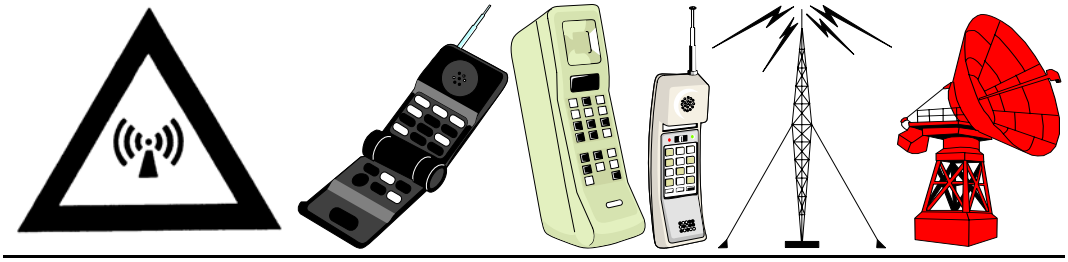
Draft guidelines for Siting of Communications infrastructure, towers (masts) and safe use of mobile telephones and other wireless terminals



MAST SITING COMMITTEE DRAFT 0: JULY 2007

Technical representation

These guidelines were developed by a committee comprising of the following members:

Kenya Bureau of Standards

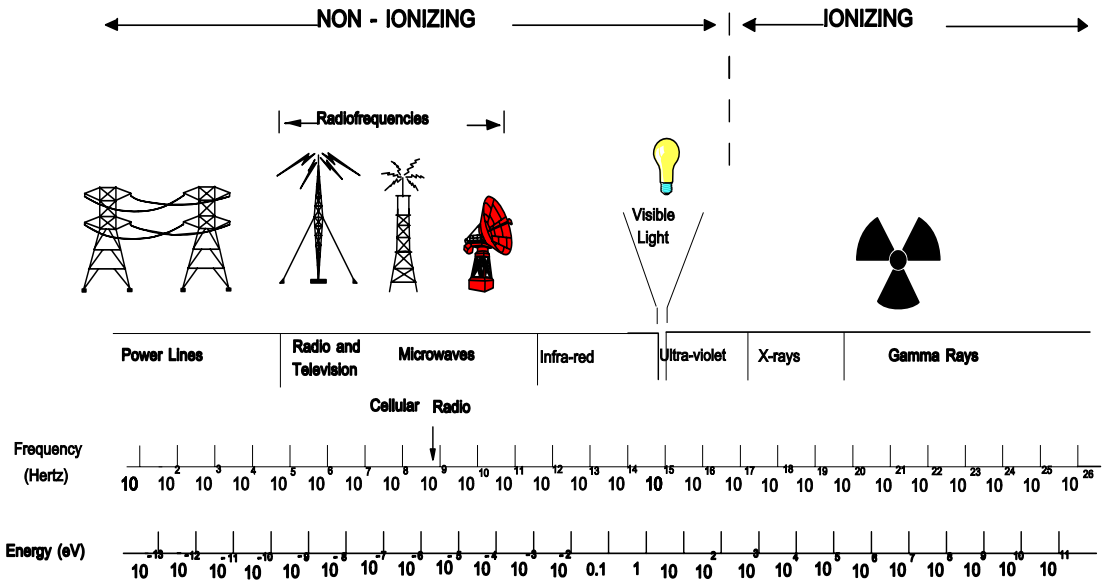
National Environmental Management Authority

Radiation Protection Board, Ministry of Health

Kenya Civil Aviation Authority

Ministry of Local Government

Communications Commission of Kenya



Draft guidelines for Siting of Communications infrastructure, towers (masts) and safe use of mobile telephones and other wireless terminals

Preamble

The increased use of mobile phones and other modern wireless communications devices around the world has raised public interest in the siting of communication masts/towers, aesthetics of the communications masts/towers and possible health concerns associated with exposure to electromagnetic emissions. These concerns relate to both handheld devices, base stations, towers and masts. In response to this, the Commission engaged several Government agencies, culminating in the establishment of the Standing Committee. Through this collaborative approach designed to take on board the requirements of various agencies and government ministries, the Standing Committee has been developing guidelines that will set out the procedures to be used by Operators and Service providers in the rollout of Communications base stations, towers, masts and also provide guidelines fort the safe use of mobile telephones and similar technologies.

The Guidelines for Siting of Communications base stations, towers, masts and safe use of mobile telephones and similar technologies was prepared by the mast siting standing committee, a committee comprised of representative members from Kenya Bureau of Standards (KEBS), Radiation Protection Board (RPB), National Environmental Management Agency (NEMA), Ministry of Local Government Kenya Civil Aviation Authority (KCAA) and Communication Commission of Kenya (CCK)

References in this guidelines has been made to standards set by the Kenya Bureau of Standards on safety limits of Electromagnetic radiation, requirements of the environmental impact assessment study developed by National Environmental Management Agency, documentation and recommendations made by Radiation Protection Board on the effects of Radio frequency radiation to health, information provided by the Ministry of Local Government requirements for the construction of the communication masts as per requirements on land use and zone requirements. Information provided by Kenya Civil Aviation Authority on requirements to ensure that communication masts/towers do not substantially interfere with air safety requirements as well as information from the Communications Commission of Kenya with regards to management of frequencies and co-location of communication facilities.

These guidelines seek to regulate the siting, construction and modification of communication masts/towers. The lack of regulation would result in the construction, siting and modification of numerous communication masts which will not only have an adverse visual impact to the landscape and environment but may pose potential damage to property caused by failure of communication structures to comply to the appropriate design and construction criteria. These guidelines will seek to minimise these effects as well as address issues that may be of health concern with regards to radiation emissions from the communication facilities, the precautionary approach principle and also provide information on the safe use of mobile telephones and other similar technologies.

Information contained in these guidelines can be should be used within the Communications industry as a guide in the process for application for collocation of communication facilities and applications for the construction of new communication facilities as well as guidelines on decommissioning of communication facilities. These

guidelines will not seek to change or replace existing guidelines/requirements of the Commission or requirements of other agencies but see to facilitate faster processing of applications and harmonise processes within the lead agencies that will manage the application and approval processes.

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List of abbreviations and acronyms

ACA	Australia Communications Authority
AM	Amplitude modulation
ANSI	American National Standards Institute
APC	Adaptive Power Control
BTS	Base Transceiver Station
CCK	Communications Commission of Kenya
CDMA	Code Division Multiple Access
CW	Continuous wave
DDC	District Development Committee
DECT	Digital Enhanced Cordless Telecommunications
DNA	Deoxyribonucleic acid
DTX	Discontinuous transmission
EIA	Environmental Impact Assessment
EEG	Electroencephalogram
EIRP	Effective Isotropic Radiated Power
EIRP	Equivalent isotropically radiated power
EME	Electromagnetic Energy Level
EMR	Electromagnetic Radiation
ERP	"Evoked" or "Event-related" potential
FCC	Federal Communications Commission
FDA	Food and Drug Administration
GSM	Global System for Mobile Communications or *Groupe Spéciale Mobile*
ICNIRP	International Commission for Non-Ionising Radiation Protection
IEGMP	Independent Expert Group on Mobile phones
ITU	International Telecommunication Union
KCAA	Kenya Civil Aviation Authority
NEMA	National Environment Management Authority
NRPB	National radiation protection board
SAR	Specific Absorption Rate
TDD	Time Division Duplex.
TDMA	Time Division Multiple Access
TETRA	Terrestrial enhanced trunk radio system
UMTS	Universal Mobile Telecommunications System

Introduction

In many developed countries, over half of the population already use mobile phones and the market is still growing rapidly. The industry estimates that there are as many as 1.6 billion mobile phone subscribers worldwide. Because of this, increasing numbers of mobile base stations have had to be installed. For instance, in July 2005 there were about 45000 base stations in operation in the United Kingdom and about 82,000 cell sites in the United States by 2000, with each cell site holding one or more base stations. In Kenya, we had 1519 Base stations at the end of June 2006. Base stations have low-powered radio antennae that communicate with users' handsets. Before the advent of mobile communications services in Kenya, masts/towers existed for other services such as broadcasting and HF radio communication. These services did not however require many masts and hence elicited very few objections from the public.

The increased use of mobile phones around the world has raised public interest in possible health issues associated with exposure to electromagnetic emissions. These concerns relate to both mobile phone handsets and mobile phone base stations. Here in Kenya, residents of several areas have made several petitions to the Communications Commission of Kenya and other Government agencies opposing the construction of base stations in their neighbourhoods.

Within the UK for instance, the Ministry of Public Health called for an independent expert group to be set up to undertake a comprehensive review of the possible health effects of mobile telecommunications technologies. This Group was chaired by Sir William Stewart and published its report whose findings are referenced within this document.

The Commission, in collaboration with other lead agencies formed a standing committee to deal with the issues by developing these guidelines to siting of the communication base stations, masts, towers and safe use of mobile telephones and other similar technologies. The standing committee was comprised of members from the Radiation Protection Board (RPB), Kenya Bureau of Standards (KEBS), National Environmental Management Agency (NEMA), Kenya Civil Aviation Authority (KCAA), Ministry of Local Government and Communication Commission of Kenya (CCK).

The standing committee was formed for the purpose of developing of guidelines that would provider communication service providers with a guide on how to implement their communication infrastructure in a manner that does not adversely affect the environments and minise effects of radiation emission for the communication facilities. Further to this aim, the standing committee developed these guidelines so as to to regulate the siting, construction and modification of communication masts/towers.

These guidelines will address issues that may be of health concern with regards to radiation emissions from the communication facilities, encourage co-location of communication facilities and the use the precautionary approach principle and also provide information on communication technologies and the safe use of mobile telephones. These guidelines will also provide procedures that have harmonised regulations and requirements of the different lead agencies and has thus provided the requirements on what the service provider needs to fulfil and what necessary approvals are required.

Draft guidelines for Siting of Communications infrastructure, towers (masts) and safe use of mobile telephones and other wireless terminals

1. Scope and objectives

1.1. Scope

These guidelines are established to regulate the design, location, construction and modification of communication structures and antenna support structures for communication services in order to protect the health, safety and welfare of communities and preserve the environment while at the same time not unreasonably interfering with the development of the communications market in the country. These guidelines also set out the safety limits for RF communication facilities and mobile telephone handsets permitted in Kenya and spell out restrictions for their use in certain designated areas. These guidelines are established pursuant to the Kenya Communications Regulations, 2001

1.2. Objectives

The objectives of these guidelines are the following:

1) To regulate the placement, construction and modification of mobile/wireless communication structures and systems in Kenya;

2) To apply a precautionary approach to the deployment of communication infrastructure;

3) To provide best practice processes for demonstrating compliance with relevant exposure limits and the protection of the public;

4) To ensure relevant stakeholders are informed and consulted before communication infrastructure is constructed;

5) To specify standards for consultation, information availability and presentation;

6) To protect residential areas and other land uses from potential adverse impacts of communication structures;

7) To minimize the potential adverse visual impact of communication antennae and support structures through careful design, siting, landscaping and innovative camouflaging techniques;

8) To ensure that any new communication tower or structure is located in an area compatible with the neighbourhood, surrounding land uses or surrounding community to the extent possible;

9) To maximize the use of existing and new support structures so as to minimize the need to construct new or additional facilities;

10) To promote and encourage shared use/co-location of communication structures and antenna support structures as the primary option for mobile/wireless communication services instead of the construction of additional single-provider towers;

11) To avoid potential damage to property caused by failure of communication structures by ensuring that such structures are soundly and carefully designed, constructed, modified, maintained and removed when no longer used or when determined to be structurally unsound;

12) To encourage the safe, effective and efficient provision of mobile/wireless communication services to the community;

13) To ensure that the regulation of mobile/wireless communication services does not prohibit or have the effect of prohibiting the provision of such services;

14) To ensure that that the regulation of wireless communication services does not unreasonably discriminate among functionally equivalent providers of such services;

15) To facilitate the ability of the providers of communication services to provide such services to the community through an efficient and timely application process;

16) To create a hierarchy that influences both where new communication towers and facilities are located and the types of antennas that are used and that favors co-location and public owned sites and promotes use of an antenna with the least amount of adverse visual impact; and

17) To encourage the location of communication towers in non-residential areas and to locate them, to the extent possible, in areas where the adverse impact on the community is minimal.

1.3. Applicability

1.3.1. These guidelines shall apply to new and existing communication installations, including replacements as set forth in 3.12. These guidelines shall not govern any facility used exclusively for receive-only antennas except to the extent that it interferes or manifests characteristics for which these guidelines apply. The use shall not be regulated or permitted as an essential public service utility, or private utility. The foregoing notwithstanding, all pre-existing communication facilities at the time of passage of these guidelines shall be registered with the Communications Commission of Kenya within sixty (60) days from the effective date hereof together with the height, width and location thereof. CCK shall use its best efforts to notify all persons or entities subject to the registration requirement, but the failure of CCK to notify an individual or entity shall not relieve such individual or entity of the requirement of registration. Failure to register an existing communication facility shall raise a presumption that the said communication facility was not a legal nonconforming use on the date of passage of these guidelines.

Except as provided in these guidelines, any current legal use being made of an existing communication facility on the effective date of these guidelines (herein "non-conforming structures") shall be allowed to continue, even if in conflict with the terms of these guidelines, except to the extent that continued operation of the facility in its current state poses demonstrated health, safety and environmental hazards to legitimate residents and activities on the site. However any pre-existing communication facilities shall comply with any EMCA, KCAA, CCK guidelines or Kenya standard that require that such facilities be brought into conformance within six (6) months of the effective date of such standard or guidelines, unless a different compliance schedule is mandated by CCK or any other relevant government agency having jurisdiction of the compliance parameters. Failure to comply within the specified time period shall constitute grounds for removal of the facility at the operator’s expense.

Any communication facility site that has received approval in the form of either a conditional use permit or building permit prior to the effective date of these guidelines, but has not yet been constructed or located, shall be considered a non-conforming structure so long as such approval is current and not expired.

1.3.2. These guidelines do not apply to the following:

a) communication infrastructure used or intended to be used for the purpose of providing a facility for use by, or on behalf of, a defense organization for defense purposes; or

b) communication infrastructure used or intended to be used for the sole purpose of facilitating the provision of emergency services by emergency services organizations; or

c) communication infrastructure and equipment covered by Annex E of KS 1847-1

1.4. Severability

1.4.1. 1.4.1 If any word, phrase, sentence, part, clause, sub clause, or other portion of these guidelines or any application thereof to any person or circumstance is declared void, unconstitutional, or invalid for any reason, then such word, phrase, sentence, part, clause, sub clause, or other portion, or the proscribed application thereof, shall be severable, and the remaining provisions of these guidelines, and all applications thereof, not having been declared void, unconstitutional, or invalid, shall remain in full force and effect as if the word, phrase, sentence, part, clause, sub clause, or other portion so declared or adjudged

invalid or unconstitutional were not originally a part thereof. The Commission hereby declares that it would have adopted the remaining parts of these guidelines if it had known that such part or parts thereof would be declared or adjudged invalid or unconstitutional.

1.4.2 Any permit or administrative approval issued under these guidelines shall be comprehensive and not severable. If part of a permit is deemed or ruled to be invalid or unenforceable in any material respect, by a competent authority, or is overturned by a competent authority, the permit or approval shall be void in total, upon determination by the Commission.

1.5. Conflict with other laws

Whenever the provisions of any other statute or covenants require more restrictive standards than those of these guidelines, the provisions of such statutes or covenants shall govern.

2. Definitions

The following words, terms, and phrases, when used in these guidelines, shall have the following meanings.

NOTE The word "shall" is always mandatory and not merely directory. The word "may" is directory and discretionary and not mandatory.

accessory facility or **structure**

an accessory facility or structure serving or being used in conjunction with wireless telecommunications facilities, and located on the same property or lot as the wireless telecommunications facilities, including but not limited to, utility or transmission equipment storage sheds or cabinets

accessory use

a use customarily incidental and subordinate to the principal use or building and located on the same lot with such principal use or building

Administrative review

a process where the relevant authority approves (by granting administrative approval) or denies an application. Applications that qualify for administrative review are subject to requirements of these guidelines and include:

a) Installing an antenna on an existing non-residential structure other than a tower (such as a building, sign, light pole, water tower, utility pole, or other free-standing, non-residential structure) in any commercial or industrial district that is less than 15 m in height so long as such addition does not add more than 3 m to the height of the existing structure.

b) Installing an antenna on an existing tower of any height, including a pre-existing tower, and further including the placement of additional buildings or other supporting equipment used in connection with said antenna, so long as the addition of said antenna adds no more than 6 m to the height of the existing tower.

c) Replacing an existing tower, which adds no more than 3 m to the overall height of the existing structure with only one replacement, allowed.

d) Installing an antenna on an existing structure other than a tower (such as a building, sign, light pole, water tower, or other free standing, non residential structure) that is more 15 m in height, so long as such addition does not add more than 6 m to the height of the existing structure.

Antenna

a transmitting and/or receiving device mounted on a tower, building or structure and used in telecommunications that radiates or captures electromagnetic waves, optical signals, digital signals, analogue signals, radio frequencies (excluding radar signals), wireless telecommunications signals and other communications signals, for television, radio, digital, microwave, cellular, telephone, personal communication system (PCS) or similar forms of wireless telecommunication and includes directional

antennas such as panel and microwave dish antennas, and omni-directional antennas such as whips, but excluding radar antennas, amateur radio antennas and satellite earth signals. This definition does not include over-the-air reception devices which deliver television broadcast signals, direct broadcast signals, direct broadcast satellite services or multichannel multi-point distribution services.

antenna dish (satellite dish)

an antenna with a concave shape used for the reception and/or transmission of radio signals to and from satellites

antenna tower (mast)

a structure used to support an antenna at some height above the ground

average (temporal) power

the time-averaged rate of energy transfer

averaging time

the appropriate time period over which exposure is averaged for purposes of determining compliance with RF exposure limits

backhaul network

the lines that connect a telecommunication service provider's towers/cell sites to one or more cellular telephone switching offices, and/or long distance providers, or the public switched telephone network

base transceiver station (BTS)

an earth-based transmitting/receiving station for cellular phones, paging services and other wireless transmission systems and includes its associated infrastructure including any antennas, housings and other equipment

broadcasting facility

any telecommunication tower built primarily for the purpose of broadcasting audio or audiovisual signals

cable micro-cell network

a series of multiple low-power transmitters/receivers attached to existing wirelines systems, such as conventional cable or telephone wires, or similar technology that does not require the use of towers. A cable micro-cell network is assumed to require co-location on existing poles

"carrier on wheels" or "cell on wheels" ("COW")

a portable self-contained cell site that can be moved to a location and set up to provide personal wireless services on a temporary or emergency basis. A COW is normally vehicle-mounted and contains a telescoping boom as the antenna support structure.

co-located telecommunications facility

the placement of a new telecommunications facility on an existing telecommunications tower, existing building or support structure owned by more than one provider

commercial impracticability or **commercially impracticable**

the inability to perform an act on terms that are reasonable in commerce, the cause or occurrence of which could not have been reasonably anticipated or foreseen. The inability to achieve a satisfactory financial

return on investment or profit, standing alone, shall not deem a situation to be "commercially impracticable" and shall not render an act or the terms of an agreement "commercially impracticable".

