and use for radio frequency technology, the need remains for continued research to ensure permissible exposure limits are safe. The ICNIRP guidelines are reviewed regularly by evaluating research results and are updated when necessary. The latest update occurred in 2010 that covered non-ionizing radiation exposure for frequencies ranging between 0 and 100kHz. Exposure limits are expressed in Specific Absorption Rate (SAR) for frequencies between 10MHz and 10GHz and in power density (Watt per square meter) for frequencies above 10GHz. **The ICNIRP exposure limits for non-ionizing radiation of antennae operating at 900MHz is 0.08 W/kg (SAR) or 4.5Wm² (f/200) (ICNIRP 1998).**

Each country usually sets its own national exposure limits or adopts the international limits set by the organisations listed above. The RF radiation and permissible power density exposure limits varies considerably between countries (Table 4-2).

Table 4-2: International exposure limits of permissible RF radiation of antennae operating in the 900MHz frequency range

POWER DENSITY LIMITS	ORGANISATION/ COUNTRY
5.7 W/m ²	NCRP
5.7 W/m ²	IEEE/ ANSI (1992)
4.5 W/m ²	ICNIRP (1998)
1 mW/m ² "	Austria (Precautionary limit)
20 mW/m ²	Russia
100 mW/m ²	Poland
160 mW/m ²	Italy
240 mW/m ²	Czechoslovak Socialist Republic
2 W/m ²	New Zealand
3 W/m ²	Canada (Safety Code 6, 1997)
4.5 W/m ²	Germany

Table 4-3 contains a summary of the ICNIRP exposure guidelines for different sources of radiation at different frequencies.

Table 4-3: Summary of the ICNIRP Exposure Guidelines for different sources of radiation at different frequencies (ICNIRP 1998)

SOURCE OF RADIATION	EUROPEAN POWER FREQUENCY		MOBILE PHONE BASE STATION FREQUENCY		MICROWAVE OVEN FREQUENCY
	50 Hz	50 Hz	900 MHz	1.8 GHz	2.45 GHz
Frequency (<i>f</i>)	50 Hz	50 Hz	900 MHz	1.8 GHz	2.45 GHz
Unit	Electric field (V/m)	Magnetic field (μ T)	Power density (W/m^2)	Power density (W/m^2)	Power density (W/m^2)
Public exposure limits ($f/200$)	5 000	100	4.5*	9	10
Occupational exposure limits	10 000	500	22.5	45	-

* Calculated using the formula of $f/200$; where f is frequency in MHz (ICNIRP 1998)

Namibia has no regulations specific to sources of non-ionising radiation. The National Radiation Protection Authority (NRPA) within the Ministry of Health and Social Services was established to administer the Atomic Energy and Radiation Protection Act (No. 5 of 2005) and is therefore mandated to regulate activities related to radiation. NRPA accepts the guidelines of the World Health Organisation which endorses the exposure limits determined by the ICNIRP. The NRPA currently neither prescribes nor enforces any compulsory exposure limits for electromagnetic fields, but does advise all parties concerned (whether these be government, the industry or the general public) that voluntary compliance with the afore-mentioned ICNIRP exposure guidelines of 1998 is the recommended and science-based way to deal with any situation involving human exposure to non-ionising electromagnetic fields. However, the Atomic Energy and Radiation Board of Namibia, in collaboration with stakeholders is seeking to establish guidelines to ensure public protection from short and long-term effects of radiation, appropriate for the Namibian context.

A recent review revealed that the scientific literature published since the 1998 guidelines has provided no evidence of any adverse effects below the basic restrictions and does not necessitate an immediate revision of its guidance on limiting exposure to high frequency electromagnetic fields (ICNIRP 2009).

4.3.2 INTERNATIONAL CIVIL AVIATION STANDARDS

The charter of International Civil Aviation Organization or ICAO is the Convention on International Civil Aviation, to which each ICAO contracting state is a party.

Creating and modernising Standards and Recommended Practices, or SARPs on international aviation is the responsibility of the ICAO, the specialised agency of the United Nations whose mandate is to ensure the safe, efficient and orderly evolution of international civil aviation.

Namibia is a Contracting State obliged to ensure civil aviation safety in accordance with the prescribed Standards and Recommended Practices. Under the terms of their license, as issued by the Namibia Directorate Civil Aviation, airports are normally required to prevent new developments or extensions to existing structures from infringing the Obstacle Limitation Surface (OLS). The OLS completely surrounds an aerodrome, but those surfaces aligned with the runway(s) used to protect aircraft landing or taking-off can be more limiting than those surrounding the rest of the aerodrome, particularly closer to the aerodrome.

In accordance with Part 139 of the Namibian Civil Aviation Regulations, as regulated by the Aviation Act (No. 74 of 1962), no obstacle (e.g. a telecommunication tower) higher than 150 feet (45.7 m) above the mean level of the landing area and fall within a distance of 8 km (measured from the aerodrome reference point of any aerodrome), shall be erected without the written approval from the Director of the Directorate of Civil Aviation.

The purpose of the ICAO Annex 14 Obstacle Limitation Surfaces is to define the volume of airspace that should be ideally kept free or safeguarded from obstacles, and to take the necessary measures to ensure the safety of aircraft, and thereby the passengers and crews aboard them, while taking-off or landing, or while flying in the vicinity of an airport.

This is achieved by a process of evaluating a proposed development so as to:

- Protect the blocks of air through which aircraft fly, by preventing penetration of these surfaces' lower limits;
- Protect the integrity of radar and other electronic aids to air navigation, by preventing reflections and diffractions of the radio signals involved; and
- Protect visual aids, such as Approach and Runway lighting, by preventing them from being obscured, or preventing the installation of other lights, which could be confusing for them.

BTS sites that are located within 8 km of an existing aerodrome and higher than 150 feet (45.7 m) above the mean level of the landing area of such an aerodrome would need to conform with the provisions of this convention.

4.3.3 RAMSAR CONVENTION ON WETLANDS OF INTERNATIONAL IMPORTANCE (1971)

The following provisions from the Ramsar Convention on Wetlands of International Importance (1971) are applicable to the existing activity:

- Article 2(1) provides for the inclusion of wetlands in a "List of Wetlands of International Importance" "especially where these have importance as waterfowl habitat".
- Article 2(6) provides for the exercising of international responsibilities with respect to these wetlands.
- Article 4 provides for the promotion of conservation of wetlands and waterfowl. Namibia is a signatory to this convention.

All areas included in the “List of Wetlands of International Importance” and their conservation has the support of national government. Some of the BTS sites are located near some of these areas. The Proponent therefore has a responsibility in terms of impact avoidance and mitigation to ensure that steps are taken to conserve water birds.

4.4 REGULATING AUTHORITIES

4.4.1 INTERNATIONAL TELECOMMUNICATION UNION

ITU (International Telecommunication Union) is the United Nations specialised agency for Information and Communication Technologies (ICT). Namibia is a member country of ITU and is administered through the Ministry of Information and Communication Technology. ITU is headquartered in Geneva, Switzerland, and has twelve regional and area offices around the world. ITU is at the very heart of the ICT sector, brokering agreement on technologies, services, and allocation of global resources like radio-frequency spectrum and satellite orbital positions, to create a seamless global communications system that is robust, reliable, and constantly evolving (www.itu.int).

4.4.2 COMMUNICATIONS REGULATORY AUTHORITY OF NAMIBIA

CRAN (the Communications Regulatory Authority of Namibia) is the official regulator of the Namibian communications, broadcasting and postal services sector and has been operational since 18 May 2011. CRAN was established under the Communications Act, No. 8 of 2009. CRAN was established to provide for the regulation of telecommunications services and networks, broadcasting, postal services and the use and allocation of radio spectrum.

The Authority issues broadcasting service licenses and radio spectrum use licenses.

4.4.3 NATIONAL RADIATION PROTECTION AUTHORITY

The National Radiation Protection Authority (NRPA) within the Ministry of Health and Social Services was established to administer the Atomic Energy and Radiation Protection Act (No. 5 of 2005) and is thus mandated to regulate activities related to radiation. NRPA accepts the guidelines of the World Health Organisation who endorses the exposure limits determined by the ICNIRP (ICNIRP 1998). The NRPA currently neither prescribes nor enforces any compulsory exposure limits for electromagnetic fields, but do advises all concerned (whether they be a government, the industry or the public) that voluntary compliance with the aforementioned ICNIRP exposure guidelines is the recommended and science-based way to deal with any situation involving long-term human exposure to non-ionising electromagnetic fields.

5 DESCRIPTION OF THE EXISTING ACTIVITY

This chapter first provides a generic description of Base Transceiver Stations (BTSs). Some information on the existing activity is provided, including examples of different tower designs, and typical operational and decommissioning requirements.

The content of this chapter is based on and derived from secondary sources of information, in-house information as well as information provided by the Proponent.

5.1 POWERCOM NETWORK

Figure 1-1 indicates the existing PowerCom network of towers across the country.

PowerCom's current network consists of 298 sites, located across the country within each of the 13 regions (see Figure 1-1, Appendix D for the 13 regional maps and Appendix E for site-specific information). The 298 sites are located within townlands boundaries of urban centres as well as on state land (whether communal, or earmarked for conservation).

5.2 NEED AND DESIRABILITY

The Namibian Government's Vision 2030 document stipulates that Information and Communication Technology (ICT) must be the most important sector in the economic development of the country by 2030. The establishment of an environment conducive to the growth of telecommunications and ICT in Namibia is a national imperative.

Namibia currently has a large unmet demand for ICT. BTSs facilitate mobile telecommunication services by providing network coverage for these services. Therefore, an unavoidable consequence in meeting the demand for ICT is the erection and operation of an ever-increasing number of BTS sites.

The existing BTS sites are therefore necessary and desirable in maintaining existing coverage, which supports the Telecom Group's directive of providing competitive telecommunication services to the Namibian public.

5.3 SITE SELECTION

The existing sites identified and assessed from the side of PowerCom as sites to host the BTSs were based on the following criteria:

- Locality of existing network infrastructure (coverage);
- Cell reach and capacity of specific technology;
- Surrounding topography and built environment;
- Location of existing clientele;
- Location of future/potential clientele; and

- Size of required footprint.

5.4 CELLULAR COMMUNICATION

5.4.1 WHAT IS A CELLULAR SYSTEM?¹

Mobile communication networks are divided into geographic areas called cells, each served by a base station (Figure 5-1). Mobile devices are the user's link to the network. The system is setup to ensure that mobile devices maintain the link with the network as users move from one cell to another.

To communicate with each other, mobile devices and BTSs exchange radio signals. The level of these signals is carefully optimised for the network to perform effectively. BTSs can only serve a certain geographical area (Figure 5-2). They are also closely regulated by frequency use to prevent interference with other radio systems used, for example, by emergency services, taxis as well as radio and television broadcasters.