Commission

Communications Commission of Kenya

continuous exposure
exposure for durations exceeding the corresponding averaging time

decibel (dB)
ten times the logarithm to the base ten of the ratio of two power levels

duty factor

the ratio of pulse duration to the pulse period of a periodic pulse train. Also, may be a measure of the temporal transmission characteristic of an intermittently transmitting RF source such as a paging antenna by dividing average transmission duration by the average period for transmissions. A duty factor of 1.0 corresponds to continuous operation.

effective radiated power (ERP) (in a given direction)

the product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction

egress

refers to the exit or way out of a facility.

electric field strength (E)

a field vector quantity that represents the force (**F**) on an infinitesimal unit positive test charge (**q**) at a point divided by that charge. Electric field strength is expressed in units of volts per meter (V/m).

electromagnetic radiation (EMR)

energy radiated in the form of a wave as a result of motion of electric charges. Energy transmission over the entire electromagnetic spectrum is technically known as electromagnetic radiation (EMR) and includes commonly experienced emissions such as visible light, TV transmission, and AM and FM radio signals. A number of other terms are commonly used for the whole spectrum which include EME (electromagnetic energy), EMF (electromagnetic fields) which are often used interchangeably with EMR.

emergency service organization

includes, but is not limited to:

a) police forces or services;

b) fire services (urban and rural); and

c) ambulance services

energy density (electromagnetic field)

the electromagnetic energy contained in an infinitesimal volume divided by that volume

engineer

a qualified engineer, licensed by the Engineers Registration Board (ERB), who specializes in either electrical or communications engineering, especially the study of micro-frequencies; and/or, who specializes in structural integrity and determining whether a tower or antenna support structure has the capacity to accommodate more than one provider

equivalent isotropically radiated power (EIRP)

the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna

essential services

those services provided by governmental entities that directly related to the health and safety of its residents, including fire, police and rescue

exclusion zone

an area around a transmitting station within which exposure limits may be exceeded

existing tower

any telecommunications tower in existence at the time a telecommunications site plan is submitted

exposure

exposure occurs whenever and wherever a person is subjected to electric, magnetic or electromagnetic fields other than those originating from physiological processes in the body and other natural phenomena

exposure, partial-body

partial-body exposure results when RF fields are substantially non-uniform over the body. Fields that are non-uniform over volumes comparable to the human body may occur due to highly directional sources, standing-waves, re-radiating sources or in the near field.

fall zone (setback)

the area on the ground within a prescribed radius, beginning from the base of a telecom structure or an antenna support structure, that may be impacted if a telecom structure fails or collapses

fixed radio links

comprises point-to-point and point-to-multipoint services, fixed at both ends

general population / uncontrolled exposure

general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

geographic antenna placement area

the general vicinity within which the placement of an antenna is necessary to meet the engineering requirements of an applicant's cellular network or other broadcasting need

guyed tower

a telecommunications tower that is supported, in whole or part, by guyed wires and ground anchors

height

the distance measured from ground level including the base pad to the highest point on the tower or other structure, even if the said highest point is an antenna or lightning protection device

immediate circle

a non-public network used within an organization. For example, a company radio network used by company employees to communicate with each other, a taxi service network or a regional water authority network.

ingress

refers to the entrance or way into a facility

installation

in relation to radiocommunications infrastructure, includes:

a) the construction of the radiocommunications infrastructure, on over or under any land;

b) the attachment of the radiocommunications infrastructure to any building or other structure; and

c) any activity that is ancillary or incidental to the installation of the radiocommunications infrastructure

interested and affected parties

includes persons who reside within the immediate vicinity of the facility and may have an interest in the proposed facility

ionising radiation

gamma rays, alpha and beta particles, high-speed electrons, neutrons, protons and other particles capable of producing ions directly or indirectly in their passage through matter

lattice tower

a telecommunications tower that is constructed to be self-supporting by lattice type supports and without the use of guyed wires or other supports

major modifications

improvements to existing telecommunications facilities or support structures that result in a substantial change to the facility or structure. Collocation of new telecommunications facilities to an existing support structure without replacement of the structure shall not constitute a major modification. Major modifications include, but are not limited to, extending the height of the support structure by more than 6 m or 10% of its current height whichever is greater, and the replacement of the structure.

maximum permissible exposure (MPE)

the root mean square and peak electric and magnetic field strength, their squares, or the plane-wave equivalent power densities associated with these fields to which a person may be exposed without harmful effect and with an acceptable safety factor.

micro-cell network

a series of multiple low-power transmitters/receivers of limited range that transmit to an antenna that is attached to existing wirelines systems, such as conventional cable or telephone wires, or similar technology that does not require the use of towers. A micro-cell network is assumed to require co-location on existing poles.

microwave dish antenna
a telecommunications tower consisting of a single free standing pole or spire self-supported on a permanent foundation, constructed without guy wire, ground anchors, or other supports

minor modifications

improvements to existing telecommunications facilities and support structures, that result in some material change to the facility or support structure but of a level, quality or intensity that is less than a “substantial” change. Such minor modifications include, but are not limited to, extending the height of the support structure by less than 6 m or 10% of its current height, whichever is greater, and the expansion of the compound area for additional accessory equipment.

monopole tower

a telecommunications tower consisting of a single free-standing pole or spire self-supported on a permanent foundation, constructed without guy wire, ground anchors, or other supports

non-ionising radiation

various electromagnetic radiation that lack the necessary energy to ionise atoms in their interaction with matter. They include radio frequency radiation (RF radiation), microwave radiation, infrared radiation, visible light and most frequencies of ultra-violet radiation.

occupational exposure

occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on methods to minimize such exposure risks.

operator

an individual, partnership, association, joint-stock company, trust, or corporation engaged in control and maintenance of all instrumentalities, facilities and apparatus incidental to wireless telecommunication transmission, including but not limited to, a tower, antennae, associated buildings, cabinets and equipment. For the purposes of this article, an "operator" may or may not hold a sublease, license or title on or for the lot on which a tower is sited.

ordinary maintenance

ensuring that telecommunications facilities and support structures are kept in good operating condition. Ordinary maintenance includes inspections, testing and modifications that maintain functional capacity, aesthetic and structural integrity; for example the strengthening of a support structure’s foundation or of the support structure itself. Ordinary maintenance includes replacing antennas and accessory equipment on a like-for-like basis within an existing telecommunications facility and relocating the antennas of approved telecommunications facilities to different height levels on an existing monopole or tower upon which they are currently located. Ordinary maintenance does not include minor and major modifications.

owner

either the owner of the real property on which the telecommunications facility, tower or antenna is located or the owner of the telecommunications facility, tower or antenna itself

panel antenna

a flat, rectangular antenna or array of antennas designed to concentrate a radio signal in a particular area

Permit

A document issued by a competent Authority giving consent, temporarily or permanently, to an entity to do something or undertake an activity,

personal wireless services

mobile services, unlicensed wireless services, and fixed wireless or wireless local loop services

pre-existing facility, tower or antennae

any facility, tower or antenna which has been constructed or for which a building permit has been properly issued prior to the effective date of this Section, including permitted facilities, towers, or antennae that have not yet been constructed so long as such approval is current and not expired

privately owned

owned by any entity other than Government or its agencies

public utility

any publicly owned, franchised or regulated facility for rendering electrical, gas, communications, transportation, water supply, sewage disposal, drainage, garbage or refuse disposal and fire protection to the general public

RF hazard area

an area where the emission level exceeds the mandatory limits for general public exposure to RF EMR set forth in KS 1847-1

specific absorption rate (SAR)

a measure of the rate of radio frequency energy absorption in body tissue

telecommunications/communications

the transmission, between or among points as specified by the user, of information of the user's choosing, without change in the form or content of the information as sent or received, by wire, radio, optical cable, electronic impulses, or other similar means, including, but not limited to, any "telecommunication service," “enhanced service,” “information service,” or "internet service," as such terms are now, or may be in the future be, defined under federal law. As used in this definition, "information" means knowledge or intelligence represented by any form of writing, signs, signals, pictures, sounds, or any other symbols.

telecommunications facility

any cables, wires, lines, wave guides, antennas and any other equipment or facility that is used or associated with the provision of one or more telecommunications services, including, without limitation, radio transmitting towers, telecommunications towers, other supporting structures, and associated facilities used to transmit telecommunications signals. The term telecommunications facility shall specifically exclude amateur radio transmitting towers and broadcasting facilities. An open video system is not a telecommunications facility to the extent that it provides only video services; a cable system is not a telecommunications facility to the extent that it provides only cable service.

telecommunications services

the offering of telecommunications (for the transmission, between and among points, specified by the user of information of the user's choosing, without change in the form or content of the information as sent and received, by wire, radio, optical cable, electronic impulses, or other similar means), for a fee directly to the public, or to such classes or users as to be effectively available directly to the public, regardless of the facilities used. They include all instrumentalities, facilities, apparatus, and services (among other things, the receipt, forwarding, and delivery of telecommunications) incidental to the transmissions. Personal wireless telecommunications services shall not be considered as essential services, public utilities or private utilities.

telecommunications stealth facility

a state of the art facility that is disguised, hidden, part of an existing or proposed structure, or placed within an existing or proposed structure in a manner that make it not readily identifiable as a telecommunications facility. An existing or proposed structure may or may not have a secondary function (e.g., bell tower, spire, flag pole, etc.). This term shall be synonymous with "camouflaged facility".

telecommunications tower height

the vertical distance measured from the finished grade of the parcel to the highest point of the structure, including the base pad. This measurement does not include antenna, lighting or lightning rods which extend vertically from the highest point of the structure.

telecommunications tower

any structure and support thereto, designed and constructed primarily for the purpose of supporting one or more antennas intended for transmitting or receiving personal wireless services, telephone, and similar telecommunications purposes and services and radio and television services including amateur radio services, including lattice, monopole, and guyed towers. The term includes personal wireless service facilities for the provision of mobile services, unlicensed wireless service facilities (telecommunications services using duly authorized devices which do not require individual licenses), and Fixed Wireless and Local Loop services. Also referred to as "tower."

time division multiple access (TDMA)

a digital transmission technology that allows a number of users to access a single RF channel without interference by allocating unique time slots to each user within each channel

tower

any structure that is designed and constructed primarily for the purpose of supporting one or more antennas, including self-supporting lattice towers, guy towers, or monopole towers. The term includes radio and television transmission towers, microwave towers, common-carrier towers, cellular telephone towers, alternative tower structures, and the like.

unlicensed wireless service

the offering of telecommunications service using duly authorized devises which do not require individual licenses, but does not mean the provision of direct-to-home satellite services

wireless telecommunications facility

a facility consisting of the structures, including towers and antennas mounted on towers and buildings, equipment and equipment shelters, accessory buildings and structures, and site improvements, involved in sending and receiving telecommunications or radio signals from a mobile communications source and transmitting those signals to a central switching computer which connects the mobile unit with land based or other telephone lines

whip antenna

a cylindrical antenna that transmits signals in 360 degrees

3. Requirements for siting of communication structures and equipment

3.1. General guidelines

All wireless communication towers, except those excluded under clause 1.3.2, erected, constructed or located within Kenya shall comply with the following requirements:

3.1.1. A proposal for a new wireless communication service tower shall be considered for approval only if the communication equipment planned for the proposed tower cannot be accommodated on an existing or approved tower due to one or more of the following reasons:

a) The planned equipment would exceed the structural capacity of the existing or approved tower or building, as documented by a qualified and licensed professional engineer, and the existing or approved tower cannot be reinforced, modified or replaced to accommodate planned or equivalent equipment at a reasonable cost.

b) The planned equipment would cause interference materially impacting the usability of other existing or planned equipment at the tower or building as documented by a qualified and licensed professional engineer and the interference cannot be prevented at a reasonable cost.

c) Existing or approved towers and buildings within the geographical service area cannot accommodate the planned equipment at a height necessary to function reasonably as documented by a qualified and licensed professional engineer.

d) Other unforeseen reasons, which in the Commission's opinion, make it not feasible to locate the planned communications equipment upon an existing or approved tower or building.

3.1.2. Any proposed wireless communication service tower shall be designed structurally, electrically, and in all respects, to accommodate both the applicant's antennas and comparable antennas for at least two additional users if the tower is over 30 m in height or for at least one additional user if the tower is 18 m to 30 m in height. Towers must be designed to allow for future rearrangement of antennas upon the tower and to accept antennas mounted at varying heights. Tower owners are required to allow additional antennas on their towers for competitors and tenants as outlined above. Governmental usage shall have highest priority.

3.1.3. The owner of any existing and/or approved and constructed wireless communication tower/facility, shall be required to make said tower/facility available, at a reasonable and pro-rata cost relative to construction and maintenance, to any other wireless communications company and/or competitor seeking the approval or use of a similar tower/facility, provided said tower/facility still has the capacity to accommodate the needs of the wireless communications company and/or competitor seeking tower/facility approval.

3.1.4. A communication facility owner shall ensure that all franchises/licenses required by law for the provision of communication services in Kenya have been obtained and shall file certified copies of these documents with CCK. The construction, operation and repair of a facility shall be in accordance with all applicable requirements. The construction, operation and repair shall be performed in a manner consistent with applicable Kenya standards. The facility must be designed to meet or exceed current Kenyan Electricity, Environmental, Communications, Civil Aviation, building and radiofrequency emission standards. A statement shall be submitted by a licensed engineer certifying compliance with these guidelines.

3.1.5. If such applicable standards and guidelines require retroactive application, then the facility owner shall bring its facilities into compliance with such revised standards and guidelines within six (6) months of the effective date of such standards and guidelines, unless a different compliance schedule is mandated by the controlling local authorities and lead agencies. Failure to bring it into compliance with such revised standards and guidelines shall constitute grounds for removal at the facility's owner or operator's expense.

3.1.6. Annexes B, E, J, K and L have been developed to provide guidance on statutory requirements necessary for a complete application.

3.2. Towers and antenna design requirements and the precautionary approach

3.2.1. Proposed new or modified towers and antennas shall meet the following design requirements:

3.2.1.1. Towers and antennas shall be designed and galvanized or painted with a rust-preventive paint of an appropriate colour to blend into the surrounding environment through the use of colour and camouflaging architectural treatment and the requirements set out in annex E, except in instances where the marking (colour and light) are dictated by other authorities.

3.2.1.2. Wireless communication service towers shall be of a monopole design, unless it is determined that an alternative design would better blend in with the surrounding environment, except in instances where the marking (colour and light) are dictated by other authorities

3.2.1.3. Lattice towers may be allowed if all other requirements of these guidelines are met.

3.2.1.4. Guyed structures are discouraged and may only be allowed if the applicant demonstrates to the satisfaction of the Commission that no other type of communication facility structure will provide an equivalent level of service. Economic considerations shall not be used in determining whether a guyed structure may be used.

3.2.1.5. Height of all communication towers shall be limited to a maximum of 60m unless the applicant can demonstrate to the satisfaction of the Commission that a greater height is necessary to provide coverage meeting the minimum requirements of the Commission's and other relevant government agencies' licences. The heights of communication towers will however be subject to the provisions set out in section 9.2 of this document. The applicant must demonstrate that there are no other feasible locations within 5km of the proposed site that would provide functionally equivalent service to the minimum CCK requirement without the maximum height requirement,

3.2.1.6. New towers shall be designed structurally and electrically to accommodate the applicant's antennas and comparable antennas for at least two additional users (minimum of 3 total users required for each communication facility structure). Towers must also be designed to allow for future rearrangement of antennas on the tower and to accept antennas mounted at different heights. The requirement for construction to allow a minimum of two additional users may be waived by the Commission if evidence is provided that special circumstance exists that would prevent the proposed communication facility structure from feasibly supporting additional antennas and users. Communication facilities permitted under these guidelines shall allow other users to lease space on the communication facility structure up to the maximum number of users allowed by permit.

The owner/operator of the facility shall make space available at reasonable rates and with contractual terms standard in the industry, which shall be filed with the CCK. The owner/operator of a facility shall not charge providers seeking to co-locate in excess of the fair market value for the space, as determined at the time of the request for co-location. In the event of a dispute, the parties shall select an independent appraiser to determine a reasonable rate. If the parties cannot agree on the selection of an appraiser, CCK shall arbitrate. All appraisals shall be performed at the expense of the parties.

3.2.2. Application of precautionary approach to infrastructure design

3.2.2.1. With the objective of minimizing unnecessary or incidental RF emissions and exposure, these guidelines require that in designing infrastructure, the operator and/or owner shall have regard to:

a) the reason for the installation of the infrastructure considering — coverage, capacity and quality;

b) the positioning of antennas to minimize obstruction of radio signals;

c) the objective of restricting access to areas where RF exposure may exceed limits of the EMR standard;

d) the type and features of the infrastructure that are required to meet service needs including:

i) the need for macro, micro or pico cells; and

ii) the need for directional or non-directional antennas.

e) the objective of minimizing power whilst meeting service objectives; and

f) whether the costs of achieving this objective are reasonable.

3.2.2.2. All operators shall comply with these procedures.

3.2.2.3. If the infrastructure is associated with a base station used for the supply of mobile or other wireless telecommunications services, site EMR assessments shall be made in accordance with the prediction methodology and report format in Annex B

3.3. Tower setbacks

All proposed towers and any other proposed wireless communication facility support structures shall be set back from adjoining parcels, recorded rights-of-way and road and street lines by the following distances:

3.3.1. In industrial areas, towers may encroach into the rear setback area, provided that the rear property line adjoins another industrially zoned property and the tower does not encroach upon any easements.

3.3.2. Towers shall not be located between a principal structure and a public street, with the following exceptions:

a) In industrial zoning districts, towers may be placed within a side yard adjoining an internal industrial street.

b) On sites adjacent to public streets on all sides, towers may be placed within a side yard adjoining a local street.

3.3.3. A tower's setback may be reduced or its location to a public street varied to allow the integration of a tower into an existing or proposed structure such as a church steeple, light standard, power line support device or similar structure.

3.3.4. To minimize the risks posed by collapsing towers, towers shall be set back a distance equal to 1.5 times the fall zone of the tower from any residential structure and/or property line. Also, to encourage the construction of monopole structures, monopole towers may have a 20% reduction in the required setbacks. To encourage location of towers in existing forested areas with a minimum depth of 30 m, the tower may have a 20% reduction in the required setbacks. In no case shall the setback be less than those required for the underlying land use. Said setback reductions shall only be allowed upon a professional engineering certification which states that the structure's break point will be above the halfway point of the tower height and, where applicable to the type of tower that the tower is designed to crumble inward in the event of collapse. Towers, guys, and accessory facilities must satisfy the minimum zoning district setback requirements. No tower shall be allowed within airport hazard overlay areas.

3.3.5. Minimum lot area (if owned by the applicant) or leased area, set aside for the use of a tower facility, shall be 1.5 times the fall zone (unless the tower will meet the criteria above for a 20% reduction in the lot or lease area — 1.5 × fall zone × 0.80) of the tower and shall include all required buffers and setbacks as required by these guidelines.