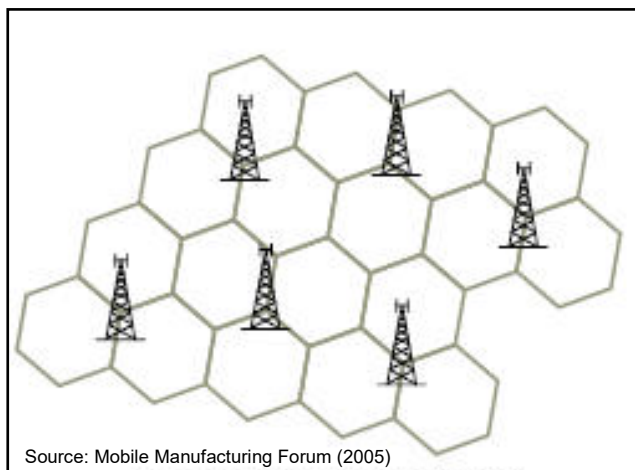


Figure 5-1: Theoretical Modelling of a Network

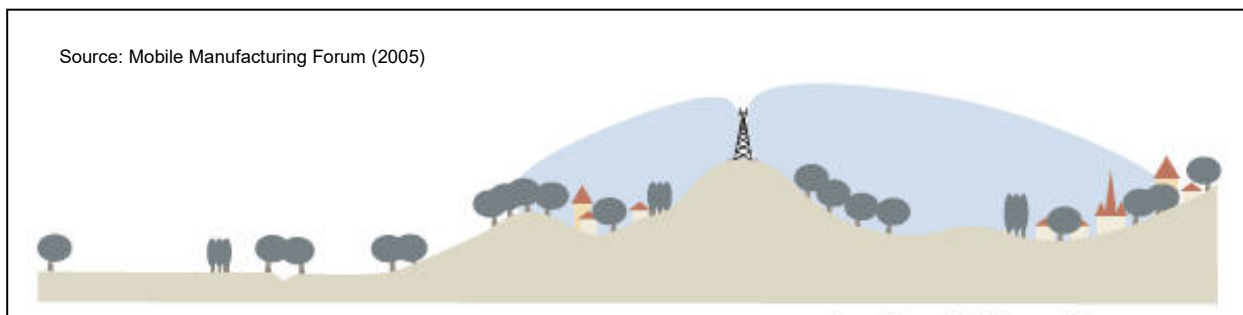


Figure 5-2: Example of a Base Station's coverage area

¹ Information extracted from Mobile Manufacturing Forum (2005) Mobile Phone Base Stations EMF - Health Fact Pack

5.4.2 HOW A CELLULAR SYSTEM WORKS

5.4.2.1 Mobile Devices

When a mobile device is switched on, it responds to specific control signals from nearby BTS. When it has found the nearest BTS in the network to which it subscribes, it initiates a connection. The phone will then remain dormant, just occasionally updating with the network, until the user wishes to make a call or a call is received. Reception signal strength is directly linked to proximity of the mobile phone to the base station (Figure 5-3).

Mobile devices use automatic power control as a means of reducing the transmitted power to the minimum possible while maintaining good call quality. For example, while using a phone the average power output can vary between the minimum levels of about 0.001 watts up to the maximum level which is still less than 1 watt. This feature is designed to prolong battery life and possible talk time.

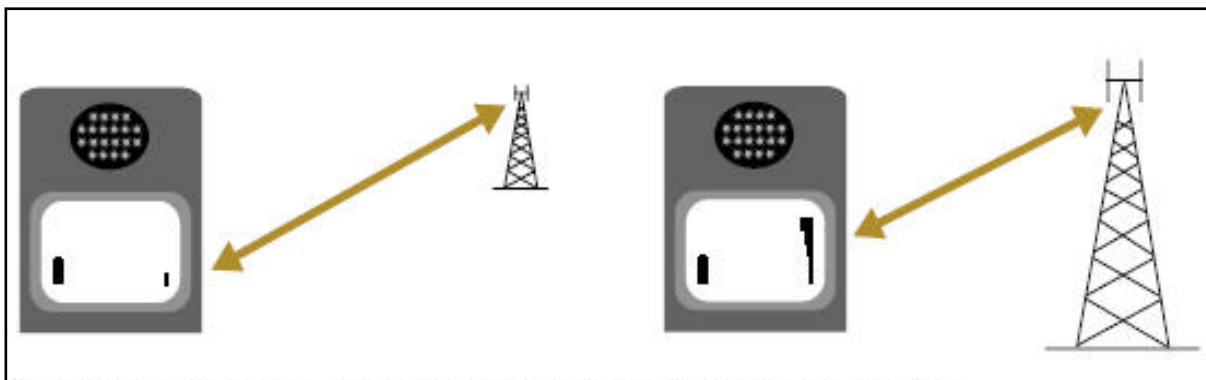


Figure 5-3: Illustration of Signal Strength

Another aspect of a mobile network is that as the user is moving while talking; the network needs to be able to pass the call from one BTS to another. This process is called a 'handover' – literally, where the network hands over the call from one BTS to another, and it is undertaken seamlessly and without the caller being aware of the change.

5.4.2.2 Base Transceiver Stations

Base Transceiver Station (BTS) vary considerably in the levels of power emitted depending on the required area or 'cell' that they are providing coverage for. Typically, transmitted power from an outdoor base station may range from a few watts to about 100 watts, while the output power of indoor base stations is lower. For comparison purposes, 100 watts is equivalent to a standard light globe used in homes.

A BTS comprises of several different components including an equipment shelter, a tower or support structure (see Figure 5-4) which provides the necessary height to give better coverage, and the transceivers and antennae which sit atop the tower – or in some cases antennae are attached to the top of buildings, where

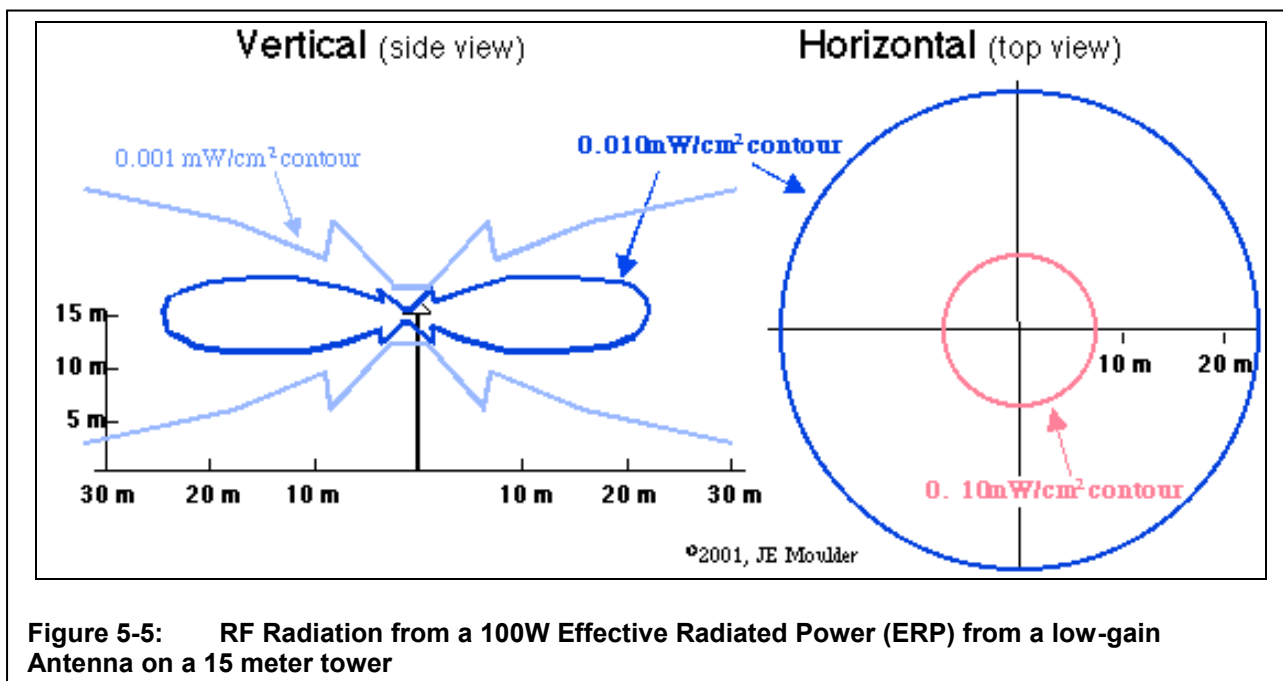


Figure 5-4: Example of BTS (Monopole)

the building itself provides sufficient height. The antennae are typically about 15-30 cm in width and up to a few metres in length, depending on the frequency of operation.

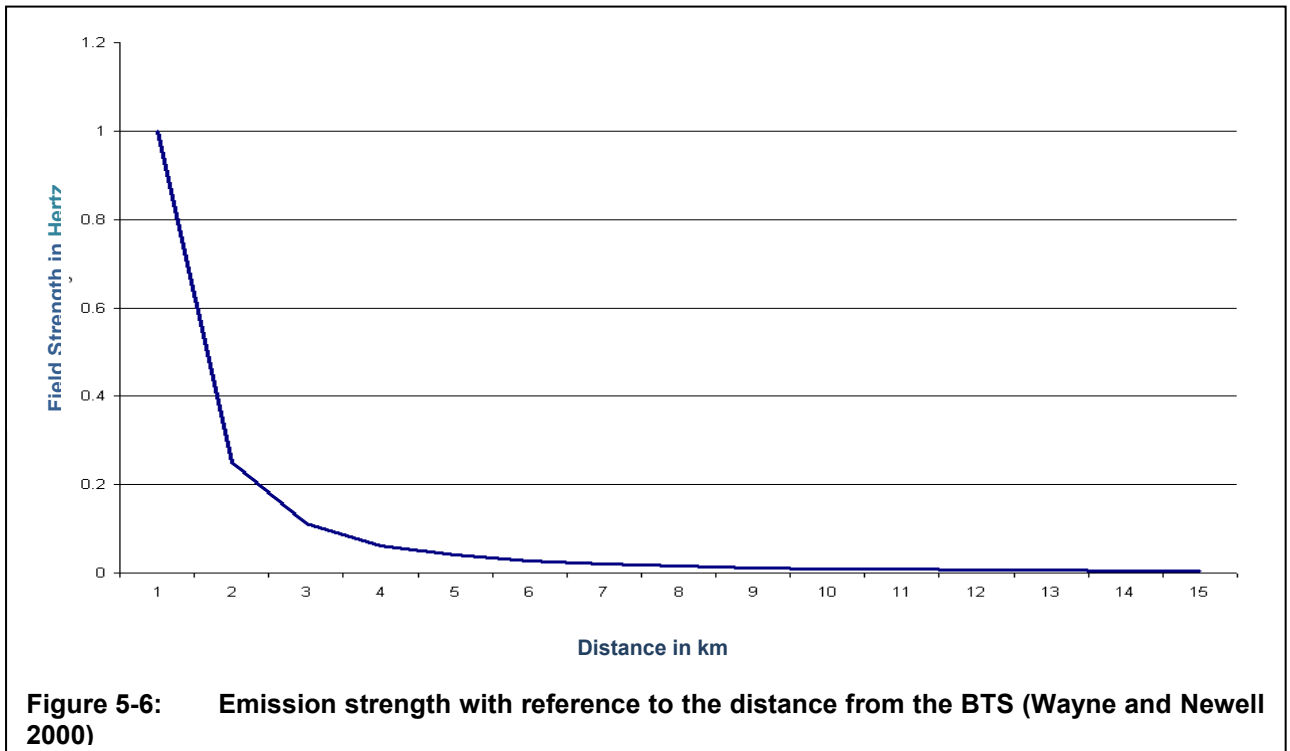
5.4.2.3 Direction of an Antenna

A BTS's antennae emit Radio Frequency (RF) radiation or electromagnetic energy in beams that are typically very narrow in a vertical direction (height), but quite broad in a horizontal direction (width) (Figure 5-5). Because of this, the RF energy at ground level directly below the antenna is very low.



This is particularly relevant as there is a common misconception that emissions are stronger directly under antennae which partly explains some of the concern about those placed near schools or residential buildings.

As illustrated by Figure 5-6, the radio wave intensity decreases rapidly as it travels away from the antenna. In free space, the intensity decreases to a quarter ($\frac{1}{4}$) when the distance is doubled. In reality, the intensity reduces much more quickly than that due to the loss of signal strength (also known as 'attenuation') that is caused by having to pass through obstacles such as trees and buildings.