3.3.6. The lot or lease area shall not encompass any public road right of ways, or railroad right of ways.

3.3.7. CCK may, on appeal, reduce the minimum setback along a public right of way to 50% of the tower height if the applicant demonstrates that the facility incorporates stealth design. Setback requirements shall be measured from the base of the tower to the perimeter of the property (property line) on which it is located, except that, in addition, ground anchors of all guyed communication towers, if permitted, shall be located on the same parcel as the tower and shall meet the setbacks of the applicable land use. The equipment or associated structure shall meet the minimum setbacks required for a principal building in the underlying land use.

3.4. Accessory utility buildings

All utility buildings and structure accessories to a tower shall be architecturally designed to blend in with the surrounding environment and shall meet the minimum setback requirements of the underlying zoning district. Ground mounted equipment shall be screened from view by suitable vegetation, except where a design of non-vegetative screening better reflects and compliments the architectural character of the surrounding neighbourhood. Isolated towers shall be fenced against easy access. Only buildings accessory to the communication towers shall be allowed on site.

3.5. Inspection

All towers shall be inspected at least twice a year by the owner/operator and serviced as frequently as may be necessary, to maintain the tower in a safe and weather-withstanding condition and records, containing such details as may be specified by the Commission, kept and submitted to the Commission in addition to other compliance returns requirements.

CCK in consultation with other lead agencies shall conduct periodic inspection of facilities to ensure compliance. If inspection determines non-compliance with applicable codes and standards then, upon notice, the owner shall have no more than thirty (30) days to bring the facility into compliance unless a time extension has been granted for good cause by the relevant authority. Failure to do so shall constitute grounds for the removal of the facility at the facility owner or operator's expense.

3.6. Lighting

No lighting of the principal communication facility structure, either from ground mounted or communication facility structure mounted lights, shall be allowed unless required by the KCAA or CCK.

If required, communication facility structure mounted lighting shall be limited to red flashing lights from sunset to sunrise. White strobe or other similar lighting may be allowed from sunrise to sunset. Lighting of accessory structures and the facility site may be permitted by the Commission if it is of low intensity, directed inward and downward and is limited to within the facility site boundary.

When incorporated into the approved design of the tower, light fixtures used to illuminate ball fields, parking lots, or similar areas may be attached to the tower. Such lighting shall be designed and arranged so that it does not glare onto adjacent property or roadways.

3.7. Signage

No signs, including commercial advertising, logo, political signs, flyers, flags, or banners, but excluding warning signs, shall be allowed on any part of an antenna or communication tower. Any signs placed in violation of these guidelines shall be removed immediately at the owner or operator's expense. Notwithstanding any contrary provisions, the following warning signs shall be utilized in connection with the tower or antenna site, as applicable:

3.7.1. If high voltage is necessary for the operation of the tower or any backhaul network or associated equipment, "HIGH VOLTAGE — DANGER" warning signs shall be permanently attached to the fence or wall surrounding the structure and spaced no more than 6 m apart;

3.7.2. "NO TRESPASSING" warning signs shall be permanently attached to the fence or wall surrounding the structure and spaced no more than 12 m; (a) the height of the lettering of warning signs shall be at least 0.3 m and the signs shall be installed at least 1.5 m above the finished grade; (b) the warning signs may be attached to free standing poles if the content of the sign may be obstructed by landscaping.

3.7.3. Wireless communication facilities shall contain a sign no larger than 0.36 m^2 in order to provide adequate notification to persons in the immediate area of the presence of an antenna that has transmission capabilities and shall contain the name(s) of the owner(s) and operator(s) of the antenna(s) as well as emergency phone number(s). The sign shall be on the equipment shelter or cabinet of the applicant and be visible from the access point of the site and must identify the equipment owner of the shelter or cabinet. The sign shall not be lighted, unless lighting is required by applicable law, rule or regulation.

3.8. Parking

Adequate parking spaces shall be provided for use by maintenance personnel on each site so that parking on public road right-of-way will not be necessary. Additional parking may be required if the minimal parking proves to be inadequate. Access must be provided by a gated, all-weather gravel or paved driveway.

A minimum of one space shall be provided per user located on the facility site. No vehicle storage shall be permitted.

3.9. Security of wireless communication facilities

Towers and associated accessory building/equipment shall be enclosed by a security fence or wall that is a minimum of 2 m in height and is equipped with an anti-climbing device or apparatus to prevent unauthorized access. All antennas, towers and other supporting structures, including guy wires, shall be made inaccessible to individuals and constructed or shielded in such a manner that they cannot be climbed or collided with and control points shall be installed in such a manner that they are readily accessible only to persons authorized to operate or service them. Access shall be through a locked gate or door in the required fence or wall. A description of proposed security measures shall be provided as part of any application to install, build or modify a communication facility.

3.10. Outdoor storage

No outdoor storage of vehicles, materials, or equipment is permitted. Mobile or immobile equipment not used in direct support of the facility shall not be stored or parked on site unless repairs to the facility are being made.

3.11. Facility replacement

3.11.1. Modification to existing site

Up to 50% of the height of an existing tower may be replaced with no increase in height as part of modifications made to provide for co-location of a new facility. Replacement of more than 50% shall be considered a new tower and shall meet all of the applicable requirements.

3.11.2. Rebuilding damaged or destroyed existing site

Existing towers and facilities that are damaged or destroyed may be rebuilt through administrative review and approval, provided the replacement tower or facility is the same as the original in type, location, and intensity or brings a previously nonconforming tower or facility into greater conformance and no more than 50% of the tower or facility is involved.

If more than 50% of the tower or facility is involved, it shall be considered a new facility that shall meet all of the applicable requirements. All replacements shall comply with applicable building codes and building permits obtained and must be completed within 180 days from the date the tower or facility is damaged or destroyed. If no building permit is obtained or it expires, or the replacement is not done in time, the tower or facility shall be deemed abandoned.

3.12. Removal of abandoned or unusable facility

In the event the use of a tower is discontinued by the tower owner, or in the event a tower owner files notice to the CCK of its interest to cease operating, the tower owner shall provide written notice of its intent to discontinue use and the date when the use shall be discontinued. A copy of the written notice shall be made and filed with NEMA

3.12.1. Any facility deemed abandoned pursuant to these guidelines or any facility that is not operated for a continuous period of twelve months shall be considered abandoned, and the owner or last operator thereof shall remove it within ninety days of receipt of written notice to remove from CCK. Failure to remove an abandoned tower or facility within the ninety days shall be grounds to remove it at the owner's or last operator's expense. If there are two or more users of a single tower or facility, then this provision shall not become effective until all users cease using it.

The applicant or owner of the communication facility shall provide a bond, letter of credit or other suitable financial guarantee as determined by the environment regulatory agency to ensure the removal of the facility including all subsurface structures a minimum of 1 m below grade, and restoration of the site to its preconstruction state when use of the facility has been discontinued or the facility has not been used for its permitted purpose for 12 consecutive months. This restoration shall include removal of any subsurface structure or foundation, including concrete, used to support the communication facility. Mere intent to continue use of the facility(s) shall not constitute use. The applicant/owner shall demonstrate through facility(s) lease(s), reports or other similar instruments that the use will be continued without a lapse of more than 12 consecutive months to constitute actual use. If the applicant cannot demonstrate actual use the facility shall be considered abandoned and shall be removed. Removal and restoration of the site must occur in adherence to the environmental management and co-ordination act and other environmental and local authority regulations

3.13. Non-conforming Structures constructed prior to coming into force of these guidelines

3.13.1. Operators/facility owners must ensure that they carry out necessary modifications to existing facilities in order to bring them into conformance with these guidelines within six (6) months of the date these guidelines come into force.

3.13.2. If upon inspection any such communication facility is determined not to comply with the relevant codes and standards or to constitute a danger to persons or property, then upon notice being provided to the owner of the facility and the owner of the property if such owner is different, such owners shall have thirty (30) days to bring such facility into compliance. In the event such communication facility is not brought into compliance within thirty (30) days, CCK may provide notice to the owners requiring the communication facility to be removed.

3.14. Non-conforming Structures constructed after the coming into force of these guidelines

3.14.1. Any wireless communication facilities, which have been located, constructed or modified without first obtaining the required permit or modification thereof, or any other necessary authorization, shall be removed.

3.15. Removal of Non-conforming structures

3.15.1. In the event that a communication structure is not compliant or is not brought into compliance as required under 3.13 and 3.14 above, within thirty (30) days of a notice issued to a facility owner, CCK may provide notice to the owners requiring the communication facility to be removed, and in the event that such communication facility is not removed within thirty (30) days of receipt of such notice, CCK may remove such facility and place a lien upon the property for the costs of removal. Delay by CCK in taking action shall not in any way waive its right to take action. CCK may pursue all legal remedies available to it to ensure that communication facilities not in compliance with these guidelines or which constitute a danger to persons or property are brought into compliance or removed. CCK may seek to have the communication structure removed regardless of the owner's or operator's intent to operate the tower or antenna and regardless of any permits, or otherwise, which may have been granted.

3.15.2. If CCK removes, or causes to be removed, wireless communication facilities, and the owner of the wireless communication facilities does not claim and remove it from the site to a lawful location within ten (10) days, then CCK may take steps to declare the wireless communication facilities abandoned, and sell the facilities and their components.

3.15.3. If the owner of an abandoned tower or antenna wishes to use such abandoned tower or antenna, the owner first must apply for and receive all applicable permits and meet all of the conditions of this ordinance as if such tower or antenna were a new tower or antenna.

3.15.4. Every provider of communication services and/or communication operator may be required to contribute to the National Environment Restoration Fund as stipulated in section 25 of the EMCA, 1999.

3.16. Facility appearance

3.16.1. Towers shall either maintain a galvanized steel finish or, subject to any applicable standards of the civil aviation authority, be painted a neutral colour to reduce visual obtrusiveness and so as to be consistent with the natural or built environment of the site.

3.16.2. The design of the equipment structure and any other associated permitted structures shall, to the maximum extent practicable, use materials, colours, textures, screening, and landscaping that minimize the visual impact and enhance compatibility with the surrounding natural or built environment. Camouflage and stealth technology, if available and economically feasible, shall be used to minimize visual impact on surrounding property. Additionally the design of the site shall also comply with any design guidelines as may be applicable to the particular area in which the facility is located. Monopole structures shall be preferred.

3.16.3. Facilities must comply with all applicable landscaping requirements of this code. Local authorities may require landscaping in excess of those requirements in order to enhance compatibility with adjacent uses. At a minimum the landscaping shall consist of a landscape strip of not less than 10 feet in width planted with materials which will provide a visual barrier to a minimum height of 6 feet. The landscape strip shall be exterior to any security wall.

3.16.4. For co-located communication facilities, the antenna and supporting electrical and mechanical equipment must be of a neutral colour that is identical to, or closely compatible with, the colour of the supporting structure to minimize the visual impact and enhance compatibility with surrounding development.

3.16.5. If an antenna is installed on a structure other than a tower, the antenna and supporting electrical and mechanical equipment must be to the maximum extent practicable, of stealth design.

3.17. Building codes — Safety standards

Prior to the issuance of a building permit to construct a facility, antenna or tower, the owner/applicant or operator/applicant shall provide CCK with all required licenses and certifications from relevant government agencies. To ensure the structural integrity of towers, the owner or operator of a tower shall ensure that it is maintained in compliance with Kenya standards contained in applicable building codes and the applicable Kenya standards for towers that are published by the Kenya Bureau of Standards, as amended from time to time. Towers shall comply with the relevant part of BS 8100 or such other Kenya standards as may be designated. If, upon inspection, it is determined that a tower fails to comply with such codes and standards, then upon notice being provided to the operator or owner of the tower, the operator shall have thirty (30) days to bring the tower into compliance with such standards. Failure to bring a tower into compliance within thirty (30) days shall constitute grounds for the removal of the tower at the owner or operator's expense.

3.18. Franchises

Owners and/or operators of towers and antennae shall certify that all franchises required by law for the construction and/or operation of a wireless communication system have been obtained and shall file a copy of all required franchises with CCK as part of the minor or major communication site plan submission.

3.19. Separation

Separation distance shall be measured by a straight line between the bases of the communication towers. Construction of any new mast or tower within 2 Km of an existing tower shall be subject to approval by/from the Commission

3.20. Interference with public safety communications

No new or existing wireless communications service shall interfere with public safety communications. No new wireless communication service installation shall be undertaken unless an intermodulation study which provides a technical evaluation of existing and proposed transmissions and indicates all potential interference problems is undertaken and concludes that the proposed installation would not interfere with public safety communications.

3.21. Nuisances

Communication facilities, including, without limitation, power source, ventilation and cooling, shall not be maintained or operated in such a manner as to be a nuisance.

Generating sets used for on-site power supply shall comply with the relevant part(s) of KS ISO 8528.

3.22. Maintenance

a) Tower owners shall at all times employ ordinary and reasonable care and shall install and maintain in use nothing less than commonly accepted methods and devices for preventing failures and accidents which are likely to cause damage, injuries, or nuisances to the public.

b) Tower owners shall install and maintain towers, communication facilities, wires, cables, fixtures, and other equipment in compliance with the requirements of the KS 1587, KS 662 and all relevant guidelines, and in such manner that will not interfere with the use of other property.

c) All towers, communication facilities, and antenna support structures shall at all times be kept and maintained in good condition, order, and repair so that the same shall not menace or endanger the life or property of any person.

d) Licensed maintenance and construction personnel shall perform all maintenance or construction of towers, communication facilities, or antenna support structures.

e) All towers shall be compliant with current Kenya standard for radio frequency emissions. In order to provide information to its citizens, copies of ongoing CCK information concerning wireless communications facilities and radio frequency emission standards shall be made available to the public and updated annually. Applicants shall be required to provide information on the projected power density of the facility and how this meets Kenya standards.

3.23. Application of the precautionary approach to site selection

These guidelines require, as a minimum, that for each site the operator shall have regard to:

a) the reasonable service objectives of the operator including:

   i) the area the planned service must cover;

   ii) power levels needed to provide quality of service;

   iii) the amount of usage the planned service must handle;

b) ALARA principle on minimization of EMR exposure to the public;

c) the need to avoid proximity to existing or planned establishment of a community sensitive location/facility e.g., residential areas, childcare centres, schools, care centers for the aged, hospitals and landmarks;

e) relevant central and local government communication planning policies;

f) the outcomes of consultation processes with Councils and communities as set out in Annex E

g) the need to preserve anything of heritage significance (built, cultural and natural);

h) the physical characteristics of the locality including elevation and terrain;

i) the availability of land and public utilities;

j) the availability of transmission to connect the radiocommunications infrastructure with the rest of the network, e.g. line of sight for microwave transmission;

k) the radiofrequency interference the planned service may cause to other services;

l) the radiofrequency interference the planned service could experience at that location from other services or sources of radio emissions;

m) any obligations, and opportunities, to co-locate facilities.

3.24. Application of precautionary approach to site operation

3.24.1. Operators shall operate their infrastructure in a manner consistent with the objectives in 5.23.

3.24.2. Operators shall demonstrate compliance with the Kenya standards and guidelines regarding maximum human exposure limits for radiofrequency fields.

3.24.3. Operators shall take appropriate measures to restrict general public access to RF hazard areas. In this context general public may include window cleaners, building maintenance staff, etc.

3.24.4. For each RF hazard area, an operator shall ensure warning signs are in place in a location and in a manner that is appropriate so that they are clearly visible. See Annex K for examples.

3.24.5. In assessing whether measures are appropriate, the operator must have regard to:

a) the kinds of people who may have access to the area;

b) the need for physical barriers;

c) relevant occupational health and safety requirements;

d) the views of the property owner;

e) any site changes that have been made; and

f) any other matter which may be relevant to ensure site safety with regards to EMR.

3.24.6. Operators must ensure that their technical staff who may be involved in activities on or adjacent to radiocommunications infrastructure are trained in radio frequency exposure safety.

3.24.7. Operators must ensure that transmission equipment no longer in service does not transmit.

4. Guidelines for new communication facilities that are Co-located

4.1. Siting alternatives hierarchy

Development of a facility use shall be in accordance with the following siting alternatives hierarchy. The order of ranking, from highest to lowest, shall be 4.1.1, 4.1.2, 4.1.3. Where a lower ranked alternative is proposed (e.g., 6.2), the applicant must demonstrate by substantial evidence that higher ranked options are not technically feasible or available.

4.1.1. Co-location on existing communication tower
4.1.2. Co-location on existing building/other structure
4.1.3. Development of new communication tower

4.2. Co-location requirements

4.2.1. General

4.2.1.1. Placement of antennas on existing towers or others structures shall be preferred as opposed to the construction of a new tower. An application for administrative review to co-locate on an existing wireless communication facility or other structure shall contain proof of the intent of

the existing owner to permit the applicant's use as specified in the application see form Form CMT-01 (Annex D).

4.2.1.2. An Application to co-locate on an existing wireless communication facility or other structure that does not meet the criteria for an administrative review shall be subject to policy and requirements specified in Clause 4.3.

4.2.1.3. There may be a site visit and there shall be a pre-application meeting (attended by the applicant, consultant, and/or CCK staff prior to the submittal of any application, the purpose of which shall be to address issues which will help expedite the review and permitting process and any concerns regarding the site or the facility and the treatment of such. Costs of CCK's consultants to prepare for and attend the pre-application meeting will be borne by the applicant.

4.2.1.4. Provisions of these guidelines may not be waived as a relief or exemption during the pre-application meeting.

4.2.1.5. All applicants for an administrative review for wireless communication facilities or any modification of such facility shall comply with the requirements set forth in these guidelines.

4.2.1.6. Only applications meeting the application requirements stated herein will be accepted for review.

4.2.1.7. No wireless communication facilities shall be installed or constructed until the application has been reviewed and approved and the administrative approval has been granted and all applicable permits applied for and obtained by the applicant.

4.2.1.8. All applications for the co-location of wireless communication facilities meeting criteria for an administrative review shall contain the information hereinafter set forth. Where a certification is called for such certification shall bear the signature and seal of a licensed professional engineer. An application for an administrative review for wireless communication facilities shall be signed on behalf of the applicant by the person preparing the same and with knowledge of the contents and representations made therein and attesting to the truth and completeness of the information.

4.3. Co-location guidelines

The following are required for co-location of facilities, towers or antennae:

4.3.1. Use guidelines

Co-location is permitted in all locations

4.3.2. Height

4.3.2.1. Tower height shall be in accordance with 5.2.

4.3.2.2. Building/other structure

The minimum height of the building/structure before installation of the communication facility shall be 15 m. The maximum height of the communication facility or antenna installed on an existing building or structure other than a tower shall not exceed 7.5 m above the building/structure. This requirement shall not however be in conflict with civil aviation requirements.

4.3.3. Antenna type

To minimize adverse visual impacts, the antenna used shall be in accordance with the following alternatives hierarchy. The order of ranking, from highest to lowest, shall be a, b, c, d. Where a lower ranked alternative is proposed (e.g., c), the applicant must demonstrate by substantial evidence that higher ranked options are not technically feasible.

a) Stealth

b) Panel

c) Whip

d) Dish

4.3.4. Modification

Modifications to the structure to accommodate co-location shall be in accordance with Clause 4.2.