There are sometimes questions as to why BTS equipment is not always placed in areas remote from habitation. There are two main reasons:

- Firstly, if the equipment is placed too far from the users it not only gives poor communication quality but also causes the phones to increase their output power to sustain the connection, thus decreasing battery life and talk time. Increased output power increase the level of RF radiation.
- Secondly, there are practical limitations to the geographic area that a base station can effectively serve, especially where there are high numbers of users. In this instance, the BTSs need to be closer together to provide increased capacity rather than coverage, and because of their proximity to one another, each base station needs to operate at very low power levels to avoid interfering with others nearby. Therefore, a properly designed network will optimize coverage and capacity and therefore operate at only the lowest power levels necessary to provide good communications. The lower the power levels the lower the levels of RF radiation.

To ensure that RF radiation exposure to the public remains within the ICNIRP exposure limits, transmitting antennae are typically elevated on support structures, and the immediate area is fenced where necessary to restrict access. Measurements of power density (W/m^2) are used to verify that the exposure levels of the antennae system are within the maximum permissible exposure levels.

5.4.3 GSM TECHNOLOGY

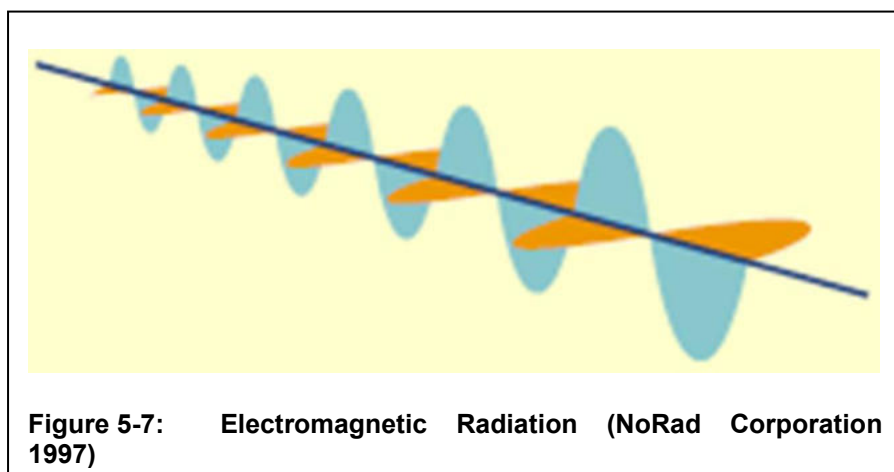
Global System for Mobile Communication (GSM) is an open, digital cellular technology used for transmitting mobile voice and data services. The GSM standard is the most widely accepted

standard and is implemented globally. The GSM makes use of a narrow-band Time Division Multiple Access (TDMA) technique for transmitting signals, which is a digital wireless telecommunication transmission technique. TDMA allocates each user a different time slot on a given frequency. The advantages of TDMA include among others, the transmission of data as well as voice communication, and the ability to carry between 64 kilobits per second (kbps) to 120kbps of data rates, which is the most cost effective technology to convert an analogue system to digital; and provides users extended battery life since it only transmits portions of the time during conversations.

5.5 RADIO FREQUENCY RADIATION²

5.5.1 WHAT IS RF RADIATION?

Radio Frequency (RF) radiation or electromagnetic radiation refers to the energy emissions generated from the interaction of an oscillating electric field and a magnetic field. Electromagnetic energy (Figure 5-7) consists of waves of electric and magnetic energy moving together (i.e., radiating) through space at the speed of light. Electromagnetic energy may be regarded as waves in the air that transmit energy but can also be controlled through amplitude, pulsing, etc., to transmit speech, images and so forth. Hertz (cycles per second) are used to express the range or spectrum of frequency of the waves. KiloHertz, megahertz and gigahertz (10^3 , 10^6 and 10^9 hertz, respectively) are measurements at the higher frequencies.



The energy of the radiation is proportional to its frequency: the greater the frequency, the shorter the wavelength and the greater the energy transmitted. The strength of the RF radiation decreases with the distance from the source.

The non-ionising range of electromagnetic frequencies, i.e. those below 10^{16} hertz, can be divided into static electric and magnetic fields, extremely low frequency (ELF) electric and magnetic fields, intermediate frequency (IF) fields and RF fields, which can be further subdivided into radio frequencies and microwave frequencies. Other types of non-ionizing

² Information extracted from Dawoud, M. 2003. High Frequency Radiation and Human Exposure. *In*: Proceedings of the International Conference on Non-Ionizing Radiation at UNITEN (ICNIRP 2003).

radiation within the electromagnetic spectrum include visible light, infrared radiation and other forms of electromagnetic radiation with relatively low frequencies (Figure 5-8).

The Electromagnetic energy used in cellular telephony is transmitted in the form of RF radiation (radio waves). RF radiation has its most important application in providing telecommunication services. Radio waves used in the transmission of voice and data services are typically within the Ultra High Frequency (UHF) range, between 300MHz to 3GHz and with wavelengths of between 10cm and 1m. RF radiation associated with BTSs operating in the UHF frequency range is non-ionising because the energy levels emitted are not high enough to cause damage to the chemical bonds within living cells of organisms.

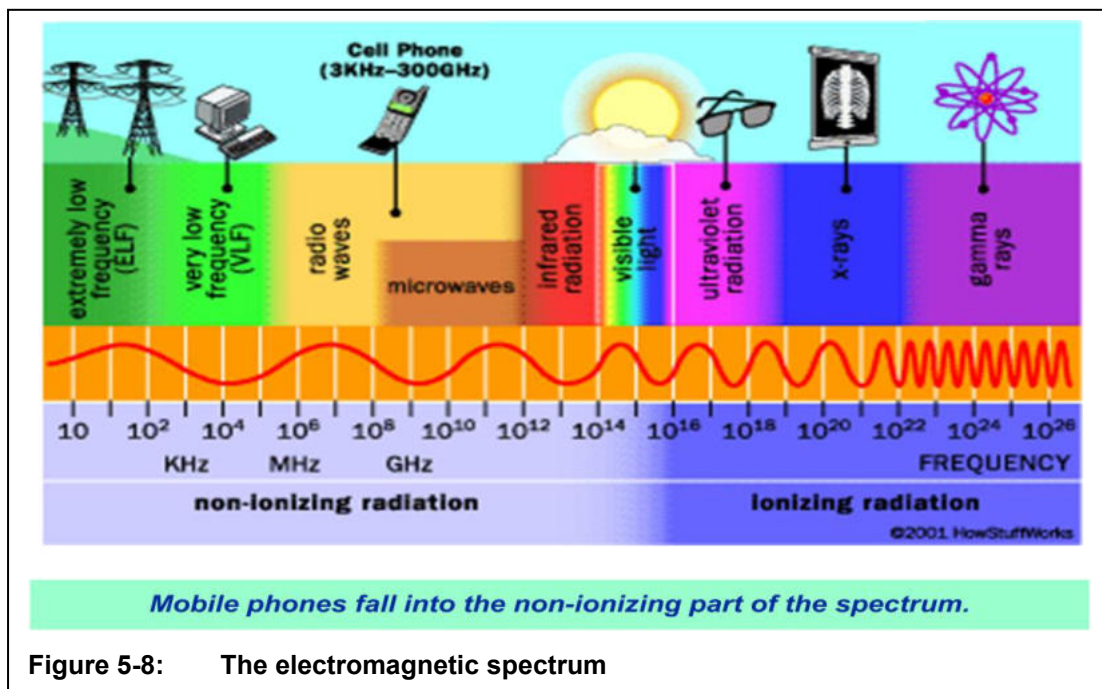


Figure 5-8: The electromagnetic spectrum

Typical exposure levels from sources of electromagnetic radiation are summarised in Table 5-1 and Table 5-2. To protect human health from exposure to and potential impacts of radio frequency radiation, international safety guidelines have been developed by various organizations to establish exposure limits from transmitting antennae.

Table 5-1: Typical public RF radiation exposure levels by a given source (WHO 2012)

SOURCE	ELECTRIC FIELD (volts/metre (V/M))	MAGNETIC FLUX DENSITY (micro tesla (µT))
Natural fields	200	70 (Earth's magnetic field)
Mains power in a home	100	0.2
Mains power (beneath large power lines)	10 000	20
Electric trains and trams	300	50
TV and computer screens (at operator position)	10	0.7

Table 5-2: Typical maximum public RF radiation exposure per source (WHO 2012)

SOURCE	RF ENERGY (W/m ²)
TV and radio transmitters	0.1
Mobile phone base stations	0.1
Radars	0.2
Microwave ovens	0.5

5.5.2 TRANSMITTED ENERGY FROM MOBILE DEVICES AND BASE STATIONS

The use of a mobile device involves the transmission of a signal between the device and a nearby BTS, both of which emit RF radiation. Mobile devices and BTSs present quite different exposure situations. RF exposure to the user of a mobile device is significantly higher than the RF exposure to a person living near a BTS. However, apart from infrequent signals used to maintain links with nearby BTSs, the mobile device transmits RF energy only while a call is being made, whereas BTSs are continuously transmitting signals.

5.5.2.1 MOBILE DEVICES

Mobile phones are low-powered RF transmitters, emitting maximum powers in the range of 0.2 to 0.6 watts per meter squared (m²). Other types of hand held devices, such as "walkie talkies", might emit 10 watts or more. The RF field strength, and hence the RF exposure to a user decreases rapidly with distance from the device. Therefore, the RF exposure to a user of a mobile phone located 10s of centimetres from the head (using a "hands free" appliance) is far lower than to a user who places the headset against the head. RF exposures to nearby people are very low.

5.5.2.2 BASE TRANSCEIVER STATIONS

BTSs 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. BTS antennae are typically mounted on buildings or towers at a height of 15 to 50 metres above ground. These antennae emit RF beams that are typically very narrow in the vertical direction but quite broad in the horizontal direction. Because of the narrow vertical spread of the beam, the RF field intensity at the ground directly below the antenna is low. The RF field intensity increases slightly as one moves away from the base station and then decreases at greater distances from the antenna (see Figure 5-5 and Figure 5-6).

Figure 5-5 indicates the levels of exposure from a 100W effective radiation power low-gain antenna at a height of 15m. Exposure within the first 10 meters from the source (antenna) is measured at 0.1mW/cm², decreasing to 0.01mW/cm² at a distance of just above 20 meters from the antenna. Exposure to base station radiation is therefore considerably less than the international safety standards of the Commission on Non-Ionising Radiation Protection (ICNIRP 1998). In addition, the antenna is typically elevated on a tower/ building and directed to ensure that the radiation is not transmitted in unintentional directions.

5.6 HEALTH CONCERNS ASSOCIATED WITH RF RADIATION³

Common concerns associated with the continuous radiation emitted from BTSs and antennae are related to the long-term effects that the exposure to radio frequency (RF) radiation may have on human health. **Recent studies in Europe have shown that RF exposures (non-ionising) from telecommunication base stations in public areas range from 0.002% to 2% of the permissible international exposure limits as stipulated by the ICNIRP.** This however depends on various factors such as proximity to the exposure and the surrounding environment. Detailed reviews conducted on wireless telecommunications using digital transmissions have not revealed any associated health hazards. However, it should be noted that it is difficult to evaluate potential health hazards from low frequency radio signals as opposed to higher strength radio radiation (i.e. at frequencies above 3 GHz). **To date, the only health effect from RF fields identified in scientific reviews have been related to an increase in body temperature (> 1 °C) from exposure at very high field intensity found only in certain industrial facilities, such as RF heaters. The levels of RF exposure from base stations and wireless networks are so low that the temperature increases are insignificant and do not affect human health.**

Health hazards claimed to be associated with RF radiation are among others, increased risk of cancer, interrupting brain wave patterns, cognition and behaviour, altered sleep and cardiovascular function. To date, no adverse short- or long-term health effects have been shown to directly result from RF radiation produced by base stations. **A major portion of RF public exposure is produced by mobile and wireless portable devices and not from fixed transmitters (i.e. BTSs).** The ICNIRP supports on-going research studies investigating the potential effects of RF Radiation from mobile and fixed base stations, especially long-term exposure, limits of exposure and epidemiological studies, in an attempt to protect the public from radiation exposure and associated health risks.

Although the Specific Absorption Rate (SAR) is determined at the highest certified power level in laboratory conditions, the actual SAR level of the phone while operating can be well below this value. This is because mobile devices use adaptive power control to reduce the transmitted power to the minimum possible whilst maintaining good call quality. Once a call is established the mobile phone will power down to the minimum level required. Therefore, the closer to a BTS and the better the reception, the lower the actual SAR level.

³ Information extracted from Electromagnetic fields and public health, Base stations and wireless technologies. Fact Sheet No. 304. World Health Organisation <www.who.int>

5.7 BASE TRANSCEIVER STATIONS

5.7.1 DESIGN AND SPECIFICATIONS⁴

A BTS can either be a stand-alone site with structures, such as that indicated by Figure 5-4, or be a roof top site with structures, such as that indicated by Figure 5-9



Institute for Geopathology SA, 2015

Figure 5-9: Example roof top BTS

The sites included as part of the existing activity are all of the stand-alone BTS type.

The design drawings for all existing BTS sites should have been drawn by professionally registered engineers. Furthermore, professionally registered engineers should have overseen the on-site construction of each of the existing BTS sites.

5.7.1.1 Base Transceiver Stations and Related Infrastructure

A BTS would typically provide for a site area, fenced-in with controlled access, which host the tower structure with antennae fitted to the top and container type of structures (which contains the transceiver equipment, power distribution cabinet and battery back-up cabinet). Figure 5-4 presents a typical BTS.

5.7.1.2 Transceiver Equipment and Antenna System

Transceiver equipment typically consists of two basic parts: Baseband Processing Unit (BBU) and Remote Radio Unit (RRU).

The RF energy associated with the sites 'for this project is "non-ionizing", which means the energy of the particles is too low to break chemical bonds within the cells of living organisms (see Section 5.5.1 – WHAT IS RF RADIATION?).

The antenna system applied depends on the type of service and area to be covered (i.e. km² radius). The other aspect according to which antennae can be classified is the frequency range

⁴ Information provided by Powercom (PTY) Ltd.

of the RF energy emitted. Antennae fixed to tower structures within urban areas typically operate in the 790MHz to 960MHz and 1710–2180MHz frequency range with output power equal to approximately 20W. The antennae are fitted to the top of the tower structure.

The alignment and radiation pattern (i.e. horizontal or vertical alignment and tilt) of the antennae determine how the power radiates from the antennae system and how the desired power output is achieved. The main beam from these antennae should not reach ground level until its distance from the antenna is around 50 – 200m. At this point, the amount of power emitted by this beam is of such low value as to be deemed insignificant in terms of any damaging radiation (see Section 5.4.2 – HOW A CELLULAR SYSTEM WORKS).

5.7.1.3 Support Structure/ Tower

The most visible component of the BTS is the support structure or tower, which purpose is exclusively to provide height to the antennae required for optimal coverage. The height of the tower structure is directly related to the area covered.

Different types of structures of different heights and appearance are currently used by the Proponent according to the purpose of the particular BTS, its locality and required coverage.



The types of structures in use are -


- Concrete structure
- Guyed tower
- Lattice structure
- Steel monopole (includes disguised tower structure)

Key descriptive information of the 298 sites are summarised in Table 5-3 below. For more site specific information please see Appendix E.

As required by the Namibian Civil Aviation Regulations and Technical Standards (NAM-CATS-AH) 'Licensing and operation of aerodromes and heliports' and the ICAO Annex 14, the Ministry of Works and Transport's Directorate of Civil Aviation (DCA) requires that certain structures near aerodromes be painted the internationally accepted colours orange/ red and white. Other aircraft warning devices include dual navigational lights to be installed at a height of 15m.

Table 5-3: Key descriptive information and typical design specific potential impacts (see Appendix E for detailed site specific information)

TYPE OF TOWER	APPEARANCE (EXAMPLE)	DESCRIPTION OF KEY FEATURES
<p>Guyed lattice (44 sites)</p>	 <p>Source: www.powercom.na</p>	<p>Height range: 48 – 200 m</p> <p>These structures are anchored in place by steel guy wires. Guy wires are diagonal tensioned cables attached to the ground, usually spaced at equal angles about the structure's base, to resist lateral/sideward forces such as those created by wind.</p>
<p>Steel Lattice (153 sites)</p>	 <p>Source: www.powercom.na</p>	<p>Height range: 6 – 70 m</p> <p>Steel lattice structures are mostly constructed with a triangular cross section, which taper/narrow from the base upwards</p>

TYPE OF TOWER	APPEARANCE (EXAMPLE)	DESCRIPTION OF KEY FEATURES
<p>Steel monopole (80 standard sites and 1 disguised site)</p>	 <p>Source: www.powercom.na</p>	<p>Height range: 10 – 42 m</p> <p>These structures are constructed out of steel tubes and have the advantage of protecting cables and other components from harsh weather conditions, but are also prone to damage from wind.</p>
<p>Concrete structure (22 sites)</p>	 <p>Source: www.powercom.na</p>	<p>Height range: 10 – 75 m</p> <p>Reinforced concrete towers are more expensive to construct relative to other tower types but provide greater resistance to lateral forces (i.e. winds). This tower type is mostly utilised when antennae with narrow beam-widths are to be mounted and when the structure is to be occupied by people.</p>

5.7.2 HEALTH AND SAFETY STANDARDS⁵

The design specifications and standards which all existing sites should adhere to are SABS 1200DA (excavation standards) and SABS 0225-1991, SABS 0162-1993, BS 8100-1986 for purpose of the tower. The design drawings for all the existing BTS sites should have been drawn by professionally registered engineers. Professionally registered engineers should have overseen the onsite construction of each of the existing BTS sites.

The installation should have been and operation of the BTS should be carried out in accordance with the requirements set by STS10_Equipment installations in buildings R0.1 Final 23-7-2007, STS11_ RF installations R0, STS01_ Equipment Container R1.0 Final 23-7-20073. The *Standard Technical Specifications for RF Installations* (STS-11) provides for the general requirements regarding materials, equipment and installation. STS-10 provides for the standard technical specifications for the supply, installation and commissioning of equipment inside equipment rooms complete with mechanical and electrical installations. STS-01 provides for the standard technical specifications for the supply, installation, commissioning and delivery of an equipment container complete with mechanical and electrical installations.

Grounding of each of the existing sites should have been conducted in accordance with Grounding Guidelines for Cellular Radio Installations, 68P81150E62. Installation and Configuration Manual (26 September 2003). STS-3 also provides standard technical specifications for the supply, installation and commissioning of a grounding and lightning protection system.

All tower structures associated with existing BTS sites, which are located within 8 km of an aerodrome and which are higher than 45 m above the mean level of the landing area of such aerodromes should have received the necessary approval from the DCA in accordance with the Aviation Act (No. 74 of 1962) (see Section 4.2.3 – AVIATION ACT NO. 74 OF 1962, AS AMENDED). These towers should be painted the standard aviation orange and white, or fitted with aircraft warning devices (Chapter 6 ICAO) as appropriate.

The BTSs and their equipment (including antennae) selected by the Proponent should have been tested and should comply with the following International safety and quality standards:

- The European Commission - Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999.
- Federal Communications Commission - Part 15 of the Rules applicable to Class B digital devices.
- ANSI IEEE C95.1-1991, *IEEE - Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*.
- CENELEC 95 ENV 50166-2, *Human Exposure to Electromagnetic Fields High Frequency (10kHz to 300 GHz)*.

⁵ Information provided by PowerCom (PTY) Ltd

- The Telecommunication Standardization Sector (ITU-T) - coordinates standards for telecommunications on behalf of the International Telecommunication Union (ITU) and is based in Geneva, Switzerland.
- International Telecommunication Union - an intergovernmental public-private partnership organization since its inception and now has a membership of 191 countries and over 700 public and private sector companies as well as international and regional telecommunication entities. All Vendors are affiliated with the International Telecommunication Union (ITU).

All equipment used at the existing sites should comply with the CRANs regulations in respect of Type Approval and Technical Standards for Telecommunications Equipment (GG No. 5659, GN No. 22, 30 January 2015).

Equipment and cables should comply with all the relevant trade associations' specifications. Equipment used should indicate compliance with EU safety, health and environmental requirements.

Decommissioning activities should comply as a minimum with the relevant specifications within the Labour Act's (11 of 2007) Health and Safety Regulations (1997) (see Section 4.2.5 – LABOUR ACT NO. 11 OF 2007, AS AMENDED).

5.7.3 INFRASTRUCTURE REQUIREMENTS

5.7.3.1 Access

Access to the existing sites will in most cases be obtained via the existing road network within local authority areas, or from the Roads Authority road network. In some instances privately owned and maintained roads, as well as informal roads within state land, are utilised to gain access to the existing sites. The Proponent is responsible for the maintenance of some of the roads utilised to gain access to the existing sites.

5.7.3.2 Electricity Supply

Electricity supply typically in place for a given BTS site, involves a primary source and a backup source. The most common combination is usually electricity from an existing grid connection as a primary source and the backup source of electricity generated from one of several power options (e.g. solar power, generator-set, etc.).

5.7.4 BTS SHARING

The Proponent is responsible for the operation and maintenance of all the existing BTS sites. Of the 298 BTS sites, 175 are primarily utilised by Telecom Namibia Ltd (Telecom), while the remaining 123 BTS sites are shared between Telecom and other parties.

5.7.5 OPERATION AND MAINTENANCE

The BTS requires little maintenance and has a life span of approximately 1 million hours for the antennae and approximately 25 years for the tower structure.

Tower inspection and maintenance is carried out by contractors appointed by the Proponent. Tower inspection and maintenance occurs on average once a year. The inspection and maintenance of each tower structure should be carried out by suitably trained and qualified maintenance contractor's.

Equipment inspection and maintenance (e.g. upgrading and replacement of hardware) at a given BTS site is carried out on average twice a year by Telecom staff members located at a Telecom office nearest to such a site. Emergency repairs/maintenance is carried out by the same members of staff. Access to each site is required during equipment inspection and maintenance as well as emergency repairs/maintenance.

All materials necessary for inspection and maintenance (whether routine or emergency) should be transported to and stored within the footprint of each existing BTS site. BTS site inspection and maintenance consist of the following components:

1. Tower/ mast inspection and maintenance;
2. Equipment inspection and maintenance; and
3. General site inspection and maintenance.

5.7.5.1 Tower/ Mast Inspection and Maintenance

The tower structure will be inspected and maintained manually and does not require any large cranes. The tasks involved with respect to tower inspection and maintenance include the following:

- Random checks will be conducted on tower parts/ components (e.g. bolts, ladders, brackets, guy wires, paint etc.). Parts requiring repair or replacement will be repaired or replaced as required. Components located at dangerous heights, which required repair or replacement will be attended to by qualified and experienced personnel making use of a winch to hoist personnel and maintenance equipment and material from segment to segment.
- The foundation slabs will be checked for cracks or signs of wear.

The maintenance personnel should be transported to each site on a daily basis. No workers should reside on-site during maintenance activities. The typical duration of inspection and maintenance activities is less than a week.

5.7.5.2 Equipment Inspection and Maintenance

The activities associated with inspection and maintenance of the equipment containers and buildings are as follows:

- Check external and internal wall finishes in terms of paint
- Check condition of roofs, gutters, downpipes
- Check roof sealing/waterproofing of towers and containers
- Check power supply components (generator sets, solar panels, batteries)

- Check cooling components (fans, air filters, air conditioners etc.)