4.3.5. Future co-location

Wherever feasible, the facility owner shall provide for future co-location on the facility by other service providers and for public purposes or demonstrate by substantial evidence that it is not feasible.

4.3.6. Lease

The Government or its agency may require, as a condition of entering into a lease agreement, the dedication of space on the facility for public health and safety purposes, as well as property improvement on the leased space. Any dedications and improvements shall be negotiated prior to the execution of the lease.

4.3.7. Equipment structure

4.3.7.1. Ground installed

The equipment structure shall not contain more than 42 m^2 of gross floor area or be more than 3 m in height (excluding any platform structure). The equipment shall meet the minimum setbacks required for a principal building in the underlying area under consideration.

4.3.7.2. Roof installed

The equipment structure shall not contain more than 42 m^2 of gross floor area or be more than 3 m in height (excluding any platform structure), subject to compliance with the guidelines of all building codes adopted by the local authority.

4.3.8. Communications facility site plan

A minor communication facility site plan that meets the requirements of 6.3 shall be submitted with an application for co-location, except that for a micro-cell network or cable micro-cell network a minor communication facility site plan shall not be required for each individual low-power transmitters/receivers, but one is required for each facility that transmits to, or receives from, the individual low-power transmitters/receivers.

5. Guidelines for new communication facility, tower and antenna that are not co-located

The following are required for new facilities, towers or antennae:

5.1. Use guidelines

a) Permitted use

1) Government owned property

2) Heavy industrial district

A communication tower may also be incorporated into new development of a permitted use as an accessory use, provided the permitted principal use is a communication-related use and the applicant demonstrates that the communication tower is a necessary and inseparable part of the operations of the use. In such cases, the communication tower and any associated equipment structure shall comply with these guidelines and all other applicable code provisions.

b) Conditional use

1) GB — General business district

2) RC — Regional commercial district

3) SO — Service/office district

4) CBD — Central business district

5) LI — Light industrial Area

c) Accessory use

A new communication tower that is, or will be, accessory to a principal use shall be located only in the side or rear of the property. Accessory uses and activities shall be subject to the same guidelines as apply to principal uses in each district, unless otherwise stated. Permitted uses and approved conditional uses shall be deemed to include accessory uses and activities that are necessarily and customarily associated with, and appropriate, incidental, and subordinate to the principal uses allowed.

5.2. Maximum communication tower height

The height of the tower shall be determined by measuring vertically down from the tower's highest point to the ground. When a tower is attached to a structure or dwelling, the height of the tower shall be determined by measuring vertically down from the tower's highest point to the ground upon which the structure or dwelling stands.

Any antenna, lighting, lightning rod, lighting beacon or other facility shall not extend more than 3 m above the height of the communication tower. In addition to the requirements set out above, all installations must comply with civil aviation requirements. Towers/Masts used for the various communication services shall be subject to the heights/treatment described below:

5.2.1. Mobile Base Transceiver Station Masts/Towers

Base stations for Mobile or Fixed Wireless Telephony systems shall be subject to the following maximum heights:

a)	Single antenna array or a single user:	30 m
b)	Two antenna arrays or for two (2) users:	36 m
c)	Three or more antenna arrays of for three (3) or more users:	45 m
d)	Rural areas	60m
e)	Industrial areas	45m
f)	Commercial areas	40m
g)	Residential areas	20m

5.2.2. Microwave Transmission System Masts/Towers

Facilities in this category shall take into account line of site technical requirements with regard to their height but must in any case comply with civil aviation requirements where they apply.

5.2.3. Radio and TV and Broadcast Towers/Masts

All masts/Towers intended for use in the broadcast of radio and/or TV signals shall be located at sites designated for broadcast transmitters by the Communications Commission of Kenya and must comply with any conditions specified by the Commission, which must take into account civil aviation requirements and those of other relevant government agencies. The maximum heights are specified in relevant ITU broadcasting plans.

5.3. Temporary facility

As part of a proposal to develop a new telecommunication tower or facility, the owner may construct a temporary antenna support facility. The temporary facility shall be located on the same site as the new tower, shall be subject to the provisions of Clause 3 and shall not continue in use for more than 30 consecutive days. A temporary facility needed to allow for modification and/or repairs to a tower necessary to aid in post-disaster relief efforts are exempt from the 30 day limitation.

5.4. Site plan

A major communication facility site plan that meets the requirements of 10.4 shall be submitted with an application for a new communication facility, communication tower or communication antenna that are not co-located, except that for a micro-cell network or cable micro-cell network a major communication facility site plan shall not be required for each individual low-power transmitters/receiver.

6. New communication facility site plan submission and review requirements.

All communication facilities must undergo a full EIA study in accordance with Legal Notice no. 101 of 2003 and must include the information specified in Annex E

6.1. Application for infrastructure roll-out

6.1.1. Purposes — The Application for infrastructure roll-out has the following purposes:

a) To acquaint the applicant with the application submittal process;

b) To provide for an exchange of information regarding the proposed communication structure(s) and any plans for other current and future towers, stealth monopoles and telecommunication facilities;

c) To advise the applicant about policies and guidelines that create opportunities or pose constraints on the proposed communication structure(s); and,

d) To determine what information that the applicant shall submit, including, but not limited to, any accompanying studies, documents or reports.

6.1.2. There may be a site visit and there shall be a meeting (attended by the applicant, consultant, and/or CCK staff prior to the submittal of any application, the purpose of which shall be to address issues which will help expedite the review process and address any concerns regarding the site or the facility and the treatment of such. Costs of the CCK's consultants to prepare for and attend the pre-application meeting will be borne by the applicant. The applicant shall submit to CCK the number of completed applications determined to be needed at the pre-application meeting.

6.1.3. Information provided — The pre-application meeting shall be an informal review of the proposal. The applicant shall bring the following items to the pre-application conference:

a) A preliminary site plan showing the property lines and setbacks of the proposed telecom structure(s) and existing zoning and land uses on the site;

b) A drawing or sketch of the proposed telecom structure(s); and,

c) The name, address and phone number of the applicant and the consultant that prepared the site plans and other documents.

6.1.4. Action — No official approval or disapproval of a proposed communication structure occurs at the pre-application meeting. An application for infrastructure roll-out shall have effect for six (6) months. If no required application has been filed within six (6) months of the conference, the applicant shall participate in another conference, unless an extension is granted by the Commission.

6.2. Action on applications

CCK shall act on any communication facility site plan application (submission) within a reasonable period of time after the request is filed taking into account the nature and scope of such request. However, if CCK does not accept the application (submission) provided as complete and accurate, or if CCK deems it necessary to make reasonable request for additional information, the time in which an application (submission) is processed shall be tolled pending receipt of the requested information and evaluation thereof. All applications that are reviewed administratively shall be completed within forty-five (45) days of a complete and accurate application.

6.3. Communication facility site plan

6.3.1. General

A major communication facility site plan submission shall contain all of the items required for a minor communication facility site plan (including information required for a final site plan), include a major communication facility site plan submission fee as stipulated in item C4 of Annex C, provide the information specified in Annex E and be subject to the following:

6.3.2. Information required

6.3.2.1. A scaled site plan clearly indicating the location, type and height of the proposed communication facility, on-site land uses and zoning, adjacent land uses and zoning (including when adjacent to other local governments), comprehensive plan future land use designation of the site and all properties within the applicable separation distances set forth in 3.19, adjacent roadways, proposed means of access, setbacks from property lines set forth in 4.3.2, elevation drawings of the proposed communication facility, topography, parking, and other information deemed to be necessary to assess compliance with these guidelines.

6.3.2.2. The setback distance between the proposed communication facility and the nearest residential unit, platted residentially zoned properties, and unplatted residentially zoned properties.

6.3.2.3. A description of compliance with all applicable laws.

6.3.2.4. Identification of the entities providing the backhaul network for the communication facility described in the application and other communication facilities owned or operated by the applicant.

6.3.2.5. Certification — For all co-located facilities, a sworn, notarized statement from a licensed engineer that certifies that the structure can support the additional load due to the co-location of facilities and compliance with the antennae type hierarchy of these guidelines.

6.3.3. 10.4.3 Inventory of towers

6.3.3.1. Each applicant shall submit an inventory of its own facilities and those of companies proposing to co-locate on the proposed communication facility, or tower, existing towers, and approved communication facilities within the location, or within 2 km of the building thereof. The operator/service provider will provide updates, from time to time, on additional facilities installed by other operators/service providers that opt to co-locate on the operator's facility after approval has been granted. No new tower shall be permitted or major communication facility site plan approved unless the applicant demonstrates to the satisfaction of CCK by substantial evidence that no existing facility (whether or not owned by the applicant) can accommodate, as is or through modification, the proposed facility. Substantial evidence to demonstrate that no existing facility is suitable shall consist of any of the following:

(a) An affidavit demonstrating that the applicant made diligent efforts to install or co-locate on existing towers and other existing structures within the geographic search area, as determined by a qualified radio frequency engineer, and within a 2 km radius of the proposed tower site.

(b) An affidavit demonstrating that existing towers and structures located within the geographic search area, as determined by a qualified radio frequency engineer, and within a 2 km radius of the proposed tower site do not have the capacity to provide reasonable technical service consistent with the applicant's technical system, including, but not limited to, applicable CCK requirements.(Determine from legal dept if a report could be submitted instead of an affidavit-cost implications associated with submitting it)

(c) Written technical evidence from a qualified radio frequency engineer that existing towers and structures within the geographic search area are not of sufficient height to meet the applicable CCK requirements.

(d) Written technical evidence from a qualified structural engineer that existing towers and structures within the geographic search area do not have sufficient structural strength to support the proposed facility.

(e) A written statement from a qualified telecommunications engineer submitting technical evidence substantiating his opinion that the existing towers and structures within the geographic search area are incompatible due to electromagnetic/radio frequency interference or interference with public safety communications or the usual and customary transmission or reception of radio, television, or other communications service enjoyed by surrounding properties and that antenna on the existing tower or structure cannot be relocated on the existing structure to accommodate additional users.

(f) An affidavit that the fees, costs, or contractual provisions required by the owner to share an existing tower or structure within the geographic search area, or to adapt an existing tower or structure within the geographic search area for sharing, are unreasonable. Costs exceeding new tower development are presumed to be unreasonable.

(g) The applicant demonstrates that there are other limiting factors that render existing towers and structures within the geographic search area and within a 2 km radius of the proposed tower site unsuitable.

(h) The applicant demonstrates that state of the art technology used in the wireless communication business and within the scope of the applicant's CCK license, is unsuitable for the site involved.

(i) The applicant demonstrates that there are other limiting factors that render existing towers and structures within the geographic search area and within a 2 km radius of the proposed tower site unsuitable.

6.3.3.2. CCK reserves the right to share inventory information with other applicants seeking to site their communication facilities; however, in doing so, CCK shall neither be responsible for the accuracy of the information nor will it infer that any sites are available or suitable.

6.3.4. Review and approval

Any operator shall be required to obtain all approvals, permits and Licences from relevant Government agencies and Local Authorities before commencement of construction work.

A site plan shall be reviewed and approved by CCK either administratively or in consultation with relevant Government agencies. CCK may commission a review by a licensed professional consultant of its choice, with appropriate technical experience to review the plan and all supporting documentation. The cost of this

review shall be borne by the applicant through a cost recovery process of CCK and no review will commence until a cost recovery arrangement is finalized wherein the applicant agrees in writing to pay all the reasonable costs associated with said review and has advanced an amount equal to one-half of the amount estimated by the proposed reviewer for the cost of the review.

7. Special exemption provisions

For circumstances where a prospective facility owner or operator or a communication services provider is able to demonstrate, based upon clear and convincing, substantial verifiable technical evidence, that it is unable to locate a communication facility, tower or antenna, which is necessary under its service requirements, under the terms of the existing provisions of these guidelines on any available sites (including opportunities for co-location), and that, pursuant to national law, it has a right to locate a facility, tower or antenna in a location not permitted under the provisions of these guidelines or in accordance with the terms of these guidelines, the following will apply.

7.1. Application requirements, review and approval

7.1.1. A communication facility site plan application clearly indicating the specific reasons why a special exemption is justified and providing documentation to support the justification shall be submitted to the Commission.

7.1.2. Upon receipt of a complete communication facility site plan, CCK shall commission a review of the plan and all supporting documentation. The cost of this review shall be borne by the applicant through a cost recovery process of CCK and no review will commence until a cost recovery arrangement is finalized wherein the applicant agrees in writing to pay all the reasonable costs associated with said review and has advanced an amount equal to one-half of the amount estimated for the cost of the review.

7.1.3. If the new facility, tower or antenna is not a permitted or conditional use, as defined in 9.1, then special exemption approval shall be required.

7.1.4. The review of any application for a special exemption use under this section shall require approval of the special exemption by CCK, after a public hearing, following a public hearing and recommendation by the relevant government agencies. Notice of the public hearing shall be as is required for changes of use.

7.1.5. In granting a special exemption approval, the Commission may impose conditions to the extent necessary to minimize any adverse effect of the proposed communication facility, tower or antenna.

7.1.6. Any information of an engineering nature that the applicant submits, whether civil, mechanical, or electrical, shall be certified by an engineer registered by the ERB.

7.1.7. An applicant for special exemption use shall submit the information described in this clause and Clause 9. This information shall be accompanied by a non-refundable fee as stipulated in item C5 of annex C to cover the administrative costs of the review. Any costs or expenses incurred by the Commission that exceed the amount stipulated in item C5 in annex C shall be reimbursed by the applicant or property owner upon the applicant's receipt of an invoice from the Commission setting forth the expenses that exceeded the amount stipulated in item C5 in annex C. Any pre-application conference fee shall accompany the information as provided in 10.1. The application shall be signed in the presence of a notary public and the notary shall affix his or her seal to the application

7.1.8. Within forty-five (45) days of receipt of the review pursuant to 5.1, the matter shall be brought before the Commission for review under existing regulations. It shall be the burden of the applicant to make all showings by clear and convincing evidence and provide all evidence required for the granting of a special exemption.

7.2. Factors considered in granting special exemption approval for communication facilities

The Commission shall consider the factors listed in Annex F in determining whether to approve a special exemption.

7.3. Determination of compliance based on financial and technical feasibility

The applicant shall comply with all requirements of these guidelines for a new communication facility, communication tower or communication antenna which are technically and financially feasible as are reasonably determined by the Commission.

7.4. Commencement of construction

No work whatsoever shall commence on site unless special exemption use is approved or all necessary approvals/permits have been obtained to begin construction of any part of a facility, tower or antenna.

7.5. Violations

7.5.1. Any person who attempts to erect or erects a communication facility covered by this guidelines without having first obtained the necessary building permit, conditional use permit and all other approvals or variance in the manner provided in these guidelines shall be deemed to be in violation of these guidelines. Any responsible party or other persons convicted by a court of competent jurisdiction of violating any provision of these guidelines shall be guilty of violating duly adopted guidelines and shall be punished either by a fine of the amount stipulated in item C6 in annex C or by imprisonment not to exceed 6 months or both. In addition, the violation of any provision of these guidelines may be deemed grounds for removal of the communication facility and the government may seek any other remedy or damages to the full extent of the law.

7.5.2. If any structure is erected, constructed, reconstructed, altered, repaired, converted or maintained in violation of these guidelines or without obtaining that required permits, or if any building, structure or land is used in violation of these guidelines, CCK, in addition to any other remedies, may institute proceedings to prevent such unlawful erection, construction, reconstruction, alteration, conversion, maintenance or use or to correct or abate such violations. Each and every day such unlawful erection, construction, reconstruction, alteration, conversion, maintenance or use continues may be deemed a separate offense**.**

8. Nonconforming uses

8.1. No expansion of nonconforming use

Towers that are constructed, and antennae that are installed, in accordance with the provisions of these guidelines shall not be deemed to constitute the expansion of a nonconforming use or structure.

As of the effective date of these guidelines, no person shall be permitted to site, place, build, construct, significantly modify or prepare any site for the placement or use of wireless communication facilities without having first obtained a permit or approval (where applicable) for wireless communication facilities.

8.2. Pre-existing facility, towers or antennae

All wireless communication facilities existing on or before the effective date of these guidelines shall be allowed to continue as they presently exist, provided however, that any significant modification of an existing wireless communication facility must comply with these guidelines, including submitting an application for such modification. In addition, if any violations exist as of the effective date of these guidelines or arise in the future at any wireless communication facility, including at any wireless communication facility existing on or before the effective date of these guidelines, then CCK shall take appropriate action pursuant to the terms of these guidelines.

Antennas or towers located on property owned, leased, or otherwise controlled by the government shall be exempt from the requirements of these guidelines, provided a license or lease authorizing such antenna or wireless communication facilities has been approved by the Commission after a public hearing and adjoining owners notification.

9. Health and safety information

9.1. Operators should keep informed via relevant scientific bodies of the significance of the results of scientific investigations or studies on EMR. Guidance on quality research is included in Annex L

9.2. RF EMR health and safety information

If formally requested, through the regulator, an operator must make the under listed available to the its customers, at no charge. The operator may also additionally refer its customers to Annex G of these guidelines for more information

a) information regarding how they address RF EMR health and safety issues in relation to their networks; and

b) information about where research reports on the health and safety impacts of radiofrequency infrastructure may be obtained. An operator may meet this requirement by referring members of the public to an industry body or Government agency where the operator has entered into a specific agreement for this purpose.

9.2.1.1. For a specific site, an operator must provide, as soon as practicable and at no charge, the following information to members of the public on request:

a) a description of their radiofrequency infrastructure on the site;

b) the operating frequency of the radiofrequency transmitter;

c) a declaration that their infrastructure is in compliance with the mandatory limits for general public exposure to RF EMR as set forth in KS 1847-1;

d) details of any RF hazard areas associated with their infrastructure and management practices to restrict access to RF hazard areas;

e) the levels of exposure to EMR emissions in accordance with Annex B.

f) coverage information of the area.

9.2.1.2. This section does not apply where in the reasonable opinion of the operator the information is being sought for commercial purposes.

9.2.2. Additional information supplied by the operator

9.2.2.1. An operator may provide information about the health and safety aspects of RF transmitters in addition to that set out in Annex G.

9.2.2.2. The operator shall not assert anything to the effect that the absence of scientific proof means that there is no possibility of risk arising from the operation of radiocommunications infrastructure.

9.2.2.3. Where an operator provides or quotes summaries of scientific information, the operator must reference the source of information.

10. Communications Facility Compliance Checklist

In view of the non-conclusive results of the studies that have been conducted by the said normative sources quoted herein, it is recommended that anyone planning to set up a communications facility (Antennas, towers or communications masts of the types described in these guidelines) takes a precautionary approach and adopt the following measures on this matter, which will be kept under continuous review until further information is available.

10.1. Requirements for Siting of Communication Masts/Towers

In considering the importance of the use of wireless communications devices, and while striking a balance with any health risks that may be associated with their usage, it is important that the siting of communication masts/towers be done under certain minimum requirements/criteria that will ensure that public safety standards are not compromised.

The following are some of the requirements that need to be observed:

10.1.1. No communication masts/towers shall be sited near or in the vicinity of strategic National Installations or sites without prior consultations with CCK and the relevant government departments.

10.1.2. All proposed communication masts/towers shall comply with the relevant principal laws, by-laws, guidelines and regulations.

10.1.3. The operators should decommission, within 6 months from the effective date of these guidelines, all existing masts/towers whose disputes are still unresolved and are not compliant with the proposed guidelines.

10.1.4. Antenna sites should be designed in such a way that the public cannot access such areas and as a general rule, the nearest the public can be from an antenna should not be less than 6m.

10.1.5. The signal of the strongest intensity should not land on the ground at a horizontal distance less than 100m from the foot of the antenna (Annex N).

10.1.6. The signal of the strongest intensity should not land on a existing or planned establishment of a community sensitive location/facility e.g., school compound, a hospital, residential areas, childcare centres, care centers for the aged, and landmarks or other sensitive public institutions

10.1.7. Siting of communication facilities shall be based on the precautionary approach outlined in Annex J of these guidelines and should avoid community sensitive locations such as schools and other facilities set out in Annex J.

10.1.8. The antenna height must not be less than 15m from the ground.

10.1.9. If the antenna has any tilt other than 0º, it must be stated and the angle used in the determination of line-of-sight distance to the ground (hypotenuse) stated. In consistence with the above, the maximum antenna tilt should not exceed 5.5º assuming the signal is 6º off the vertical direction.

10.1.10. As far as practicable, antennas installed on buildings should all point away from the building and the beam of the strongest signal from each must not land directly on another building within the distance just before the signal lands on the ground.

10.1.11. For roof-mounted antennas, the transmitting antennas should be elevated above the height of people who may access the roof for one reason or another.

10.1.12. For roof-mounted antennas, the transmitting antennas should be kept away from the areas where people are most likely to be, like roof access and telephone service points.

10.1.13. Special precautions should be taken to keep high-power antennas away from areas accessible by the public.

10.1.14. Operators shall be required to define physical exclusion zones around base station transmitters (especially antennas) to warn the public of areas within which exposure guideline limits may be exceeded.

10.1.15. Exclusion zones shall be under the supervision of the licensee and is accessible only to authorized personnel. The licensee shall provide sufficient security to prevent entry of unauthorized persons into the exclusion zones.

10.1.16. Each exclusion zone should be defined by a physical barrier and a clearly visible, worded warning sign informing the public and workers that RF emission within the zone may exceed national guidelines and hence could pose adverse health effects.

10.1.17. Warning signs shall incorporated into microcell and picocell transmitters to indicate that they should not be opened when in use.

10.1.18. The operators shall share communication masts to avoid duplication of structures within one location (co-location/co-siting).

10.1.19. Special precautions shall be taken when designing co-location sites, where multiple antennas owned by different companies are on the same structure. This will involve determination of power densities for individual services and the levels summed in order to obtain the power level at the specific converging point, since maximum levels for individual operators may occur at different distances.

10.1.20. For purposes of annual audit, all the operators shall provide to CCK details of all their base stations countrywide. This shall include the name of the operating company; their emissions; the grid reference; the height of the antenna above ground level; the date that transmission started (only for year one data); the frequency range and signal transmission characteristics. Both the Commission and the relevant operators shall keep this information.

10.1.21. All operators shall provide copies of environmental and health and safety audits annually for all their communication masts/towers countrywide.

10.1.22. 15.1.22 The Commission shall conduct both random and regular inspections of the communication masts and facilities in conjunction with other relevant lead agencies to ensure compliance to these guidelines.

11. Complaint Handling Guidelines

11.1. Requirement to Develop Complaint Handling Procedures

11.1.1. An Operator/Service Provider must put in place procedures for dealing with complaints raised by its customers or the public with regard to any matter relating to the use of wireless communications systems for the delivery of its services.

11.1.2. An operator must make information about the procedures available to the public, including information about how the operator/service provider can be contacted by a person in order to make a complaint.

11.2. Complaint Handling Procedure

11.2.1. An Operator/Service Provider must acknowledge complaints, in writing, within five working days of receipt of the complaint. The Operator/Service Provider must investigate the matters raised by a complaint unless the Operator/Service Provider believes that the complaint is frivolous or vexatious, or is not made in good faith.

11.2.2. If an Operator/Service Provider decides not to investigate a matter, it must give the complainant written notice of the decision, and of the reasons for the decision. Further, where an Operator/Service Provider does not act on a complaint on such grounds, he shall be obliged to inform the Communications Commission of Kenya, citing the grounds on which it believes the complaint to be frivolous or to have been made in bad faith.

11.2.3. The Operator/Service Provider must advice the complainant in writing of the outcome of its investigations into the matters raised by the complaint and inform the complainant of the action taken within 14 working days of receipt of the complaint.

11.2.4. If a complainant is dissatisfied with the Operator/Service Provider's response, the Operator/Service Provider must inform the complainant of the availability of external options for complaint handling, which must at a minimum include the Communications Commission of Kenya, including a hyperlink to the Commission's website.

11.2.5. All operators/service providers should provide hyperlinks to the Communications Commission of Kenya website on their websites.

11.2.6. Operators/Service Providers must maintain a written record of complaints and the way in which the carrier dealt with the complaints including references to responses sent to complainants.

11.2.7. Where the Operator/Service Provider assesses a complaint to be frivolous or vexatious, it must:

11.2.7.1. Record its decision not to proceed with further correspondence and may cease correspondence

11.2.7.2. Inform complainants of the availability of external options for complaint handling.

12. Privacy, Confidentiality and Information sharing

These guidelines shall be used for the sole purpose of providing information to service providers within the industry on the requirements they are required to fulfil before construction of a communication base stations, masts and towers as well as collocation guidelines. These guidelines shall also be used by consumers to obtain information on regulation of siting of communication masts, towers, obtain information on wireless technologies as well as obtain information on communication applications and the safe use of mobile phones.

Information obtained from communication service providers in order to fulfil the requirements stipulated within these guidelines will be held in strict confidence. The information provided to the Commission shall however be shared with other lead government agencies mentioned within these guidelines, upon their request, in instances where the government agency may require more information about the communication service provider. This information will not be shared with other third parties besides other government agencies.

Annex A (normative) ─ Safety limits

Table A.1 — RF safety limits approved for Kenya (KS 1847)

Parameter	BST safety limit	Handset safety limits
Power density	0.2 mW/cm²	-
SAR	0.08 W/Kg	1.6 W/Kg
Electric field strength	27.5 V/m	-
Magnetic field strength	0.073 A/m	-

Table A.2 — BTS RF exposure safety limits by NRPB, ICNIRP, ACA and ANSI/FCC

Parameters	ANSI/FCC	NRPB	ICNIRP	ACA
Power density	0.57mW/cm²	3.32 mW/cm²	0.45 mW/cm²	0.2mW/cm²
SAR	0.08W/Kg	0.4W/Kg whole body exp	0.4W/Kg whole body exp	0.08W/Kg whole body exp
Electric field strength	—	112.5V/m	41.25 V/m	27.5V/m
Magnetic field strength	—	0.297A/m	0.111 A/m	0.073A/m

Annex B (normative) — RF prediction report format

As a general rule all infrastructure should be designed and installed having regard to the requirements of KS 1847.

EME report format

Summary of Estimated RF EME Levels around the *Carrier* Mobile Phone Base Station at *Location*

Issue Date:

Introduction:

This report summarizes the estimation of maximum cumulative radiofrequency (RF) electromagnetic energy (EME) levels at ground level emitted from the existing and proposed antennas at the *Operator* Mobile Phone Base Station at *Location*. Maximum EME levels estimated are at distances of 5m, 50m, 100m, 200m, 300m, 400m, and 500m from the base station. The procedures for making the estimates have been developed by the Australian Radiation Protection And Nuclear Safety Agency (ARPANSA). These are documented in the ARPANSA Technical Report; "Radiated EME Exposure Levels — Prediction Methodologies" which is available at http://www.arpansa.gov.au

EME Health Standard

ARPANSA, an agency of the Commonwealth Department of Health has established a Radiation Protection Standard specifying limits for continuous exposure of the general public to RF transmissions at frequencies used by mobile phone base stations. Further information can be gained from the ARPANSA web site.

NOTE: The basic restrictions in the ARPANSA Standard are the same as those in KS 1847-1 on which the mandatory limits in these guidelines are based.

Existing Site Radio Systems

Carrier GSM 900				
Carrier GSM 900				
etc				

Table of Predicted EME Levels – Existing

Distance from Carrier antennas - bearing x° (m)	Maximum Cumulative EME Level - All Carriers (% of ARPANSA standard)	
5		
50		
100		
200		
300		
400		
500		
Maximum EME level (y m x° from Carrier antennas)		

NOTE: This estimation is for the maximum level of RF EME at 1.5m above the ground from the existing antennas. The estimated levels have been calculated on the maximum mobile phone call capacity anticipated for this site. This estimation does not include possible radio signal attenuation due to buildings and the general environment. The actual EME levels will generally be significantly less than predicted due to path losses and the base station automatically minimizing transmitter power to only serve established phone calls.

Summary – Existing Radio Systems

RF EME levels have been estimated from the existing antennas installed at *Location*. The maximum cumulative EME level at 1.5 m above ground level is estimated to be z % of the ARPANSA reference level limit. This level complies with the limit specified in the ARPANSA Standard. The predicted levels also comply with the reference levels mandated by the Australian Communications Authority for mobile phone base stations.

Summary of Estimated RF EME Levels around the *Operator*
Mobile Phone Base Station at *Location*

Issue Date

Proposed Site Radio Systems

Carrier 3G			
Carrier CDMA			

Table of Predicted EME Levels — Existing & Proposed

Distance from Carrier antennas - bearing x° (m)	Maximum Cumulative EME Level - All Carriers (% of ARPANSA standard)
5	
50	
100	
200	
300	
400	
500	
Maximum EME level (y m x° from Carrier Antennas)	

NOTE: This estimation is for the maximum level of RF EME at 1.5m above the ground from the existing antennas. The estimated levels have been calculated on the maximum mobile phone call capacity anticipated for this site. This estimation does not include possible radio signal attenuation due to buildings and the general environment. The actual EME levels will generally be significantly less than predicted due to path losses and the base station automatically minimizing transmitter power to only serve established phone calls.

Summary — Existing & Proposed Radio Systems

RF EME levels have been estimated from the existing and proposed antennas installed at Location. The maximum cumulative EME level at 1.5 m above ground level is estimated to be z % of the ARPANSA reference level limit. This level complies with the limit specified in the ARPANSA Standard. The predicted levels also comply with the reference levels mandated by the Australian Communications Authority for mobile phone base stations.

Reference Notes:

1. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is a Federal Government agency incorporated under the Health portfolio. ARPANSA is charged with responsibility for protecting the health and safety of people, and the environment, from the harmful effects of radiation (ionizing and non-ionizing).

2. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), 2002, 'Radiation Protection Standard: Maximum Exposure Levels to Radiofrequency Fields — 3 kHz to 300 GHz', Radiation Protection Series Publication No. 3, ARPANSA, Yallambie Australia. [Printed version: ISBN 0-642-79400-6 ISSN 1445-9760] [Web version: ISBN 0-642-79402-2 ISSN 1445-9760]

3. The EME predictions in this report assume a worst-case scenario being:
— base station transmitters operating at maximum power (no automatic power reduction)
— simultaneous telephone calls on all channels
— an unobstructed line of sight view to the antennas.

In practice a worst-case scenario is rarely the case. There are often trees and buildings in the immediate vicinity, and cellular networks automatically adjust transmit power to suit the actual telephone traffic. For these reasons, care should be taken when comparing prediction reports & actual measurements, as the predicted levels will often be considerably higher.

Annex C (Normative) — Schedule of Fines, Fees and Charges

This annex outlines the fines, fees and charges payable in line with the requirements stipulated in respective sections within these guidelines. These fees and charges can be reviewed from time to time and the stakeholders and parties involved are responsible of upraising themselves with the new fines, fees and charges whenever they may change.

Item	Title	Fines, fees or charges
C3	Fees payable upon submission of a minor communication facility site plan	Two hundred fifty dollars ($250.00)
C4	Fees payable upon submission of a major communication facility site plan	Five hundred dollars ($500.00)
C5	Special exemptions provisions	
	Non refundable fee payable on submission of application for exemption	One thousand dollars ($1,000.00)
C6	Fine payable by any party on conviction for the violation of any provision within the guidelines	Five thousand dollars ($5,000.00)

Annex D (Normative) - Application for Approval to Construct Communication Towers or Masts

Application Reference: _____

(for official use only)

Name of Entity wishing to construct Facility: *(Property owner, Service Provider or Operator)*					
Type of Licence Held:		Licence No.:			
Type of Facility to be Constructed:					
Information about person Responsible for the preparation of this Application					
Name:					
Position in Organization:					
Professional Qualifications:					
Current Address Information:	P.O. Box.	Postcode :	Town:		
Email:		Mobile Tel No.:		Fixed Tel No.:	
Information about the property on which the facility is to be constructed					
Name of property owner:					
Current Address(of property owner):	P.O. Box.:		Town:		
	Post code:		Email:		
Mobile Tel No.:	+	Fixed Tel No.:	+		
LR No. of property:		Land Use of property[User]:			
Coordinates [of mast/tower] (WGS 84)		Designation of area in which property is located:			
Estate, Village and/or Town where property is located:		Size of property (sq. ft):			

Information to be provided on the site plan

1. Provide the land use or designation in which the property is situated;
2. Provide the size of the property stated both in square feet and lot line dimensions, and a site plan showing the location of all lot lines and setback distances;
3. Identify and show on the site plan the location of all structures (including residential structures) on the property which is the subject of the application;
4. Identify and show on the site plan the location, size and height of all proposed and existing antennae and all appurtenant structures;
5. Identify and show on the site plan the type, locations and dimensions of all proposed and existing landscaping, and fencing;

Other information or documentation to provide

1. Provide documentation that demonstrates the need for the wireless communication facility to provide service. Such documentation shall include, but may not be limited to propagation studies of the proposed site and all existing and proposed sites;
2. Provide the number, type and design of the antenna(s) proposed;
3. Provide the make, model and manufacturer of the tower and antenna(s);
4. Provide a description of the proposed antenna(s) and all related fixtures, structures, appurtenances and apparatus, including height above pre-existing grade, materials, color and lighting;
5. Provide the frequency, modulation and class of service of each radio or other transmitting equipment;
6. Provide the actual intended transmission and the maximum effective radiated power of the antenna(s);
7. Provide direction of maximum lobes and associated radiation of the antenna(s);

8. Provide the applicant's proposed tower maintenance and inspection procedures (and related system of records);

Documents from third parties

1. Obtain/attach copy of current CCK license applicable for the intended use of the wireless communication facilities;
2. Provide anticipated predictable RF levels at the proposed site are within or below the limits set forth in KS 1847-1;
3. Provide certification that the proposed antenna(s) will not cause interference with other communication devices nor preclude the provision of broadcasting, information and communication technology services within the geographical service area;
4. Provide documentation to show that the tower owner has a signed agreement committing a service provider to occupy space on the tower at the time of completion of construction on the new wireless communication facility;
5. Provide the number, type and design of the tower(s) and antenna(s) proposed and the basis for the calculations of the tower's capacity to accommodate multiple users;
6. Provide a statement in writing:
    a) That the applicant's proposed co-location for wireless communication facilities shall be maintained in a safe manner, and in compliance with all conditions of the existing special use permit and administrative approval, as well as all Laws; and
    b) That the construction of the wireless communication facilities is legally permissible, including, but not limited to the fact that the applicant is authorized to do business in Kenya.
7. Written certification that the communication facility, foundation and attachments are designed and will be constructed to meet all Laws and requirements for loads, including wind and weather loads;
8. Certification that the wireless communication facilities will be effectively grounded so as to protect persons and property and installed with appropriate surge protectors;
9. The Applicant shall provide a KCAA letter to determine if the additional height of the tower or existing structure intended to support wireless facilities requires lighting under KCAA guidelines. This requirement shall be for any existing structure or building where the applicant proposes to increase the height of the structure or building.

Other requirements

1. All utilities at a wireless communication facilities site shall be in compliance with all Laws, including specifically, but not limited to, KS 1587 and KS 662 where appropriate. The application shall include a detailed description of the proposed method of utilities installation;
2. An Applicant shall submit to CCK the number of completed applications determined to be needed at the pre-application meeting; and
3. No communication facilities shall interfere with any communications system, including 911 systems, public safety, police or fire protection systems. The applicant will need to demonstrate that the communication facility will not interfere with existing residential or commercial applications. If any interferences are reported, the applicant shall be required to investigate the cause and act to remedy the interference at no extra cost to the Commission if it is determined that the interference is caused by the applicant's communication facility.
4. No communication facility or tower may substantially interfere with the operation of any airport or with the operation of any flights or air space required for any of the hospitals or medical centers. All communication facilities and towers must comply with all Kenya Civil Aviation Authority requirements.

Annex E (Normative) – EIA Structure for Communication Facilities

a) Guideline on Contents of the Report

1. Location of facilities

1.1. Provide the physical address and copies of the title deed and deed plan of the site;

1.2. Provide a copy of the lease agreement (or lease option) signed by property owners if the property for the wireless communication facility is to be leased in accordance with requirements specified in *section 4.3.6* of the guidelines;

1.4. Provide the size of the property stated both in square feet and lot line dimensions, and a site plan showing the location of all lot lines and setback distances;

1.5. Identify and show on the site plan the location of all structures (including residential structures) on the property which is the subject of the application;

1.6. Identify and show on the site plan that the lot or lease area shall not encompass any public road right of ways/reserve, or railroad right of ways/reserve;

1.7. Identify and show on the site plan the location, size and height of all proposed and existing antennae and all appurtenant structures;

1.8. Identify and show on the site plan the type, locations and dimensions of all proposed and existing landscaping, and fencing;

1.9 A copy of the warranty deed and any lease or leases for the property on which the communication facility, tower or antenna is to be located shall be provided

2.0. Alternative Sites (Co-location)

2.1. Provide a detailed explanation as to why a higher priority site was not selected;

2.2. Explain why a co-location that meets *administrative review* criterion is commercially or otherwise impracticable;

a) Submit a written report demonstrating its meaningful efforts to secure shared use of existing tower(s) or the use of alternative buildings or other structures within the area.

b) Submit copies of written requests and responses for shared use in the application, along with any letters of rejection stating the reason for rejection.