5.7.5.3 General Site Inspection and Maintenance

General site inspection and maintenance activities are those pertaining to the following components:

- Access gate;
- Access road; and
- Fence and area bounded by the fence.

The activities associated with inspection and maintenance of these components are as follows:

- Check condition of access gate and locking system
- Check access road for rock spillage and surface damage/signs of erosion
- Check flood water drainage areas are clear and functional
- Clearance of vegetation (if any) and other obstacles within the area bounded by the fence;
- Check fencing posts, wire mesh, razor wire for wear, damage and corrosion

Each appointed contractor should supply his staff members with temporary toilets and all waste generated on-site during maintenance activities will be transported to the nearest approved waste treatment facilities (i.e. for sewage and for solid waste).

5.7.6 DECOMMISSIONING ACTIVITIES

Typical decommissioning activities for every tower include the following:

- Construction of a temporary work site for the appointed contractor (for the storage of equipment, vehicles etc.). The extent of this site will vary from site to site.
- Construction of temporary accommodation for the appointed contractor's personnel. This may not be applicable for every site – in some instances no temporary accommodation will necessary and no workers will reside on site, but will be transported to site daily for the duration of the decommissioning activity.
- Disconnecting of power supply and all other cables, dismantling all equipment and sorting of material into reusable, recyclable and material to be disposed of.
- Dismantling (or in rare cases felling) the tower structure.
- Ripping up concrete foundations and removing fencing and access gate.
- Removal of all rubble and disposing of all material in the appropriate manner (i.e. hazardous waste transported to nearest hazardous waste treatment facility).
- Rehabilitation of BTS site to pre-construction state.

6 GENERIC IMPACTS AND MITIGATIONS

This chapter provides a generic description of the potential impacts that might be caused as a result of the operation and decommissioning of the existing BTS sites. Not every impact is applicable to all four tower types associated with the existing 298 sites and therefore the applicability of a given impact to tower type is highlighted. Distinction is made between impacts associated with the operational phase and those associated with the decommissioning phase. Mitigation measures are prescribed for each identified impact.

The following impacts are generally associated with the operation and decommissioning of telecommunications towers:

6.1 HEALTH STANDARDS AND EXPOSURE LIMITS TO RADIO FREQUENCY RADIATION

In Namibia it is generally required that the anticipated exposure to radio frequency radiation or electromagnetic radiation (EMR) associated with BTSs remain below the limits established by the ICNIRP (1998), and ensure that such levels at all times remain below the permissible limits.

6.2 THE EMR GUIDELINES PROPOSED BY THE ICNIRP (ICNIRP 1998) RADIATION PROTECTION AUTHORITY WITHIN THE MINISTRY OF COMMUNICATION REGULATORY AUTHORITY OF NAMIBIA WIRELESS TELECOMMUNICATIONS INDUSTRY IN NAMIBIA. THESE STANDARDS ARE COVERED UNDER SECTION 4.3 – INTERNATIONAL LEGAL INSTRUMENTS

INTERNATIONAL STANDARDS AND HUMAN EXPOSURE LIMITS.

Some local authority policies support compliance with the public exposure guidelines recommended by the ICNIRP.

6.2.1 OPERATIONAL PHASE IMPACTS

There is extensive scientific literature available on the relationship between EMR and associated biological and health effects, resulting in two very conflicting groups of opinion. The one side motivating that to date the results have been inconclusive, and on the other side, promulgating that radio frequency (RF) radiation emitted from antennae associated with base stations is an imminent danger.

According to the vast amount of research conducted on the matter, there are essentially three opinions based on the scientific evidence regarding the adverse health effects of radio frequency radiation:

1. Those arguing that there is insufficient evidence on adverse health effects associated with RF radiation;
2. Those who claim that the evidence is insufficient to rule out any health risks; and

3. Those who argue that evidence shows a causal relationship between health effects and exposure to low-power microwave emissions.

This report does not set out to either prove or disprove the findings of either of the opposing opinions, but to evaluate the operation (range of technology used, antenna system and power output) of the existing BTS sites according to established internationally recognised guidelines for non-ionising radiation (ICNIRP 1998) and local guidelines endorsed by the National Radiation Protection Authority.

The maximum allowable exposure limit as recommended by the ICNIRP and NRPA is 4.5W/m². RF exposure from the antennae of a typical mobile phone base stations and radio and TV transmitters operating at 900MHz is 0.1W/m² (see Table 5-2). This value is well below the ICNIRP guideline for the public (ICNIRP 1998).

6.2.1.1 Operational Phase Mitigation Measures

The following operational phase mitigation measures are recommended:

- A RF radiation exposure assessment should be conducted for all BTS sites to confirm that actual levels of emitted radiation are below the allowable maximum prescribed. The outcome/results of the assessment should be submitted to the National Radiation Protection Authority (NRPA) (Ministry of Health and Social Services).
- Follow-up RF power density measurements should be taken for all BTS sites every 5 years, or when the BTS equipment is upgraded, or additional BTS equipment is added to a tower structure (i.e. additional sharing), to ensure that these BTS sites continue operating below the allowable maximum levels prescribed by the ICNIRP. The outcome/results of the assessment should be submitted to the National Radiation Protection Authority (NRPA) (Ministry of Health and Social Services).
- In the event that Namibia promulgates regulations on RF radiation exposure limits of non-ionising radiation in the future, all applicable facilities should be re-evaluated and adjusted accordingly to ensure compliance.

6.2.2 DECOMMISSIONING PHASE IMPACTS

Once the tower is decommissioned exposure to RF radiation ceases and hence any impacts associated with such exposure.

6.3 SAFETY STANDARDS

The design of the tower structures as well as BTS equipment should adhere to internationally recognised standards as set by the International Telecommunication Union (ITU), Independent Communication Authority of South Africa (ICASA) and that of the Communications Regulatory Authority of Namibia (CRAN). These standards are described in Section 5.7.2 – HEALTH AND SAFETY STANDARDS. Furthermore the operational and decommissioning phase activities should be carried out in a manner that does not compromise the safety of workers or nearby residents.

6.3.1 OPERATIONAL PHASE IMPACTS

The safety of surrounding residents and road users is essential during the operational and phases of the existing BTS sites. Apart from adhering to national and international design standards for BTS equipment and tower structures it is equally important to ensure residents' safety in the case of unforeseen accidents (i.e. towers falling over, vehicle accidents around the site and traffic safety, applying herbicides and related human health and environmental impact).

6.3.1.1 Operational Phase Mitigation Measures

The following operational phase mitigation measures are recommended:

Workers and Residents Health:

- The radio frequency (RF) radiation power density of the technology used should at all times operate below the allowable maximum as stipulated by the ICNIRP.
- As a precautionary measure, it is recommended that frequent RF power density measurements be taken to ensure that the BTS is operating below the allowable maximum levels prescribed by the ICNIRP.
- It is very important that this assessment and information be overseen and verified by the NRPA, and that the community be informed of these studies and the outcome thereof.
- In addition, should Namibia promulgate regulations on RF radiation exposure limits of non-ionising radiation in the future, all applicable facilities should be re-evaluated and adjusted accordingly to ensure compliance.

Residents Safety:

- The facility should be enclosed with a double brick wall with a minimum height of 2 m to prevent unauthorised access to ensure safety of residents and restrict access to authorised personnel only.
- The hazards and safety issues of unauthorised access to the BTS be clearly displayed through safety and warning signage.
- Routine safety and maintenance checks of the antenna system, the tower structure and foundations should form part of the operational activities for each BTS and included in the Environmental Management Plan.

Safety (design standards):

- All equipment, infrastructure (i.e. foundations and tower structure) comply with the applicable international standards and requirements, as well as best management principles.
- The design drawings for all existing BTS sites should have been drawn by professionally registered engineers. Professionally registered engineers should have overseen the on-site construction of each of the existing BTS sites. The operation of the existing BTS sites should be done in accordance with standards set by the South African Bureau of

Standards (See Section 5.7.2 – HEALTH AND SAFETY STANDARDS). All equipment should comply with national and international quality standards. The equipment used should comply with international safety and quality requirements of the International Electrotechnical Commission (IEC) and European Standards (EN) (see Section 5.7.2 – HEALTH AND SAFETY STANDARDS).

6.4 VISUAL IMPACT

6.4.1 OPERATIONAL PHASE IMPACTS

The towers associated with the existing BTS sites range in height from 6 to 200 m and are located within areas with vastly differing topography, elevations and sense of place.

The visual impact occurs when an object of a certain visual character/nature is introduced into a landscape with a contrasting visual character/nature.

6.4.1.1 Operational Phase Mitigation Measures

The following operational phase mitigation measures are recommended:

Visual Prominence:

- All tower structures should blend in as far as practicably possible with their surroundings, with the use of natural, non-reflective and compatible colours where applicable, except where the Directorate of Civil Aviation (Ministry of Works and Transport) requirements state otherwise.
- No advertisements should be allowed on the equipment shelter or tower structure.
- Regular maintenance of the equipment shelter and all associated structures of the base station (i.e. equipment containers, antennae, tower structure, etc.) should be done in order to maintain the visual integrity of the surrounding area.
- The navigational low intensity obstruction light at the top of the tower for the purpose of aviation safety should be shielded not to be visible from below but only from above. This will reduce visual pollution at night. This should however only be done with the approval from the DCA.

6.4.2 DECOMMISSIONING PHASE

The most significant impact expected during the decommissioning phase is as follows:

- **Negative visual impact associated with an unrehabilitated site (applicable to all tower structures)** – once a given BTS site has been deconstructed and all materials and rubble appropriately removed, a visual “scar” within a given landscape may remain contrasting with that landscape and the sense of place.

6.4.2.1 Decommissioning Phase Mitigation Measures

The following decommissioning phase mitigation measure is recommended:

- The site should be rehabilitated to a state approximating the predevelopment state
- All hazardous substances must be removed and disposed of responsibly.
- All above and below ground infrastructures must be removed.
- General rubble resulting from demolition (if structures are to be demolished) can be used as fill at nearby construction sites (if any), or otherwise disposed of at a licensed landfill site.
- Waste may not be dumped on or near any of the sites.
- Any soil that might be contaminated by fuel or other hazardous substances must be removed and disposed of at a hazardous waste disposal site.
- Contaminated soil may not be dumped on or near any of the sites.
- The soil compaction must be broken by ripping and then fertilised and suitably rehabilitated.
- No alien plant species may be established on the site during rehabilitation.
- A post decommissioning audit is recommended.

6.5 IMPACTS ON BIODIVERSITY

Preservation of the natural environment is essential in ensuring a sustainable biodiversity. It is therefore required to consider impacts on biodiversity that are likely to arise during the operation and decommissioning of the existing activity.

The existing BTS sites are located within areas with vastly differing biophysical landscapes and associated levels of biodiversity. Owing to the fact that all the sites are already in existence, limited additional habitat destruction/removal, and associated loss of biodiversity, will take place, whether during the operation phase or decommissioning phase.

6.5.1 OPERATIONAL PHASE IMPACTS

The most significant impacts expected during the operational phase are as follows:

- **Bird mortalities owing to collision with guy wires (applicable to guyed structures only)** – The guy wires on guyed lattice structures will kill birds that collide into them. These bird mortalities pose a threat to a range of wetland and savannah birds. The intensity of the threat differs from species to species, depending on their present population and range, and their vulnerability to collisions.
- **Removal of bird nests on towers (applicable only to lattice structures, which includes guyed lattice structures)** – the steel framework of lattice towers will most likely be used as a site for communal nests of weaver bird species and possibly also other small to medium-sized birds such as crows. No Red Data species are expected to nest on the lattice tower structures. The nests of the aforementioned birds pose a risk to the Proponent in the event that the nests catch fire and weaken the steel frame which might render the tower more

prone to collapse. There would be no significant impact on biodiversity if these nests were removed during routine maintenance.