3.0. Baseline Information

3.0. Provide the land use or designation in which the property is situated;

3.1 Provide certification that a topographic and geomorphologic study and analysis has been conducted, and that taking into account the subsurface and substrata, and the proposed drainage plan, that the site is adequate to assure the stability of the proposed wireless communication facilities on the proposed site;

4.0. Compliance with Relevant Regulations

4.1. Provide the anticipated RF radiation levels at the proposed site.;

4.2. Provide certification that the proposed antenna(s) will not cause interference with other communication devices nor preclude the provision of broadcasting, information and communication technology services within the geographical service area;

4.3. Provide CCK License/Certificate applicable for the intended use of the wireless communication facilities;

4.4. All utilities at a wireless communication facilities site shall be installed in compliance with all Laws, including specifically, but not limited to, KS 1587 and KS 662 where appropriate. The application shall include a detailed description of the proposed method of utilities installation;

5.0. Structure of Facility

5.1. Provide documentation justifying the total height of any tower, facility and/or antenna, and the basis thereof;

5.2. Provide documentation to show that the tower owner has a signed agreement committing a service provider to occupy space on the tower at the time of completion of construction on the new wireless communication facility;

5.3. Provide the number, type and design of the tower(s) and antenna(s) proposed and the basis for the calculations of the tower's capacity to accommodate multiple users;

5.4. Provide the make, model and manufacturer of the tower and antenna(s);

5.5. Provide a description of the proposed tower and antenna(s) and all related fixtures, structures, appurtenances and apparatus, including height above pre-existing grade, materials, color and lighting;

5.6. Provide the frequency, modulation and class of service of radio or other transmitting equipment;

5.0. Operation Activities

5.1. Provide the actual intended transmission and the maximum effective radiated power of the antenna(s), supported by copies of manufacturer's data sheets;

5.2. Provide direction of maximum lobes and associated radiation of the antenna(s);

6.0. Design or Pre-construction Phase

6.1. Provide written certification that the telecommunication facility, foundation and attachments are designed and will be constructed to meet all Laws and requirements for loads, including wind loads;

6.2. Provide certification that the wireless communication facilities will be effectively grounded so as to protect persons and property and installed with appropriate surge protectors;

6.3. Provide certification (by a registered structural Engineer) that states that the structure's break point will be above the halfway point of the tower height and, where applicable to the type of tower, that the tower is designed to crumble inward in the event of collapse; Evidence of the structural design must be documented.

6.4. Provide documentation that the wireless communication facilities will be bonded so as to protect persons and property;

7.0. Prediction of Impact

7.1.Visual Impacts

7.1.1. Furnish a visual impact assessment, the nature of which shall be determined (during preparation of TORs) (at the *pre-application meeting*,) and shall include:

a) A zone of visibility map which shall be provided in order to determine locations from which the tower may be seen.

b) Pictorial representations (which may include visual simulations) of "before and after" views from key viewpoints both inside and outside of the site as may be appropriate, including but not limited to highways and other major roads; local parks; other public lands; historic monuments; preserves and historic sites normally open to the public; and from any other location where the site is visible

to a large number of visitors, travellers or residents. Guidance may be provided, concerning the appropriate key viewpoints at a *pre-application meeting*.

c) An assessment of the visual impact of the tower base, guy wires and accessory buildings from abutting and adjacent properties and streets as relates to the need or appropriateness of screening.

7.1.2. Demonstrate and provide in writing and by drawing as part of the site plan materials how it shall meet the following requirements that shall govern the landscaping for tower sites for which a use permit is required; provided, however, that such requirements may be waived *at the pre-application meeting* and site visit if the goals of these guidelines would be better served thereby;

a) Wireless communication facilities shall be landscaped with a buffer of plant materials that effectively screens the view of the wireless communication facility from adjacent property.

b) In locations where the visual impact of the wireless communication facility would be minimal, the landscaping requirement may be reduced or waived altogether during the preapplication meeting and site visit.

c) Existing mature tree growth and natural landforms on the site shall be preserved to the maximum extent possible. In some cases, such as wireless communication facilities sited on large, wooded lots, natural growth around the property perimeter may be a sufficient buffer.

7.1.3. Both the wireless communication facilities and any and all accessory or associated facilities shall maximize the use of building materials, colors and textures designed to blend with the structure to which it may be affixed and/or to harmonize with the natural surroundings, this shall include the utilization of stealth or concealment technology as may be necessary;

7.1.4 A landscape plan which meets the requirements of these guidelines and Legal Notice No. 101 of 2003 under the EMCA 1999 shall be submitted.

7.1.5 **A** Method of providing security enclosure and finished colour and the method of providing stealth design and illumination shall be provided.

7.2. Biological Impacts

7.2.1. At a communication site, an access road, turn around space and parking within the area leased or owned by the applicant upon which the wireless telecommunication facility is sited shall be provided to assure adequate emergency and service access. Maximum use of existing roads, whether public or private, shall be made to the extent practicable. Road construction shall at all times minimize ground disturbance and the cutting of vegetation and road grades shall closely follow natural contours to assure minimal visual disturbance and reduce soil erosion;

8.0. Occupational Health and Safety

8.1. Provide a copy of each of the policies or certificates representing the insurance in the required amounts;

8.2. Submit a statement in writing:

a) That the applicant's proposed wireless communication facilities shall be maintained in a safe manner, and in compliance with all conditions of the use permit, as well as all Laws and applicable Kenya Standards; and

b) That the construction of the wireless communication facilities is legally permissible, including, but not limited to the fact that the applicant is authorized to do business in Kenya. [31, 32 should be deleted]

9.0. Public Consultation

9.1. In order to better inform the public, in the case of a new telecommunication tower, the applicant may, prior to the public hearing on the application, be required to hold a "balloon test" as part of the required materials constituting a completed application. The applicant shall arrange to fly, or raise upon a temporary mast, a minimum of a one metre in diameter brightly colored balloon at the maximum height of the proposed new tower. The dates, (including a second date, in case of poor visibility on the initial date) times and location of this balloon test shall be advertised by the applicant seven (7) and fourteen (14) days in advance of the first test date in a newspaper with a general circulation in the site. The applicant shall inform the Commission, in writing, of the dates and times of the test, at least fourteen (14) days in advance. Notice of the balloon test shall be posted in a prominent place on the property (determined at the pre-application meeting) at least ten (10) days prior to the balloon test. The balloon test shall be flown for at least four consecutive hours sometime between 7:00 am and 4:00 PM on the dates chosen. The primary date shall be on a weekend, but to prevent delays in the processing of the application, in case of poor weather on the initial date, the secondary date may be on a weekday.

10. Environmental Management Plan

10.1 Provide the applicant's proposed tower maintenance and inspection procedures (and related system of records);

11. Decommissioning Phase

11.1. Provide a detailed decommissioning phase plan for the removal of communication facilities;

12.0. Submission of the Report

12.1. Provide the name, address and phone number of the person responsible for preparing the application;

12.2. Provide the name, address, and phone number of the property owner, service provider or operator, and the actual applicant, and to include the legal form of the applicant;

b) Guideline on Required Detailed Information per EIAS Outlines

This section details requirements under Part A of this annex.

1.0. Information to be provided on the site plan

a) Provide the land use or designation in which the property is situated;
b) Provide the size of the property stated both in square feet and lot line dimensions, and a site plan showing the location of all lot lines and setback distances;
c) Identify and show on the site plan the location of all structures(including residential structures) on the property which is the subject of the application
d) Identify and show on the site plan the location, size and height of all proposed and existing antennae and all appurtenant structures;
e) Identify and show on the site plan the type, locations and dimensions of all proposed and existing landscaping, and fencing;

2.0. Detailed project description:

a) Provide detailed written description of the type of service and facilities to be provided.
b) Provide detailed written description of the size of the overall *franchise area* licensed by the Communications Commission of Kenya (CCK)
c) Provide detailed written justification for installation of service equipment at this site.

3.0. Structure of the facility i.e. Tower and Antennas Description:

Provide a description of the tower, antennas, and support facilities as follows:
a) Size (height above ground level to top of tower and to top of antennas, dimensions of all components, including base and top dimensions);
b) Type (e.g., self-supporting monopole, guyed tower, self-supported steel lattice), materials and color of the tower;
c) Number, type (e.g., dish, whip, panel), size (e.g., height, diameter) and color of the antennas;
d) Configuration and sizes of the tower foundation and antenna supports (e.g., cross arms, guy wires, and antenna mounts);
e) Lighting or striping as an air navigation hazard, as per KCAA requirements
f) Equipment shelter (size, height, and color).
In addition, include manufacturer's specifications and details for proposed tower and antennas.

4.0 Design of the Buildings and Structures:

Provide construction plans and details for all proposed accessory buildings. Show plans and elevations and label dimensions, construction materials and exterior colors.

5.0. Compliance with Relevant Regulations

Identify all permits or approvals necessary from local or national agencies for this proposed project. Provide names and phone numbers of key points of contact with said agencies. Provide copies of written approvals and other permits received.

The Commission will not approve a project which has been denied a permit or which is a prohibited use under local zoning requirements and other local laws or ordinances. In this process the Commission will recognize local community goals expressed in a formally adopted master plan. If the Local Government Notice Form indicates that approval is required from the local municipality, the applicant should provide the following:
a) a copy of the local application or, if issued at the time of this application, the written approval document (e.g., permit or signed subdivision plan);
b) the minutes of all meetings at which the project was discussed; and
c) a copy of the provisions of By-Laws, or guidelines pertaining to the project or a statement from the municipality that the project meets the requirements of the local ordinance and may be approved as designed.

The applicant shall also obtain a determination from the local municipality as to whether the proposed project may be undertaken without a "*use variance or area variance*." If a variance is required, the applicant shall provide a copy of the variance with this application.

6.0. Archaelogical Impacts

Provide documentation from National Museums of Kenya/Kenya Wildlife Services that the project will not have an impact on any historical or archaeological resources, structures or on any areas eligible for inclusion to the National

Heritage/Historic Registers. If it is determined that there is a potential for impacts to archaeological or historic resources, then provide their recommendations for mitigation of those impacts.

Provide Kenya Civil Aviation Authority Form Notice of Proposed Construction or Alteration Form or similar documentation showing KCAA decision on lighting or painting.

7.0 Co-location:
Provide the names, addresses and phone numbers of the current owner(s) of the towers, building or structure upon which co-location was considered or is proposed.

If co-location is proposed, provide to-scale site plans and elevations of the existing tower, building or structure to be used for co-location

Provide plans, elevations, and details showing the proposed electronic communication facilities and existing antennas located on the tower.

8.0. Impact Mitigation Measures
Describe efforts to reduce the impacts of the project, such as:

a) Avoiding ridge lines where the tower will be silhouetted to the sky or site the tower and facilities to be back-dropped by existing trees and topography;
b) Limiting the amount of vegetation removal to provide maximum screening (e.g., separating the equipment shelter from the tower to maintain vegetation near the tower; constructing the equipment shelter on piers rather than at grade level; helicoptering materials in rather than constructing a new access road through wooded areas);
c) Locating the tower in areas of existing tall trees and providing an effective year-round landscaped buffer (with supplemental plantings if necessary) that is under the control of the landowner or lessee;
d) Using existing roads or driveways for access rather than constructing new roads and driveways;
e) Screening the tower with false walls, columns or other building elements as appropriate to the setting;
f) Using security spot lighting that will direct the light in a manner that is non-obtrusive to adjacent landowners;
g) Using color to blend the tower with its surroundings;
h) Using different tower and antenna configurations (e.g., using a guyed tower rather than a monopole, simulated tree silhouettes, smaller dimensioned cross members, lattice structures) to minimize visibility; and
i) Locating the tower so that if there is a failure of the structure it will not impact adjacent land uses or be of any potential danger to adjacent landowners;
j) Not siting towers in or near wetlands;
k) If fencing is to be installed, ensuring that it will minimize habitat fragmentation.

If the visual impact analysis reveals that there is vegetation on or adjacent to the project site that must be retained for screening of the proposed tower/antennas, document how such vegetation will be protected throughout the operational life of the project (e.g., acquiring a larger lease/purchase area and limiting the vegetation to be removed or by written agreement with the landowner(s) that a defined vegetative buffer will remain uncut outside the lease/purchase area for a specified time period).

9.0. Alternatives Analysis for Proposed New Towers
Describe the alternatives that were evaluated including use of visual simulation that may be necessary to justify selection of the preferred alternative.

a) Alternative Heights
Provide RF analysis for a tower at roof or canopy height. Provide RF analysis for a taller tower.

b) Alternative for co-Location
Provide RF analysis for use of other tall structures within the proposed service area.

c) Alternative Tower Design
Provide justification for each selected tower type (monopole, self-supported steel lattice or guy). As part of the justification, provide at least one photo simulation from a key vantage point. Provide justification for selection of antenna, and use of microwave links as may be required.

d) Alternative Site
Provide RF plot for potential alternative sites within the signal service area. Provide signal propagation studies for the preferred location at the proposed tower and antenna heights and alternative antenna heights and/or sites considered.

e) Camouflage Alternatives
When the site is not substantially invisible, provide analysis which indicates that the chosen site is necessary for system integrity and signal propagation

Provide plans to further reduce visibility of facility by use of camouflage.
Provide a detailed explanation supporting the selection of the preferred alternative taking into account the demonstrated need for the service; environmental, visual and site impacts; visual impacts; and land, initial development and life-cycle costs. Describe why various alternatives that were considered were rejected. The RF analysis should include signal strength as it is related mobile, or stationary users. The engineer submitting the RF analysis must be license to practice and all plots are to be stamped by an engineer.

10.0. Cost Benefit Analysis

Provide a statement of benefits to be derived from the project, including:

a) General service improvements to the provider's customer base;
b) Need for and/or improvements in emergency communications;
c) Direct job development (quantify)
d) Upgrading of necessary infrastructure, if any, for other business development;
e) Property tax generation;
f) Elimination of redundant facilities and/or equipment from environmentally sensitive areas; and
g) a time-frame for doing so.

Provide documentation of contact with potential service customers, including emergency service units, law enforcement units, other governmental units and businesses within the proposed service area showing that the proposed antenna height is the minimum height necessary for their purpose(s).

11.0. Project Budget

Provide approximate cost estimates for the proposed project, including

I. site acquisition costs, if any,
II. annual lease costs, if applicable
III. construction costs for site access and preparation and construction of the tower, antennas; and
IV. associated accessory structures, and annual maintenance and operation costs.

12.0. Future expansion of use of the facility by others

Provide a statement committing to good faith negotiation with other wireless communication providers for co-location rights at competitive lease rates.

13.0. Maintenance of tower(s)

If maintenance of the communication tower and associated facilities is to be contracted out or done by someone other than the applicant/service provider, provide the name of the maintenance company, key points of contact, addresses and phone numbers.

Provide a point of contact for the applicant/service provider that will be responsible for maintaining the site, facilities and compliance with all appropriate regulatory agencies.

14.0. Decommissioning Phase

a) Provide a means to guarantee that the proposed tower and associated structures will be removed and the site restored if required (such as a bond or letter of credit).

b) The discontinuance of the use for wireless communication purposes for more than ninety days shall make the future reuse of the site for wireless communication tower purposes subject to the future review and approval of CCK.

c) When the applicant, its successor in interest, assignees or subleasees cease(s) to operate the herein authorized cell site for a period of six months or more, they shall notify CCK within two weeks of abandonment; or at such earlier time as the applicant, its successor, its assignees or subleasees in interest have determined that they intend to abandon the site.

d) The Applicant shall provide CCK with a plan for review and approval for the removal and restoration of the site to its original condition. Removal of the tower and restoration of the site shall be completed within three months of the date the facility is abandoned. Upon a showing of good cause by the applicant or its successor, CCK may extend the timeframes referred to Herein. Requests and CCK permission to extend the timeframes referred to above shall be in writing.

e) The applicant, its successors in interest, assignees or sub-lessees shall actively seek and analyze state-of-the-art technologies that would eliminate the needs for the herein authorized antennas.

f) CCK shall be provided a written report every three (3) years starting from the date of this permit, fully describing all technologies that are available and the feasibility of implementing each. These reports shall also describe visual, public health and safety impacts and impacts which would result upon adjoining landowners from the implementation of each alternative technology in relation to the costs of construction, operating and maintaining the wireless communications system authorized herein. CCK reserves the right to conduct a public hearing to consider the implementation of any or all alternatives and related environmental, economic and other pertinent development considerations

15.0. RF Prediction

As a general rule all infrastructure should be designed and installed having regard to the requirements of KS 1847.

EME report format

Summary of Estimated RF EME Levels around the *Carrier* Mobile Phone Base Station at *Location*

Issue Date:

Introduction:

This report summarizes the estimation of maximum cumulative radiofrequency (RF) electromagnetic energy (EME) levels at ground level emitted from the existing and proposed antennas at the Operator Mobile Phone Base Station at Location. Maximum EME levels estimated are at distances of 5m, 50m, 100m, 200m, 300m, 400m, and 500m from the base station. The procedures for making the estimates have been developed by the Australian Radiation Protection And Nuclear Safety Agency (ARPANSA). These are documented in the ARPANSA Technical Report; "Radiated EME Exposure Levels — Prediction Methodologies" which is available at http://www.arpansa.gov.au

EME Health Standard

ARPANSA, an agency of the Commonwealth Department of Health has established a Radiation Protection Standard specifying limits for continuous exposure of the general public to RF transmissions at frequencies used by mobile phone base stations. Further information can be gained from the ARPANSA web site.

NOTE: The basic restrictions in the ARPANSA Standard are the same as those in KS 1847-1 on which the mandatory limits in these guidelines are based.

Existing Site Radio Systems

Carrier GSM 900			
Carrier GSM 900			
etc			

Table of Predicted EME Levels – Existing

Distance from Carrier antennas - bearing x˚ (m)	Maximum Cumulative EME Level - All Carriers (% of ARPANSA standard)
5	
50	
100	
200	
300	
400	
500	
Maximum EME level (y m x° from Carrier antennas)	

NOTE: This estimation is for the maximum level of RF EME at 1.5m above the ground from the existing antennas. The estimated levels have been calculated on the maximum mobile phone call capacity anticipated for this site. This

estimation does not include possible radio signal attenuation due to buildings and the general environment. The actual EME levels will generally be significantly less than predicted due to path losses and the base station automatically minimizing transmitter power to only serve established phone calls.

Summary – Existing Radio Systems

RF EME levels have been estimated from the existing antennas installed at *Location*. The maximum cumulative EME level at 1.5 m above ground level is estimated to be *z* % of the ARPANSA reference level limit. This level complies with the limit specified in the ARPANSA Standard. The predicted levels also comply with the reference levels mandated by the Australian Communications Authority for mobile phone base stations.

Summary of Estimated RF EME Levels around the *Operator*
Mobile Phone Base Station at *Location*

Issue Date

Proposed Site Radio Systems

Carrier 3G			
Carrier CDMA			

Table of Predicted EME Levels — Existing & Proposed

Distance from Carrier antennas - bearing x° (m)	Maximum Cumulative EME Level - All Carriers (% of ARPANSA standard)
5	
50	
100	
200	
300	
400	
500	
Maximum EME level (y m x° from Carrier Antennas)	

NOTE: This estimation is for the maximum level of RF EME at 1.5m above the ground from the existing antennas. The estimated levels have been calculated on the maximum mobile phone call capacity anticipated for this site. This estimation does not include possible radio signal attenuation due to buildings and the general environment. The actual EME levels will generally be significantly less than predicted due to path losses and the base station automatically minimizing transmitter power to only serve established phone calls.