- **Habitat disturbance associated with site maintenance activities (applicable to all tower types)** – faunal species of various kinds (where these are present) located in the areas adjacent to the services roads, within the footprint of the existing BTS sites and in the areas immediately adjacent to the footprint will be disturbed and in some instances might be killed during routine vegetation clearing and service road repair activities.

6.5.1.1 Operational Phase Mitigation Measures:

The following operational phase mitigation measures are recommended:

- All applicable BTS sites with guyed lattice structures should have bird flight diverter devices fitted to the guy wires. Guidance in terms of which sites require bird flight diverter devices as well as which devices are the most effective should be sought from suitably qualified bird specialists.
- Nests should be removed from lattice tower structures during maintenance operations.
- The on-site Environmental, Health and Safety Officer (as designated by the appointed contractor) should ensure that intentional and accidental disturbance of faunal species is kept to a minimum. Any contravention of the law (e.g. poaching) should be quickly and strictly dealt with.

6.5.2 DECOMMISSIONING PHASE

The most significant impact expected during the decommissioning phase is as follows:

- **Habitat disturbance associated deconstruction activities (applicable to all tower types)** – faunal species of various kinds (where these are present) located in the areas adjacent to the services roads, within the footprint of the existing BTS sites and in the areas immediately adjacent to the footprint will be disturbed and in some instances might be killed during deconstruction activities.

6.5.2.1 Decommissioning Phase Mitigation Measures:

The following decommissioning phase mitigation measures are recommended:

- The on-site Environmental, Health and Safety Officer (as designated by the appointed contractor) should ensure that intentional and accidental disturbance of faunal species is kept to a minimum. Any contravention of the law (e.g. poaching) should be quickly and strictly dealt with.

6.6 CO-LOCATION / SHARING OF SITES

Co-location or site sharing is strongly supported by the organs of state responsible for control the establishment of BTS sites (MICT and CRAN). It is therefore required that where viable from a technical and network design perspective, that co-location be considered.

6.6.1 OPERATIONAL PHASE IMPACTS

Some of the existing BTS sites are located within close proximity to each other. In instances where either site is capable of accommodating additional BTS equipment an unnecessary negative visual impact as well as impacts associated with land take and on-going maintenance activities exists.

6.6.1.1 Operational Phase Mitigation

The following operational phase mitigation measure is recommended:

- Site sharing, and the associated decommissioning of redundant infrastructure, should be considered where towers are located within close proximity of each other and where sharing of BTS equipment is possible on either of these structures is possible.

6.7 CIVIL AVIATION SAFETY

In accordance with the Aviation Act (No. 74 of 1962), the Namibian Civil Aviation Regulations (GN. No. 1 of 2001) and the Namibian Civil Aviation Technical Standards, new developments (i.e. obstacles) that are 150 feet (45.7m) above the mean level of the landing area and / or are within 8km of the reference point of a registered aerodrome (airport), may not be erected without the approval of the Directorate of Civil Aviation (DCA) within the Ministry of Works and Transport. These regulations aim to enhance the safety of civil aviation in Namibia by ensuring that the Namibian legislation complies with the minimum standards prescribed by the International Civil Aviation Organization (ICAO).

6.7.1 OPERATIONAL PHASE IMPACTS

Obstacles which infringe on the Obstacle Limitation Surfaces (OLS) of existing aerodromes may obstruction air traffic and be a safety hazard to civil aviation. Some of the existing BTS sites might affect the OLSs of existing aerodromes

6.7.1.1 Operational Phase Mitigation

The following operational phase mitigation measures are recommended:

Aviation Safety:

- The DCA should be informed of any tower structure which is located within 8km of an aerodrome and is more than 150 feet (45.7m) above the mean level of the landing area, for the purpose of registering the obstacle with all aviation service providers.
- If applicable, the DCA should record the locality of the new obstacle and provide all aviation service providers with the necessary details.

PART B - OPERATIONAL MANAGEMENT GUIDELINES

Part B of this OEMP provides the operational environmental management guidelines for the operation and decommissioning of the existing activity.

7 ROLES AND RESPONSIBILITIES

PowerCom (Pty) Ltd (the Proponent) is ultimately responsible for the implementation of the OEMP. The Proponent may delegate this responsibility at any time, as they deem necessary, throughout the remainder of the project lifecycle (i.e. operation and decommissioning phases). The following should be noted regarding the role of the Proponent:

- The Proponent is ultimately responsible for the implementation of the OEMP and the financial cost of all environmental control measures.
- The Proponent must ensure that any person acting on their behalf complies with the conditions/specifications contained in this OEMP.
- The Proponent is also responsible for the nomination of an Environmental Manager to take responsibility over implementation of the OEMP.
- The Proponent must take overall responsibility for adherence to and implementation of the Environmental Clearance Certificate once approved.
- The Proponent must take responsibility for the repair and rehabilitation of any environmental damage that may occur as a result of the activities associated the maintenance and decommissioning of the BTS sites.

The delegated responsibility for the effective administration and implementation of this OEMP is laid out in the rest of this chapter.

The role players responsible for the various aspects of the existing activity are presented Table 7-1 below.

Table 7-1: Role players responsible for various aspects of the existing activity

ORGANISATION	EXISTING ACTIVITY ROLE
National Radiation Protection Authority (Ministry of Health and Social Services)	Monitoring and enforcement with respect to radiation emission standards
Communications Regulatory Authority	Regulates telecommunications licensing in Namibia
Department of Environmental Affairs	Decision-making authority for environmental authorisation
PowerCom (PTY) Ltd.	Proponent

The role and responsibility of particular role players, under the directorship of the Proponent (in-house or outsourced) are detailed below.

7.1 ENVIRONMENTAL MANAGER

The Proponent should appoint an Environmental Manager (EM) who should oversee the implementation of all the relevant provisions of this OEMP. The appointed EM should be a suitable qualified individual knowledgeable in matters pertaining to environmental management. The EM's responsibilities are as follows:

- Ensure that the necessary authorisations and permits have been obtained/renewed.
- Ensure that all employees and contractors (maintenance and decommissioning) and the contractors' staff members are aware of the provisions of this OEMP.
- Ensure that each contractor appointed to carry out site inspection and maintenance or decommissioning has an individual who will perform the role of Environmental Health and Safety Officer
- Co-ordinate the monitoring and record keeping of environmental compliance in accordance with the Environmental Clearance Certificate and the OEMP.
- Management, recording and facilitation of communication regarding complainants with regard to this OEMP, between complainants, the Contractor and the Proponent.
- Maintain and update environmental management records, including a complaints register for each of the existing BTS sites. It is good practice to keep a diary of environmental matters and photographic records (where possible).
- Provide on-going advice to the Proponent and appointed contractors on environmental management of the existing activity.
- Suspend operations that pose an immediate and urgent threat to the environment.
- Undertaking an annual review of the OEMP and amending the document when necessary.

7.2 CONTRACTOR

The Contractor is responsible for the implementation of the relevant provisions of this OEMP and on-site monitoring. It is envisaged that different contractors might be appointed during the operation phase and decommissioning phase of this existing activity. Furthermore, the maintenance portions of the 298 sites might be awarded to different contractors. All contractors shall ensure that adequate environmental awareness training of senior site personnel takes place and that all their employees (existing and newly appointed) receive an induction presentation on the importance of complying with this OEMP. The presentation shall be conducted, as far as is possible, in the employees' language of choice. The Contractor should keep records of all environmental training sessions, including names, dates and the information presented.

In order to ensure sound environmental management, the relevant sections of this EMP should be included in all contracts of work outsourced, thus legally binding all appointed contractors and sub-contractors.

7.3 ENVIRONMENT HEALTH AND SAFETY OFFICER (EHSO)

The EHSO will be a competent person designated by the Contractor to monitor and review the on-site environmental management and implementation of this OEMP by the Contractor. The EHSO will be required to be on site on a daily basis and his/her duties will include the following:

- To environmentally educate and raise the awareness of the Contractor and his staff as to the sensitivity of the Site and to facilitate the spread of the correct attitude during works on Site.
- Conducting daily site inspections during routine and emergency maintenance activities of all individuals and/or equipment in operation areas and infrastructure/equipment maintenance areas with respect to the implementation of this OEMP on-site in terms of compliance with this OEMP.
- Recommend to the Contractor the removal of individuals and/or equipment not complying with the provisions of this OEMP from site.
- Recommend to the Contractor the issuing fines to individuals for contravening OEMP provisions.

7.4 ENVIRONMENTAL CONTROL OFFICER (ECO)

The ECO will be an independent competent person (third party) appointed by the Proponent to monitor the implementation of this OEMP by the Contractor. The ECO will be required to monitor the following:

- The ECO shall make recommendations independent of the EM who shall consider implementing such recommendations and fines as well as other issues picked up by the ECO.
- The EM must oversee the mitigation measures and ensure compliance with the conditions of the OEMP.
- Involve specialists to advise on environmental management issues as they emerge during the applicable project phase.
- The ECO will be responsible to the Proponent.
- The ECO will be on site at a predetermined frequency (at least once a year) and will be responsible for verifying the implementation of the OEMP throughout the applicable project phases.
- Recommend corrective action to the Contractor and the EM where operational or decommissioning phase activities are not in compliance with the OEMP.
- To keep a comprehensive environmental record (site diary and photographs) of activities on site.
- The ECO shall have the right to investigate the site at any time during the project phases and unexpected visits will be allowed.

8 ADMINISTRATION OF ENVIRONMENTAL OBLIGATIONS

8.1 INTERNAL REVIEW AND AUDITING

The Proponent shall establish an internal review procedure to monitor the progress and implementation of the OEMP by the appointed contractors undertaking maintenance activities.

Where necessary, upon recommendation by the EM, procedures that require modification shall be changed by the Proponent to improve the efficiency and effectiveness of the OEMP.

8.2 IMPLEMENTATION OF THE OEMP

Implementation of the OEMP will be the responsibility of all parties involved in the existing activity, with ultimate responsibility resting with the Proponent. The EM, the ECO and appointed contractors (and their designated EHSOs) will be central to the implementation of this OEMP on the ground.

8.3 OEMP MONITORING RESPONSIBILITIES

The day-to-day monitoring and verification that the OEMP is being adhered to shall be undertaken by the Contractor.

The ECO shall inspect the site at least once a year to ensure that correct procedures are being implemented and that the Contractor is complying with the environmental specifications in the OEMP.

The ECO shall address any queries to the EM. If the queries cannot be resolved at this level, they shall be referred to the Proponent, if necessary.

8.4 DISPUTES AND DISAGREEMENTS

In the event of a dispute or disagreement between role players (with regard to environmental management) an Environmental Committee should be formed. The Environmental Committee should consist of two representatives from the Proponent (including the EM) and the ECO. All disputes or disagreements will be resolved by the Environmental Committee. If no resolution on the matter is possible it must be presented to an outside party agreed upon by all parties involved or to the Department of Environmental Affairs (Ministry of Environmental and Tourism).

8.5 EMERGENCY PREPAREDNESS

The Contractor shall compile and maintain environmental emergency procedures to ensure that there will be an appropriate response to unexpected or accidental actions or incidents that will cause environmental impacts, throughout the operational phase. Such activities may include, among others;

- Accidental exposure of employees to hazardous substances,

- Injuries on duty related to falls from dangerous heights or electric shock.
- Accidental spillage of hazardous substances.
- Accidental fires.
- Specific environmental and ecosystem effects from accidental releases or incidents.

These plans shall include, among others;

- Emergency organisation and responsibilities, accountability and liability.
- A list of key personnel and contact details.
- Details of emergency services available (e.g. the fire department, spill clean-up services, etc.).
- Actions to be taken in the event of different types of emergencies.
- Incident recording, progress reporting and remediation measures required to be implemented.
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental spillages.

8.6 ENVIRONMENTAL AWARENESS TRAINING

The Contractor shall ensure that their employees and any third party who carries out all or part of the operational obligations are adequately trained with regard to the implementation of the OEMP, as well as regarding environmental legal requirements and obligations. Training shall be conducted by the Environmental Manager where necessary.

The purpose of this environmental training is to provide a general explanation of sustainable environmental practises, but also to explain the content of the OEMP, the relevance thereof and how it will be implemented through monitoring.

8.7 INFORMATION BOARD(S)

Each BTS site should have an information board erected at a conspicuous location (e.g. as high as possible on the perimeter fence) so that it is clearly visible. The board should include the contact details of the EM in case affected property owners wish to lodge a complaint.

In the case of decommissioning of tower structures the Contractor shall be responsible for erecting of temporary information boards on site. The number and locations of these boards shall be agreed by the EM.

The contents of the information board shall be provided by the EM and will essentially be to advise the public of the decommissioning operations and the prohibition on entering work areas. The information board shall apart from the details of the Contractor also provide the name and contact number of the EM to ensure that the public has access to the EM to ask for information and/or to lodge any complaints.

9 ENVIRONMENTAL MONITORING

9.1 OVERVIEW

Environmental monitoring is defined as *‘an activity undertaken to provide specific information on the characteristics and functions of environmental and social variables in space and time’* and is therefore one of the most important aspects of environmental management, which is essential for:

- ensuring that impacts do not exceed the legal standards;
- checking the implementation of mitigation measures in the manner described in the during project planning and design, and
- Providing early warning of potential environmental damages.

Environmental monitoring, having the purpose of avoiding and/or mitigating environmental impacts, is legally required (Environmental Management Act, No 7 of 2007) as a standard condition forming part of an ECC issued by the DEA.

Environmental monitoring in the case of the existing activity should be based on the findings and recommendations laid out in this OEMP. The environmental impacts referred to are listed and discussed in Chapter 6 – GENERIC IMPACTS AND MITIGATIONS above.

Environmental monitoring for the existing activity will serve the purpose of –

- recording environmental compliance during the operational and decommissioning phases of the existing activity;
- providing information to the relevant authorities (i.e. the office of the Environmental Commissioner); and
- Serve as supporting documentation for future applications for the renewal of an ECC (in the event that an ECC is awarded for the existing activity).

9.2 PROCESS AND TIME FRAME

9.2.1 OPERATIONAL PHASE MONITORING

Operational monitoring of the existing activity should be carried out for as long as the existing BTS sites are operational – i.e. up until decommissioning.

Owing to the expected frequency of operational phase maintenance activities (i.e. one a year), it is recommended that the appointed ECO conduct site monitoring during (if possible), or after the annual site maintenance has been undertaken by the Contractor.

9.2.2 DECOMMISSIONING PHASE

Figure 9-1 below indicates the activities forming part of each of the two phases' monitoring being conducted.

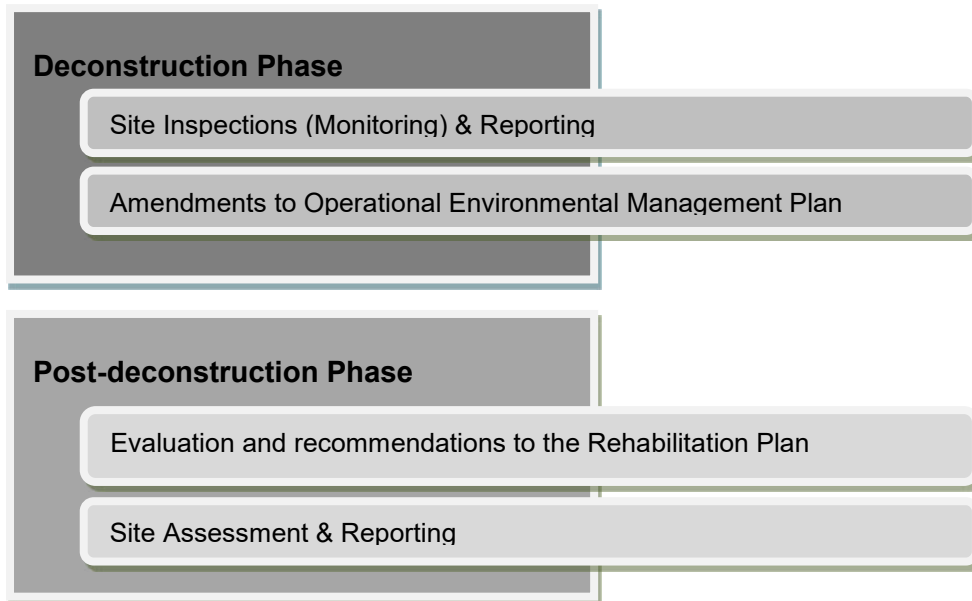


Figure 9-1: Decommissioning monitoring phase's activities

9.3 ON-SITE MONITORING

- Monitoring done during the Decommissioning Phase focuses on all activities within the affected site, which includes the respective Contractors' Camp Sites and the cart away area.
- The estimated duration of decommissioning activities would differ from site to site. It is recommended that as a minimum, three site monitoring visits be conducted per site:
 - At the start of the decommissioning process, once the Contractor has established their work site;
 - Midway during decommissioning activity; and
 - At the end of the decommissioning phase, once the site has been rehabilitated (i.e. post-deconstruction phase).
- Monitoring should be undertaken by the appointed ECO.

10 OPERATIONAL SPECIFICATIONS

This chapter deals with the operational environmental management aspects that apply to the existing activity.

Operational environmental management aspects include:

- Management of Infrastructure and Services
- Management of Waste
- Management of Hazardous Materials
- Management of Noise
- Management of Worker and Public Safety
- Management of Biodiversity
- Dealing with Complaints

10.1 MANAGEMENT OF INFRASTRUCTURE AND SERVICES

The project facilities will rely on road infrastructure to gain access to each site. In some cases these roads will not be tarred.

IMPACT	MITIGATION	RESPONSIBILITY
Erosion along access road	<ul style="list-style-type: none"> • During road maintenance works the Contractor shall protect all areas susceptible to erosion and siltation (e.g. stream banks) by installing the necessary drainage or retaining works and by taking other measures necessary to prevent the surface water from being concentrated in streams and from scouring the stream banks and depositing silt outside the demarcated work areas. Any runnels or erosion channels developed during the maintenance works or decommissioning and rehabilitation period shall be backfilled and compacted, and the areas restored. • Stabilisation of cleared areas to prevent and control erosion should be actively managed. Traffic and movement over stabilised areas shall be restricted and controlled, and damage to stabilised areas 	Contractor

IMPACT	MITIGATION	RESPONSIBILITY
	<p>shall be repaired and maintained.</p> <ul style="list-style-type: none"> • Anti-erosion compounds shall consist of an organic or inorganic material to bind soil particles together and shall be a proven product able to suppress dust and erosion. • Consideration and provision shall be made for the following methods (or combination): <ul style="list-style-type: none"> ○ Brush cut packing ○ Mulch or chip cover ○ Straw stabilising (at the rate of one bale/20m² and, if required, additional straw should be added and rotated into the top 100 mm of the completed earthworks) ○ Watering ○ Planting/sodding ○ Hand seeding sowing ○ Hydroseeding ○ Soil binders and anti-erosion compounds ○ Mechanical cover or packing structures, e.g. gabions and mattresses, geofabric, hessian cover, armour flex, log/pole fencing and retaining walls 	
Economic loss caused as a result of damage to equipment of other service providers.	Operational activities associated with the existing BTS sites should not alter/ damage any part of the existing BTS equipment of other service providers sharing the tower structure.	Contractor

10.2 MANAGEMENT OF WASTE

Adequate provision must be made for the collection, storage and disposal of waste based on the integrated approach of reduction, re-used and recycling wherever possible. Waste must be collected into suitable weather, wind and animal proof waste bins and removed to a legally registered disposal site on a regular basis. Waste bins may not be allowed to overfill. No waste will be allowed to litter or contaminate the facilities and the surrounding areas. No waste may be buried or burned.

IMPACT	MITIGATION	RESPONSIBILITY
General environmental degradation	All waste (concrete, paper, plastic, building soil, etc.) created during the construction phase should be removed from the site on a daily basis.	Contractor
Pollution of surface and ground water	<ul style="list-style-type: none"> • The Contractor shall provide staff with toilet facilities. • All temporary portable toilets shall be secured to the to prevent them toppling due to wind or any other cause. • Acts of excretion and urination are strictly prohibited other than at the toilets provided. • Toilets supplied by the Contractor for the workers shall occur at a maximum ratio of 1 toilet per 30 workers (preferred 1:15) and be within walking distance of the staff. These facilities shall be maintained in a hygienic state and serviced regularly. Toilet paper shall be provided. The Contractor shall ensure that toilets are emptied regularly, as well as before the builders' holidays. The Contractor shall ensure that no spillage occurs when the toilets are cleaned or emptied and that the contents are removed from Site. Discharge of waste from toilets into the environment is prohibited. • Only environmentally certified paint should be used. 	Contractor

10.3 MANAGEMENT OF HAZARDOUS MATERIALS

The use and storage of all fuels must be done in a responsible manner to ensure environmental safety.

IMPACT	MITIGATION	RESPONSIBILITY
Pollution of surface and ground water	<ul style="list-style-type: none"> • Fuels must be stored in suitable containers in a safe and lockable storage facility that allows for the containment of any spillage. • Adequate spill and bio-remedial products must be on hand at all times to deal with spill events. 	Contractor

10.4 MANAGEMENT OF NOISE

IMPACT	MITIGATION	RESPONSIBILITY
Inconvenience caused to nearby noise receptors	<ul style="list-style-type: none"> • Noise should be limited at all times, and activities undertaken during the applicable project phase should only occur during weekdays between 08:00am and 17:00pm, and weekends between 10:00am and 12:00am. No work is to be done on Sundays or public holidays. • The Contractor shall limit noise levels (e.g. install and maintain silencers on machinery). Appropriate directional and intensity settings are to be maintained on all hooters and sirens. No amplified music shall be allowed on Site. The use of radios, tape recorders, compact disc players and television sets shall not be permitted unless the volume is kept sufficiently low. The Contractor shall not use sound amplification equipment on Site unless in emergency situations. 	Contractor

10.5 MANAGEMENT OF WORKER AND PUBLIC SAFETY

10.5.1 GENERAL

IMPACT	MITIGATION	RESPONSIBILITY
Compromised safety for the public and workers (e.g. electric shock, tower collapse)	<ul style="list-style-type: none"> • Grounding and electrical wiring of each of the existing sites should have been conducted in accordance with Grounding Guidelines for Cellular Radio Installations, 68P81150E62. Installation and Configuration Manual (26 September 2003). STS-3 also provides standard technical specifications for the supply, installation and commissioning of a grounding and lightning protection system. • The facility should be enclosed with a fence with a minimum height of 2 m to prevent unauthorised access to ensure safety of residents and restrict access to authorised personnel. • The hazards and safety issues of unauthorised access to the BTS should be clearly displayed through safety and warning signage. • All equipment, infrastructure (i.e. foundations and tower structure) should comply with the applicable international standards and requirements, as well as best management principles. 	EM
Compromised safety for the public and workers (e.g. tower collapse)	<ul style="list-style-type: none"> • Routine safety and maintenance checks of the antenna system, the tower structure and foundations should form part of the operational activities of the BTS. • Nests should be removed from lattice tower structures during standard maintenance operations. 	Contractor
Compromised safety for road users during maintenance activities near business or residential areas	<ul style="list-style-type: none"> • Material and equipment should be offloaded on-site and not within any road. • People responsible to deliver equipment and the Contractor's personnel should have legal and valid driver's license. • All vehicles used during the relevant project phase should be within a road worthy condition and should be checked on a daily basis. Any defects should be attended to before entering the public roads. 	Contractor
Compromised safety for workers on-site (e.g. accidents resulting in injury)	<ul style="list-style-type: none"> • Only appropriately trained personnel and labourers should be used during the work associated with the applicable project phase, especially those working at dangerous heights. • All the Contractors personnel should be issued with the required safety clothing, especially those 	Contractor