Summary — Existing & Proposed Radio Systems

RF EME levels have been estimated from the existing and proposed antennas installed at Location. The maximum cumulative EME level at 1.5 m above ground level is estimated to be z % of the ARPANSA reference level limit. This level complies with the limit specified in the ARPANSA Standard. The predicted levels also comply with the reference levels mandated by the Australian Communications Authority for mobile phone base stations.

Reference Notes:

1. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is a Federal Government agency incorporated under the Health portfolio. ARPANSA is charged with responsibility for protecting the health and safety of people, and the environment, from the harmful effects of radiation (ionizing and non-ionizing).

2. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), 2002, 'Radiation Protection Standard: Maximum Exposure Levels to Radiofrequency Fields — 3 kHz to 300 GHz', Radiation Protection Series Publication No. 3, ARPANSA, Yallambie Australia. [Printed version: ISBN 0-642-79400-6 ISSN 1445-9760] [Web version: ISBN 0-642-79402-2 ISSN 1445-9760]

3. The EME predictions in this report assume a worst-case scenario being:
— base station transmitters operating at maximum power (no automatic power reduction)
— simultaneous telephone calls on all channels
— an unobstructed line of sight view to the antennas.

In practice a worst-case scenario is rarely the case. There are often trees and buildings in the immediate vicinity, and cellular networks automatically adjust transmit power to suit the actual telephone traffic. For these reasons, care should be taken when comparing prediction reports & actual measurements, as the predicted levels will often be considerably higher.

17.0. Other information or documentation to provide

a) Provide documentation that demonstrates the need for the wireless communication facility to provide service. Such documentation shall include, but may not be limited to propagation studies of the proposed site and all existing and proposed sites;

b) Provide the number, type and design of the antenna(s) proposed;

c) Provide the make, model and manufacturer of the antenna(s) and tower;

d) Provide a description of the proposed antenna(s) and all related fixtures, structures, appurtenances and apparatus, including height above pre-existing grade, materials, color and lighting;

e) Provide the frequency, modulation and class of service of each radio or other transmitting equipment;

f) Provide the actual intended transmission and the maximum effective radiated power of the antenna(s);

g) Provide direction of maximum lobes and associated radiation of the antenna(s);

h) Provide the applicant's proposed tower maintenance and inspection procedures (and related system of records);

18.0. Documents from third parties

1) Obtain/attach copy of current CCK license applicable for the intended use of the wireless communication facilities;

2) Provide anticipated predictable RF levels at the proposed site are within or below the limits set forth in KS 1847-1;

3) Provide certification that the proposed antenna(s) will not cause interference with other communication devices nor preclude the provision of broadcasting, information and communication technology services within the geographical service area;

4) Provide documentation to show that the tower owner has a signed agreement committing a service provider to occupy space on the tower at the time of completion of construction on the new wireless communication facility;

5) Provide the number, type and design of the tower(s) and antenna(s) proposed and the basis for the calculations of the tower's capacity to accommodate multiple users;

6) Provide a statement in writing:

   a) That the applicant's proposed co-location for wireless communication facilities shall be maintained in a safe manner, and in compliance with all conditions of the existing special use permit and administrative approval, as well as all Laws; and

   b) That the construction of the wireless communication facilities is legally permissible, including, but not limited to the fact that the applicant is authorized to do business in Kenya.

7) Written certification that the communication facility, foundation and attachments are designed and will be constructed to meet all Laws and requirements for loads, including wind and weather loads;

8) Certification that the wireless communication facilities will be effectively grounded so as to protect persons and property and installed with appropriate surge protectors;

9) The Applicant shall provide a KCAA letter to determine if the additional height of the tower or existing structure intended to support wireless facilities requires lighting under KCAA guidelines. This requirement shall be for any existing structure or building where the applicant proposes to increase the height of the structure or building.

19.0. Other requirements

5. All utilities at a wireless communication facilities site shall be in compliance with all Laws, including specifically, but not limited to, KS 1587 and KS 662 where appropriate. The application shall include a detailed description of the proposed method of utilities installation;

6. An Applicant shall submit to CCK the number of completed applications determined to be needed at the pre-application meeting; and

7. No communication facilities shall interfere with any communications system, including 911 systems, public safety, police or fire protection systems. The applicant will need to demonstrate that the communication facility will not interfere with existing residential or commercial applications. If any interferences are reported, the

applicant shall be required to investigate the cause and act to remedy the interference at no extra cost to the Commission if it is determined that the interference is caused by the applicant's communication facility.

No communication facility or tower may substantially interfere with the operation of any airport or with the operation of any flights or air space required for any of the hospitals or medical centers. All communication facilities and towers must comply with all Kenya Civil Aviation Authority requirements.

c) Guideline on Requirements for a duly prepared EIAS Report for Telecommunication Antennas, Mobile Phone Cell Sites And Similar Facilities

1.0. Attachments

This section presents the various information required to be submitted by the project proponent as attachments to the EIAS Report, without which the application for EIA licence will not be issued.

Attachments	**Remarks**
1. Copy of the Vicinity/Location Map (superimposing the site Development Plan) submitted to *Local Authority* and duly certified/authenticated by the same offices;	
2. Site-specific Radio Frequency Evaluation from authoritative source;	
3. Height Clearance Permit from the KCAA, Ministry of Transportation;	
4. Statement of Availability of frequency from CCK for the proposed site.	The actual frequency assignment should be done after the EIA and other requirements are met. A different document, e.g. an indication of frequency availability, could be provided initially to the service provider.
5. Zoning Certification from the local authority based on the approved comprehensive land use plan;	
6. Consent from the concerned government agencies	
7. Minutes of consultation or any proof of consultation with legitimate residents and business owners in the immediate neighbourhood.	
8. Accountability Statement of Project Proponent and Project Report Preparer/s;	
9. Receipt of the Processing Fee	

2.0. Project Location and Address of Proponent

2.1 Project Title : _____

2.2 Project Location : _____

_____

(complete address, */ street/ municipality/city*, *province*)

(GPS coordinates in WGS 84 format)

2.3 Proponent : _____

Contact Person : _____

Address : _____

Tel/Fax # : _____

E-mail : _____

2.4 Project Ownership Type:

[ ] Single Proprietorship [ ] Partnership or Joint Venture

[ ] Corporation [ ] Cooperatives

[ ] Others _____

3.0. PROJECT DESCRIPTION

3.1 Project Description/Objectives: _____

3.2 Project Total Cost […….]

Mode of Project Financing:

[ ] Self-Financed [ ] Bank Loan [ ] Govt. Financing [ ] Others _____

3.3 Land Ownership

Total Land Area (sq. meters or Ha.):_____

Total Floor Area (sq. meters or Ha.): _____

General Land Classification: [ ] Public Land [ ] A & D

Status of Land Ownership :

[ ] owned/title by virtue of:

Freehold Title No. _____
Residential Area No. _____

[ ] Owned/untitled (tax declaration) _____
[ ] stewardship contract: _____
[ ] lease: Lease Contract No. _____
[ ] others, pls. specify: _____

3.4 Project Location

How do you describe the general location of the project site?

[ ] Developed Area (within a built-up-area with presence of utility systems or network, especially water supply, roads and power supply)

[ ] Underdevelopment Area (relatively far from the urban centre with predominant absence of utility system)

3.5 Land Use Classification (based on approved land use plan of the city/municipality)

[ ] Public Please Specify: _____

[ ] A & D [Align with Local Authority classification]

3.6 Zoning Classification

3.7 Project Components

Access Road: Length: _____ m.

Width : _____ m.

Height of Tower _____m.

3.8 Utilities and Infrastructures

Water Supply

- Demand
  Estimated daily water requirement: _____ m^3.

- Supply
  Water supply source: _____

Attach panoramic view of the project site and its immediate vicinity

Sewage disposal system

— Sewage System:

[ ] Individual septic tank

[ ] Communal septic tank

[ ] Public sewerage system

[ ] Others (specify) _____

— **Power Supply**

Source of power supply:

[ ] National utility : _____

[ ] Own Generator Capacity (HP) _____

[ ] Others, pls. specify _____

3.9 Manpower and employment

How many people will be employed by the project? _____

During the pre-construction/construction period: _____

During the operation and maintenance period: _____

3.10 Construction schedule

How long will the pre-construction/construction period take? _____

4. Baseline Information

4.1 Physical Environment

Components/Parameters	**Remarks**
What is the general elevation of the project area? < 100 masl [metres above sea level] 100-300 masl 301-500 masl 501-1,000 masl 1001-1500 masl >1,500 masl (To determine elevation, refer to the topographic map where the elevation per contour line is indicated)	(indicate the area per elevation range or estimate the % to total area)
Slope and topography of the area Terrain is flat or level (0-3% slope)? Gently sloping to undulating (3-8% slope)? Undulating to rolling (8-1830% slope)? Rolling to moderately steep (18-30% slope)? Steeply sloping (30-50% slope)? Very steep to mountainous (>50% slope)?	(indicating the area per slope category or estimate the % to total area)
Are there areas in the site where indications of soil erosion are occurring? If yes, what activities are causing erosion?	Causes of erosion: [ ] heavy rains [ ] unstable slopes [ ] others, pls. specify _____ _____
Has the area experienced any flooding during the wet season? If yes, when was the last time the area was flooded? What caused the flooding?	Period(s) of flooding: _____ _____ Causes of flooding: [ ] low area/elevation [ ] poor drainage [ ] water logged area
Soil type of the specific area: [ ] sandy soil [ ] clayey soil [ ] sandy loam soil	Other soil types: _____ _____
Is there an access road going to the project site? If yes, what is its distance to the site _____km	Type of access road:
Does the site conform to the approved land use plan of the city/municipality/county?	
Are there existing structures or developments around the project site? If yes, please list them in the space below or in the opposite space.	

What is the present land use of the area?

[ ] Prime Agriculture Land
[ ] Grassland
[ ] Built-up
[ ] Game Park/Reserve
[ ] Others, pls. specify _____
[ ] Plantation
[ ] Wetland
[ ] Fishpond

4.2 Biological Environment

Are there existing trees and other types of vegetation in the site? If yes, please provide examples.
Are there birds and other forms of wildlife found in the area?
Is the site near or within a watershed or forest reservation area? If near only, how near? _____ m or km If within, indicate name of the watershed or forest reservation area.

If answer is yes to the above answers, please provide examples of these species (common or local name) in the table provided below.

Birds and Other Wildlife	**Trees and Other Important Vegetation**	**Fishery Resources**
1.		
2.		
3.		
4.		
5.		

4.3 Socio-Economic Environment

Components/Parameters	**Total Number**
Are there existing settlements in the project area? [ ] Yes [ ] No If yes, how many households or families?	
What is the total population of the area(s) covered by the project?	
Average family size:	
What are their source(s) of livelihood? Livelihood Type [ ] farming [ ] fishing [ ] backyard poultry and piggery [ ] vending / buy and sell [ ] Kiosks/provision stores [ ] others, please specify: _____	

Are there existing social infrastructures in the area? [ ] Yes [ ] No

If yes, what are these social infrastructures? (please Check)

[ ] schools [ ] communication (e.g. radio, TV, mail, newspaper)
[ ] health centres/clinics [ ] churches/chapel/mosque/temple
[ ] hospitals [ ] roads
[ ] transportation [ ] others, _____

Prediction of Impacts and Proposed Mitigation Measures

Project Phase/ Activities	Predicted and Assessed Impacts	Proposed Mitigation Measures
Site Preparation	Vegetation Loss	[ ] Landscaping the area [ ] Minimal cutting of trees [ ] Confine disturbance to area that will be utilized [ ] Transfer of trees that can be transferred, compensate those with commercial value
	Siltation	[ ] Provide sediment traps or straw bale barrier [ ] Provide protection of stockpile or minimize stockpiling
	Erosion	[ ] Stabilize excavated soil [ ] Construction of structural prevention
	Noise Generation of Equipment (please specify the type and number of equipment	[ ] Construction to be done during daytime only [ ] Proper maintenance of construction equipment [ ] Provide noise barriers in work areas
	Dust Generation	[ ] Regular sprinkling of water within the work areas
	Slope modification	[ ] Minimize land modification following established design consideration
	Waste generation	[ ] Reduce, reuse and recycle materials [ ] Proper disposal of wastes
	Blocking or drainage pattern alteration	[ ] Follow established design consideration [ ] Proper housekeeping after one activity
	Others (please specify)	[ ] Others (please specify)
Underground cable installation	Vegetation Loss	[ ] Landscaping the area [ ] Minimal cutting of trees [ ] Confine disturbance to area that will be utilized [ ] Transfer of trees that can be transferred, compensate, compensate those with commercial value
	Siltation	[ ] Provide sediment traps or straw bale barrier [ ] Provide protection of stockpile or minimize stockpiling
	Erosion	[ ] Stabilize excavated soil [ ] Construction of structural prevention
	Noise Generation of Equipment (please specify the type and number of equipment	[ ] Proper maintenance of construction equipment [ ] Provide noise barriers in work areas [ ] Construction to be done during daytime only
	Dust Generation	[ ] Regular sprinkling of water within the work areas
	Waste generation	[ ] Reduce, reuse and recycle materials [ ] Proper disposal of wastes
	Slope modification	[ ] Minimize land modification following established design consideration
	Blocking or drainage pattern alteration	[ ] Proper housekeeping after one activity [ ] Follow established design consideration

Project Phase/ Activities	Predicted and Assessed Impacts	Proposed Mitigation Measures
	Traffic congestion	[ ] Coordination with LGUs or concerned agencies (please specify) [ ] Putting of signages in strategic areas [ ] Proper scheduling of delivery of materials
	Others (please specify)	[ ] Others (please specify)
Building/Tower Construction	Noise generation (please specify the type and number of equipment	[ ] Proper maintenance of construction equipment [ ] Provide noise barriers in work areas [ ] Construction to be done during daytime only
	Dust Generation	[ ] Regular sprinkling of water within the work areas
	Waste generation	[ ] Reduce, reuse and recycle materials [ ] Proper disposal of wastes
	Handling of construction material will pose hazard to nearby residents	[ ] Proper handling of materials based on recommendations of the manufacturers
	Others (please specify)	[ ] Others (please specify)

Abandonment Plan

Project Life or Service: _____ years

Provide description of the Abandonment activities, such as, dismantling and waste disposal.

Value of removal bond and environmental restoration bond
_____

d) Guideline Public Consultation

This guideline is provided to assist communication service providers/operators in developing and implementing appropriate consultation plans for individual infrastructure.

i) Desired outcomes

In the design and installation of radiocommunications infrastructure the objectives of public consultations are to:

a) inform and receive input from Interested and Affected Parties of the proposed project;

b) provide adequate time for Interested and Affected Parties to consider and engage in meaningful dialogue on the project;

c) maximize the level of accurate and accessible information about the project to affected communities;

d) identify and attempt to resolve potential issues early in the planning process; and

e) obtain mutually acceptable outcomes on individual projects.

When considering the desired outcomes it is to be recognized that a consultation program will not always:

— satisfy all participants; or

— resolve all differences of opinion or values.

ii) Determining size and scope of consultation plan

An operator's consultation plan for each site should be open and transparent. The size and scope of the consultation plan should be weighted against the likely impact the proposal will have on directly affected parties, relevant stakeholders and community sensitive locations.

iii) Stakeholder analysis

At an early stage in the planning process, a stakeholder analysis should be undertaken to identify who the interested parties may be and the potential for concerns to be raised about a particular proposed facility. The greater the likelihood for concern, the greater the extent and nature of the consultation with stakeholders that is required.

Factors that should be considered in the stakeholder analysis include:

a) Clear identification of the proposal including consideration of the nature and siting of the facility.

Some examples of facilities which previously have been shown to be sensitive are large visually prominent facilities located very close to where people live.

b) Adjacent land uses and any sensitive land uses nearby.

Some examples of sites which previously have been shown to be sensitive are residential areas, child carecentres, schools, aged care centres and hospitals.

c) Identification of potentially Interested and Affected Parties at or near the proposed facility.

It is critical that a thorough search is undertaken to identify both individuals, organizations or stakeholder groups in a locality who are potentially affected Self help groups, Parent Groups, Sporting Groups, tenants, Occupational Health & Safety Committees, Land Boards and residents in adjacent areas but living in proximity to a proposal have previously identified themselves as affected parties. Local Authority is a good source of information about potentially affected parties in a locality.

d) Possible concerns of those individuals or groups.

Some examples of concerns that have been previously raised include health, visual amenity, potential noise and property values.

e) The community history of the locality.

Examples of sites which have previously shown to be sensitive include localities where inadequate community consultation was undertaken in the past or where the community may have been required to deal with previous trauma and loss such as bushfires or have been involved in a controversial development such as a road proposal.

f) Any regulatory controls at the locality.

Examples of sites which previously have been shown to be sensitive include heritage areas, scenic protection areas and national parks. The operator should make every effort to integrate the consultation strategy with the requirements of local planning controls and State Planning and Environmental legislation.

Engagement in seeking views of Local Council and engaging in meaningful dialogue will facilitate the development of an appropriately scoped consultation strategy.

iv) Consultation tools

The following table summarizes a number of consultation tools that can be selected to appropriately communicate with identified individuals and stakeholder(s). The number and type of tools to be used for any one proposal is dependent on the nature of the proposal and the potential level of concern and the stakeholders identified.

In all instances it is important that both verbal and written communications are clear, easy to understand and that opportunities for input and feedback are clearly stated. Further these communications should include ways the community can get additional information from a variety of sources.

Consultation tools

Notify immediate residential neighbours
Advertising in local paper
Community newsletters
Door-to-Door
Posted letters to individual residents/landowners
Consult Ward Councillors
Consult with other relevant Councillors
Consult Tenant stakeholders
Notify community representatives
Consult with community representatives
Notify representatives of sensitive activities
Council presentations
Consult residential committees/Associations
Open House
Consult with Members of Parliament
Forming Community Representative Committee
Public Meetings & Barazas

v) The Consultation plan

Once the stakeholder analysis has been completed, the proposed consultation plan can be developed. Key areas that need to be addressed in the plan that is to be submitted to NEMA include:

a) Background to the proposal including description of the current preferred proposal and the history and evaluation of alternative sites so far investigated.

b) Informal consultations so far undertaken (if any).

c) Consultation Plan Outline including who will be consulted, what consultation tools/methods will be used, stakeholder feedback opportunities and timeframe of consultation.

d) Carrier response to public feedback i.e. how the operator proposes to address concerns, evaluate the public response.

e) How the operator will report to NEMA on consultation.

e) Guideline on Visual Impact mitigation Measures

Objectives	**Performance criteria**
Visual amenity	
To minimize any detrimental impact upon the visual amenity of a locality by reducing prominence of communication infrastructure	The location of infrastructure is within existing utility corridors and sites and uses existing infrastructure, unless a need to do otherwise is demonstrated. Aerial communication lines or additional supporting structures are erected and operated in residential and commercial areas only where overhead cables operated by other utilities are in existence. Best practice methods are used to reduce the visual impact of infrastructure or to conceal infrastructure within the surrounding natural or built environment. Clearing for infrastructure corridors and facilities is minimized to limit visible prominence while responding to functional and safety requirements. Infrastructure: — avoids skyline positions (i.e. where a structure would be seen in silhouette); — crosses hills diagonal to the principal slope or crosses at the low point of a saddle between hills; or — is located around the base of hills or along the edge of existing clearings; unless a need to do otherwise is demonstrated.
To protect important public views such as vistas to significant public buildings, streetscapes and heritage areas.	Communication infrastructure does not intrude into identified important public views or measures are taken to minimize intrusion.
To avoid obstruction of private views from the building line/principal windows by telecommunication lines.	Placement of telecommunication lines avoids or minimizes obstruction of private views.
Residential amenity	
To protect residential amenity	Infrastructure servicing a network (facilities not requiring installation on an individual street basis) is not located in residential areas unless a need to do otherwise is demonstrated.