IMPACT	MITIGATION	RESPONSIBILITY
or death).	<p>working at dangerous heights.</p> <ul style="list-style-type: none"> • Working firefighting equipment must be available in and around areas where hazardous/flammable substances are stored. • Basic first aid equipment must be available and at least one person should be trained in the provision of first aid. • Emergency contact numbers must be clearly displayed at all work sites. 	
	Ensure safety awareness and compliance by all on-site personnel.	EHSO

10.5.2 RADIATION

IMPACT	MITIGATION	RESPONSIBILITY
<p>Non-thermal health concerns associated with the long-term effects of continuous exposure to low frequency electromagnetic radiation.</p>	<ul style="list-style-type: none"> • The BTSs and their equipment (including antennae) selected by the Proponent should have been tested and should comply with the following International safety and quality standards: <ul style="list-style-type: none"> ○ The European Commission - Directive 1999/5/EC of the European Parliament and of the Council of 9 March 1999. ○ Federal Communications Commission - Part 15 of the Rules applicable to Class B digital devices. ○ ANSI IEEE C95.1-1991, IEEE - Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. ○ CENELEC 95 ENV 50166-2, Human Exposure to Electromagnetic Fields High Frequency (10kHz to 300 GHz). ○ The Telecommunication Standardization Sector (ITU-T) - coordinates standards for telecommunications on behalf of the International Telecommunication Union (ITU) and is based in Geneva, Switzerland. 	EM

IMPACT	MITIGATION	RESPONSIBILITY
	<ul style="list-style-type: none"> ○ International Telecommunication Union - an intergovernmental public-private partnership organization since its inception and now has a membership of 191 countries and over 700 public and private sector companies as well as international and regional telecommunication entities. All Vendors are affiliated with the International Telecommunication Union (ITU). • A RF radiation exposure assessment should be conducted for all BTS sites to confirm that actual levels of emitted radiation are below the allowable maximum prescribed. The outcome/results of the assessment should be submitted to the National Radiation Protection Authority (NRPA) (Ministry of Health and Social Services). • Follow-up RF power density measurements should be taken for all BTS sites every 5 years, or when the BTS equipment is upgraded, or additional BTS equipment is added to a tower structure (i.e. additional sharing), to ensure that these BTS sites continue operating below the allowable maximum levels prescribed by the ICNIRP. The outcome/results of the assessment should be submitted to the National Radiation Protection Authority (NRPA) (Ministry of Health and Social Services). • In the event that Namibia promulgates regulations on RF radiation exposure limits for non-ionising radiation in the future, all applicable BTS sites should be re-evaluated and adjusted accordingly to ensure compliance. 	

10.5.3 CIVIL AVIATION

IMPACT	MITIGATION	RESPONSIBILITY
Compromised aviation safety associated with the introduction of an obstacle within the OLS of an existing aerodrome.	<ul style="list-style-type: none"> • The DCA should be informed of any tower structure which is located within 8km of an aerodrome and is more than 150 feet (45.7m) above the mean level of the landing area, for the purpose of ensuring that necessary provisions of Annex 14 of the Convention on International Civil Aviation are complied with as well as the required registering the obstacle with all aviation service providers. • If applicable, the DCA should record the locality of the new obstacle and provide all aviation service providers with the necessary details. 	EM
Compromised aviation safety associated with faulty warning equipment.	Faulty or damaged aviation warning and navigational lights must be replaced immediately	Contractor

10.6 VISUAL IMPACT

IMPACT	MITIGATION	RESPONSIBILITY
Potential negative visual impact associated with introduction of a structure into a landscape which contrasts with the existing visual character of that landscape.	<ul style="list-style-type: none"> • All tower structures should blend in as far as practicably possible with their surroundings, with the use of natural, non-reflective and compatible colours where applicable, except where the Directorate of Civil Aviation (Ministry of Works and Transport) requirements state otherwise. • No advertisements should be allowed on the equipment shelter or tower structure. • Regular maintenance of the equipment shelter and all associated structures of the base station (i.e. equipment containers, antennae, tower structure, etc.) should be done in order to maintain the visual integrity of the surrounding area. • Where applicable any mounted navigational obstruction light (located at the top of the tower for the purpose of aviation safety) should be shielded so as not to be visible from below but only from above. This should however only be done with the approval from the DCA. 	Proponent

10.7 MANAGEMENT OF BIODIVERSITY

10.7.1 GENERAL

IMPACT	MITIGATION	RESPONSIBILITY
Reduction in biodiversity associated with habitat disturbance and associated loss of faunal species (e.g. poaching, road kills, use of herbicides).	The on-site Environmental, Health and Safety Officer should ensure that intentional and accidental disturbance of faunal species is kept to a minimum. Any contravention of the law (e.g. poaching) should be quickly and strictly dealt with.	EHSO
	Manual clearing of vegetation growth in and around the site should be done as opposed to the use of herbicides. If herbicides are to be used, the following is recommended: <ul style="list-style-type: none"> • Care should be taken so as to avoid accidental spills including the health risks to people applying these herbicides. Application of herbicides should be done by wearing protective gear. • The application should conform to best practice uses, and monitored to identify any negative impacts and application strictly confined to the site. 	Contractor

10.7.2 AVIFAUNA

IMPACT	MITIGATION	RESPONSIBILITY
Bird mortality of threatened bird species due to collision with guy wires.	All applicable BTS sites with guyed lattice structures should have bird flight diverter devices fitted to the guy wires. Guidance in terms of which sites require bird flight diverter devices as well as which devices are the most effective should be sought from suitably qualified bird specialists.	EM

10.8 DEALING WITH COMPLAINTS

IMPACT	MITIGATION	RESPONSIBILITY
<p>Negative conflict associated with inappropriately handled complaints.</p>	<ul style="list-style-type: none"> • The EM's contact details should be clearly visible on the information board erected at a conspicuous location and clearly visible at each BTS site. • All complaints must be recorded in a complaints register with details of the nature of the complaint, the person or organisation that lodged the complaint, the date and the name of the responsible person dealing with the complaint. • The complaint must be fully investigated. Further clarity may also be obtained from any existing operation and environmental records, from employees, from third party specialists or from the complainant. • A strategy to deal with the complaint must be formulated, documented in the complaints register and communicated to the complainant. • The formulated strategy must be implemented by the allocation of resources. • The effects of the strategy should be monitored and the strategy modified if need be. • Once the situation leading to the complaint has been resolved, the complainant must be informed. The date hereof should be recorded in the complaints register. • Actions must be taken to prevent the situation from reoccurring and, if necessary, a contingency plan should be developed. • If a situation leading to a complaint cannot be resolved under normal conditions, an amicable solution should be devised with inputs from the complainant. • The complaints register must be reviewed regularly to ensure that all complaints have been dealt with effectively. 	EM

11 DECOMMISSIONING SPECIFICATIONS

Although the facilities are intended to be operated for an extended period of time, the specifications detailed below should be undertaken if the any of the existing BTS sites were ever decommissioned. It should be noted that some of the activities undertaken during the decommissioning phase are similar to those undertaken during the operational phase. Where applicable, the operational specifications detailed in Chapter 10 above should be complied with. Mitigation measures applicable to general construction site management and final decommissioning and rehabilitation are outlined in the tables below.

11.1 GENERAL CONSTRUCTION SITE MANAGEMENT

IMPACT	MITIGATION	RESPONSIBILITY
Habitat disturbance and visual impacts associated with the Contractor's camp	<p>The planning and design for the Contractor's Camp must ensure that there is minimal impact on the environment. The following should apply –</p> <ul style="list-style-type: none"> • The Contractor's Camp will be placed within an existing disturbed area as far as possible. • The Contractor's Camp shall be located in an area of low environmental and social sensitivity. • The Contractor's camp should be situated as low as possible (in terms of elevation) on the larger site and as far as possible from public roads. • The final location of the Contractor's camp shall be identified in consultation with the ECO. 	ECO, Contractor
Compromised public safety associated with access to work areas.	<ul style="list-style-type: none"> • Where deemed necessary by the ECO, sensitive areas shall be fenced off by the Contractor by means of a two-strand wire fence on which danger tape has been securely placed. • Fencing of the labour campsite (if applicable) and construction area shall be suitably secured to prohibit access by livestock and local fauna. Full shade cloth demarcation of 1.8m in height is recommended for the Contractor's Camp. • Fences will be constructed around Heritage resources (should these be present) to prevent access into such areas during decommissioning. • No unauthorised pedestrian or vehicular access shall be allowed into fenced, off-limit areas. • If fencing is removed temporarily for the execution of work, the Contractor shall reinstate it as soon as 	ECO, Contractor

IMPACT	MITIGATION	RESPONSIBILITY
	<p>practicable. Until re-instatement, the Contractor shall demarcate the working area by surrounding it with danger-tape marking.</p> <ul style="list-style-type: none"> • Breaches in the fencing must be repaired immediately. • The Contractor to the satisfaction of the ECO maintain all fencing. Such fences shall be erected before the start of any construction works. 	
Surface erosion and associated impacts (e.g. silting of rivers, visual impacts)	<ul style="list-style-type: none"> • Existing roads will be used as far as possible. No temporary access roads will be permitted, unless negotiated with the ECO and affected land owners. • Any temporary roads required shall be decommissioned by the Contractor and rehabilitated to their pre-construction condition. • During construction the Contractor shall protect all areas susceptible to erosion by installing all necessary temporary and permanent drainage works as soon as possible. 	Contractor
Nuisance impacts associated with the generation of dust	<ul style="list-style-type: none"> • The Contractor shall take all reasonable measures to minimise the generation of dust as a result of construction activities to the satisfaction of the ECO. Removal of any vegetation shall be avoided as far as possible, while handling and transport of erodible materials shall be avoided under high wind conditions. • Where possible, stockpiles shall be located in sheltered areas. Where erosion of stockpiles becomes a problem, erosion control measures shall be implemented at the discretion of the ECO. • Appropriate dust suppression measures shall be used when dust generation is unavoidable, e.g. straw, brush packs and chipping, particularly during prolonged dry periods in summer. Such measures shall also include the use of temporary stabilising measures (e.g. chemical soil binders and dustex). 	Contractor

11.2 FINALISATION OF DECOMMISSIONING AND REHABILITATION

IMPACT	MITIGATION	RESPONSIBILITY
Illegal decommissioning/closure of existing listed activity	All relevant authorities must be informed of the decommissioning of a given site.	Proponent
General environmental degradation and potential surface and groundwater contamination.	<ul style="list-style-type: none"> • The Contractor's work site (where applicable) should be erected on land which is already disturbed and should be located as close as practicably possible to the BTS site to be decommissioned. • The site should be rehabilitated to a state approximating the predevelopment state. • All hazardous substances must be removed and disposed of responsibly. • All above and below ground infrastructures must be removed. • General rubble resulting from demolition (if structures are to be demolished) can be used as fill at nearby construction sites (if any), or otherwise disposed of at a licensed landfill site. • Waste may not be dumped on or near any of the sites. • Any soil that might be contaminated by fuel or other hazardous substances must be removed and disposed of at a hazardous waste disposal site. • Contaminated soil may not be dumped on or near any of the sites. • The soil compaction must be broken by ripping and then fertilised and suitably rehabilitated. • No alien plant species may be established on the site during rehabilitation. • A post decommissioning audit is recommended. 	Contractor

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