Objectives	Performance criteria
Environmental values	
To protect threatened species or species at risk of becoming a threatened species *and the habitats,* ecological communities or places essential to their continuing existence.	The proposed infrastructure does not adversely impact on identified threatened species or species at risk of becoming a threatened species.
To protect areas identified as having significant natural values.	The proposed infrastructure does not adversely affect areas identified as having significant natural values.
To protect flora and fauna, habitats and ecological communities.	The proposed infrastructure uses best practice environmental management to minimize harm to the environment.
Land stability	
To ensure that communication infrastructure does not cause land instability.	Communication infrastructure (including specific access routes) does not cause erosion or cause land instability during installation and operation. Communication infrastructure is not located in areas of known unstable land where the risk is identified as unacceptable for development or installation of infrastructure.
Agricultural land	
To protect the productive capacity and efficient farming operations of agricultural land.	Infrastructure installation and operation does not degrade or restrict the productive capacity of agricultural land. Infrastructure is placed on property boundaries or fence lines (not including road alignment boundaries).
Heritage values	
To protect items, places or areas identified as having aboriginal, natural, cultural, or maritime heritage significance.	Proposals for construction and operation of communication infrastructure are approved by the Heritage Council in accordance with the requirements of the relevant Kenyan Laws.
Access	
To ensure that communication infrastructure does not impede movement of vehicular and other modes of transport.	The location of aerial communication infrastructure allows adequate clearance for vehicular traffic and will not pose a danger or encumbrance to other land users or aircraft.

f) Guideline on the preparation and submission of the Project Report

This section guides the project proponent on how to fill-up and answer the various questions and information stated in the checklist. This section also informs the project proponent on permit requirements that need to be attached to the Checklist. Likewise, it directs the proponent where to submit the Project Report Checklist and apply for an EIA Certificate, the system and timeframe for NEMA processing.

An EIA project report may only be prepared for areas or sites where a SEA report has already be prepared.

1 Contents of the Project Report Checklist

The Project Report Checklist is a simplified form designed to assist proponents' of selected projects in complying with the EIA requirements. The Project Report Checklist, to be accomplished and submitted before undertaking a project, consists of a series of questions that deals with issues and concerns about the proposed project and its environment. The questions will also provide the proponents with information on environmental impacts, both positive and negative, which will be caused by the proposed project. The Project Report Checklist has to be submitted by all government and private sector proponents applying for an EIA Licence covering projects listed under the 2nd schedule of the EMCA. The information contained herein will serve as basis for NEMA to make decision on the application for EIA Certificate.

The Project Report Checklist is divided into five (5) major sections:

— Section 1: Required Information — consist of the attachments required to be submitted as part of the Project Report Checklist

— Section 2: General Information — presents the project title, name and address of the project proponent, proponent's contact person and the location of the project;

— Section 3: Project Description — presents the plan/design components and activities during the construction and operation phases of the project;

— Section 4: Description of Project Surroundings — describes the existing physical, biological and socio-economic conditions where the project will be located;

— Section 5: Predicted and Assessed Impacts and Proposed Mitigation Measures — describes the possible impacts that are likely to occur in various stages of the project development and the corresponding mitigation and enhancement measures to prevent and/or minimize the occurrence of adverse impacts and strengthen the positive effects of the project;

2 Instructions on the Preparation of the Project Report Checklist

2.1 For the Section 1: Required Information, write a check mark (4) on the title or description of the document to be submitted. The listed documents are MUST requirements and should be submitted. Otherwise, the application will not be accepted.

2.2 The Project Report Checklist can be prepared by the proponent or any of his/her authorized representative as per NEMA procedures. The proponent's signature in the report shall be sufficient. The proponent may seek the help of NEMA personnel by clarifying questions in the Project Report Checklist.

2.3 To use the Checklist, the proponent may put a check (4) mark in the appropriate box. If your answer does not fall in any of the pre-determined responses, check (4) OTHERS and indicate your specific answer in the blank space provided or use additional sheets as necessary. If some questions are not applicable to your project, write N/A on the blank space or column.

2.4 To facilitate and assist the proponent in answering Section 5 of this checklist, a menu is provided to serve as guide and reference. However, it should be noted that this only serves as a menu checklist hence, the proponent is highly encouraged to identify additional impacts and mitigation/enhancement measures other than those provided.

The proponent may put a check (4) to the columns of Y or N on the pre-determined and identified Mitigation/Enhancement measures column. The proponent may choose the mitigating measures appropriate to the impacts identified for the proposed project. He/She may provide explanatory notes in the column of REMARKS.

2.5 Answers to the questions are not be strictly confined to the pre-determined responses. The proponent may elaborate and use as many additional sheets as needed to be able to provide adequate answers to the required information. Maps, pictures, drawings (e.g. charts, tables, diagrams, sketches) and other visual aids are deemed to provide better description of the information provided in the Checklist. These will help NEMA in understanding the proposed project, and make decision on the application for EIA Certificate.

3 Instructions on the submission of the Project Report Checklist

3.1 Upon completion of the Project Report checklist, the project proponent shall submit one (1) set of the Checklist at the EIA Section of NEMA. A duly accomplished Procedural Screening Form shall accompany the Project Report Checklist submission.

3.2 Upon the presentation/submission of the Checklist, the Screening/Verification Officer shall immediately determine its completeness and conformance with NEMA prescribed requirements. Immediate determination shall mean completion of the Procedural Review within the same day of Project Report checklist submission.

3.3 The Screening Officer shall indicate, through a check/tick mark under the Yes, No or Not Applicable column, the presence or absence of a particular information required.

3.4 The determination of the completeness of the Project Report Checklist will be based on the sufficiency of responses to all questions or checklist and information provided in the matrix.

3.5 If the Project Report Checklist is complete, it will be formally accepted. The proponent will be furnished a copy of the accomplished procedural form duly signed by the Screening Officer.

3.6 If the Checklist is incomplete, it shall be immediately returned to the proponent for revision or submission of the missing requirement/information. The reason for non-acceptance shall be stated in writing at the appropriate place in the form.

3.7 If the Project Report Checklist has complied with all NEMA prescribed requirements, the proponent shall submit 3 copies of the documents to EIA Section of NEMA.

The proponent shall pay the applicable fees at the Cashier Section of NEMA upon submitting the required number of copies at the Record Section of the same office.

3.8 All Project Report Checklist not following the said standard procedures shall not be considered as valid applications and therefore, shall not be used as a basis for recommendation on the issuance or denial of the EIA Certificate.

3.9 The project proponent or his duly recognized representative shall be the one who will follow-up the said application at NEMA Offices. The processing time including the issuance and/or denial of the EIA Certificate will take a maximum of 45 days.

3.10 The EIA Section of NEMA, in the course of substantial review, may conduct site visit or ocular inspection in coordination with the project proponent and concerned NEMA Regional Office.

3.11 If NEMA finds that the Project Report Checklist has substantially addressed all the significant impacts and relevant issues by way of mitigation and enhancement measures, it shall recommend the issuance of the EIA Certificate. NEMA may call for a Technical Conference to explain to the project proponent the relevance of the EIA and the various conditions stated therein for compliance by the project proponent.

g) Guidelines for undertaking of the Annual Environmental Audit

1. Ensure that the report is signed by both the proponent and the Expert
2. Adequately describe the facility
3. Adequately describe the various activities, processes and operations at the site.
4. Comprehensively describe the location of the facility
5. Consult the immediate neighbours indicating their proximity, detailed questionnaires, ID numbers and signatures
6. Provide detailed baseline information of the site, including the background RF radiation levels at the site in accordance to the prediction format attached.
7. Identify the actual negative and positive impacts due to the activity
8. Provide the requisite mitigation measures for the negative impacts
9. Identify the relevant legislation and indicate status of compliance to them
10. Describe all the socio-economic activities related to the facility
11. Provide a comprehensive environmental Management plan including remedial measures objectives, time plan and budget
12. Ensure that all occupational health and safety issues related to the facility are covered
13. Provide a comprehensive decommissioning plan (budgeted)
14. Indicate whether the facility has an environmental management system

RF Prediction guideline

As a general rule all infrastructure should be designed and installed having regard to the requirements of KS 1847.

EME report format

Summary of Estimated RF EME Levels around the *Carrier* Mobile Phone Base Station at *Location*
Issue Date:
Introduction: *This report summarizes the estimation of maximum cumulative radiofrequency (RF) electromagnetic energy (EME) levels at ground level emitted from the existing and proposed antennas at the Operator Mobile Phone Base Station at Location. Maximum EME levels estimated are at distances of 5m, 50m, 100m, 200m, 300m, 400m, and 500m from the base station. The procedures for making the estimates have been developed by the Australian Radiation Protection And Nuclear Safety Agency (ARPANSA). These are documented in the ARPANSA Technical Report; "Radiated EME Exposure Levels — Prediction Methodologies" which is available at http://www.arpansa.gov.au* **EME Health Standard** *ARPANSA, an agency of the Commonwealth Department of Health has established a Radiation Protection Standard specifying limits for continuous exposure of the general public to RF transmissions at frequencies used by mobile phone base stations. Further information can be gained from the ARPANSA web site.* NOTE: The basic restrictions in the ARPANSA Standard are the same as those in KS 1847-1 on which the mandatory limits in these guidelines are based. **Existing Site Radio Systems**

Carrier GSM 900				
Carrier GSM 900				

etc				

Table of Predicted EME Levels – Existing

Distance from Carrier antennas - bearing x˚ (m)	Maximum Cumulative EME Level - All Carriers (% of ARPANSA standard)	
5		
50		
100		
200		
300		
400		
500		
Maximum EME level (y m x° from Carrier antennas)		

NOTE: This estimation is for the maximum level of RF EME at 1.5m above the ground from the existing antennas. The estimated levels have been calculated on the maximum mobile phone call capacity anticipated for this site. This estimation does not include possible radio signal attenuation due to buildings and the general environment. The actual EME levels will generally be significantly less than predicted due to path losses and the base station automatically minimizing transmitter power to only serve established phone calls.

Summary – Existing Radio Systems

RF EME levels have been estimated from the existing antennas installed at *Location*. The maximum cumulative EME level at 1.5 m above ground level is estimated to be z % of the ARPANSA reference level limit. This level complies with the limit specified in the ARPANSA Standard. The predicted levels also comply with the reference levels mandated by the Australian Communications Authority for mobile phone base stations.

Summary of Estimated RF EME Levels around the *Operator*
Mobile Phone Base Station at *Location*

Issue Date

Proposed Site Radio Systems

Carrier 3G			
Carrier CDMA			

Table of Predicted EME Levels — Existing & Proposed

Distance from Carrier antennas - bearing x° (m)	Maximum Cumulative EME Level - All Carriers (% of ARPANSA standard)
5	
50	
100	
200	
300	
400	
500	
Maximum EME level (y m x° from Carrier Antennas)	

NOTE: This estimation is for the maximum level of RF EME at 1.5m above the ground from the existing antennas. The estimated levels have been calculated on the maximum mobile phone call capacity anticipated for this site. This estimation does not include possible radio signal attenuation due to buildings and the general environment. The actual EME levels will generally be significantly less than predicted due to path losses and the base station automatically minimizing transmitter power to only serve established phone calls.

Summary — Existing & Proposed Radio Systems

RF EME levels have been estimated from the existing and proposed antennas installed at Location. The maximum cumulative EME level at 1.5 m above ground level is estimated to be z % of the ARPANSA reference level limit. This level complies with the limit specified in the ARPANSA Standard. The predicted levels also comply with the reference levels mandated by the Australian Communications Authority for mobile phone base stations.

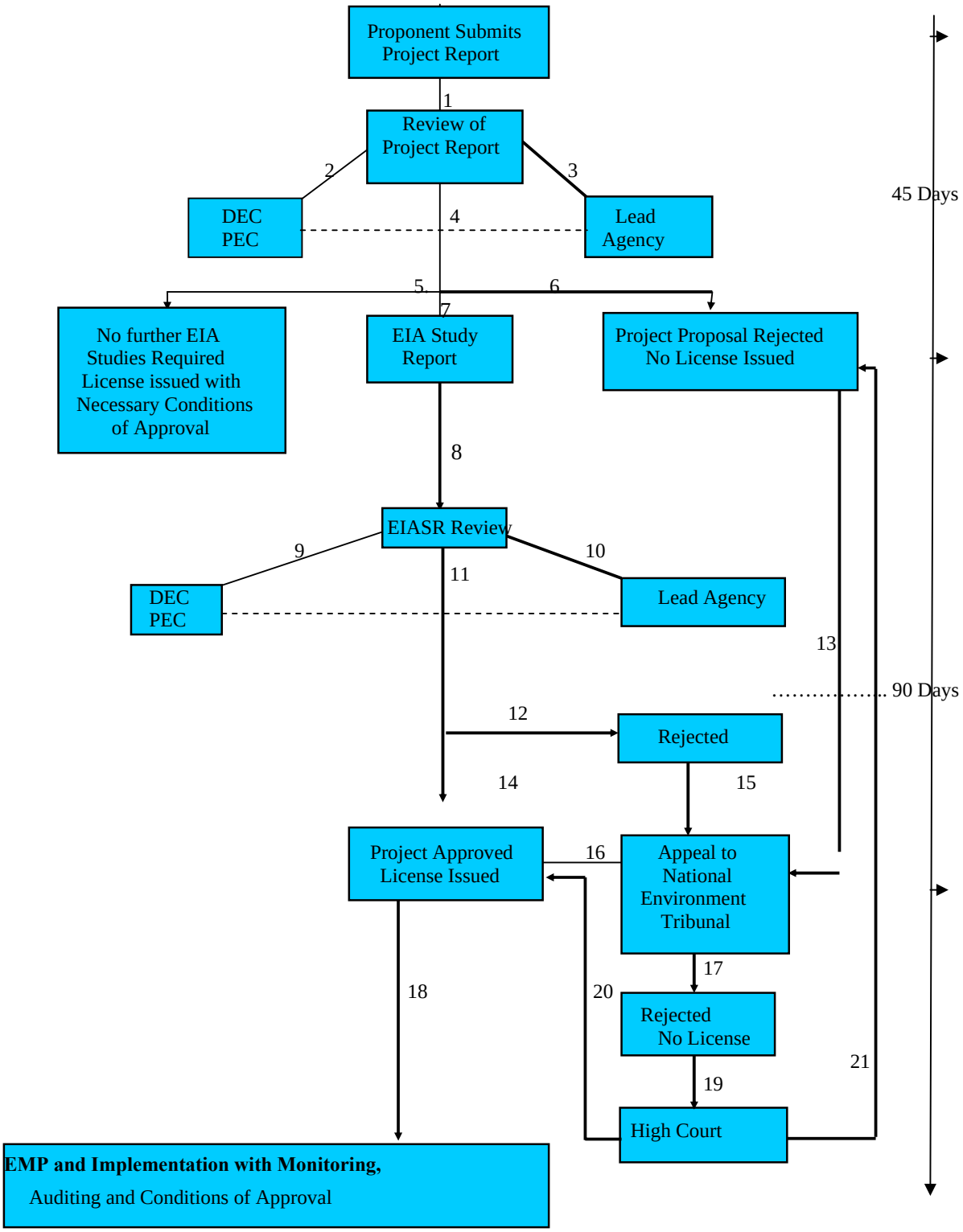
Reference Notes:

1. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) is a Federal Government agency incorporated under the Health portfolio. ARPANSA is charged with responsibility for protecting the health and safety of people, and the environment, from the harmful effects of radiation (ionizing and non-ionizing).

2. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), 2002, 'Radiation Protection Standard: Maximum Exposure Levels to Radiofrequency Fields — 3 kHz to 300 GHz', Radiation Protection Series Publication No. 3, ARPANSA, Yallambie Australia. [Printed version: ISBN 0-642-79400-6 ISSN 1445-9760] [Web version: ISBN 0-642-79402-2 ISSN 1445-9760]
3. The EME predictions in this report assume a worst-case scenario being:
— base station transmitters operating at maximum power (no automatic power reduction)
— simultaneous telephone calls on all channels
— an unobstructed line of sight view to the antennas.

In practice a worst-case scenario is rarely the case. There are often trees and buildings in the immediate vicinity, and cellular networks automatically adjust transmit power to suit the actual telephone traffic. For these reasons, care should be taken when comparing prediction reports & actual measurements, as the predicted levels will often be considerably higher.

Flow Chart on the EIA Review Process



Key

1. Submission of Report

- Dully filled EIA license application forms (Form III for EIA project report and Form IV for EIA study report)
- 10 No. Hard copies signed by both proponent and expert
- 1 No. soft copy
- Official receipt for prescribed fee of 0.1% of project cost
- LR Number (where applicable)
- Reports received, given a reference number and acknowledgement letter is issued.
- Application details are entered into a register and a file is opened

2. DEO/DEC Comments

- Report forwarded to District Environment Officer (DEO)/ District Environment Committee (DEC) for comments within seven days
- DEO/DEC prepare comments and field visit reports and submit within the next 21 days for PR

3. Relevant Lead Agencies Comments

- Report forwarded to relevant lead agencies for comments within seven days
- PR report deemed due for review after 33 days
- EIA reports are due for review one week after lapse of public comments duration (30 to 60) days

4. EIA Project Report Review

- PR report deemed due for review after 33 days
- Comments from DEOs, lead agencies and the EIA report are examined
- Review comments (issues) are sent to the proponent to address EIA processing time stops running

5. Review Outcome - Approval

- Conditions for approval are prepared and sent to proponent for acceptance
- License prepared and sent to proponent

6. Review Outcome - Rejection

- A letter with reasons for rejection is sent to the proponent

7. Review Outcome - EIAS

- A letter requesting the proponent to prepare Terms of Reference (TOR) and submit to NEMA for approval is sent to proponent
- TORS submitted
- TORS Reviewed and approved

8. Advertisement of EIASR

- Advertisement is prepared and given to proponent to place in a national newspaper and in Kenya Gazette

9. DEO/DEC Comments on EIAS

- EIAS report forwarded to DEO/DEC for comments within seven days
- DEO/DEC prepare comments and field visit reports and submit within the next 30 days for EIASR

10. Relevant Lead Agencies Comments

- Report forwarded to relevant lead agencies for comments within seven days
- EIA reports are due for review one week after lapse of public comments duration (30 to 60) days

11. EIAS Report Review

- EIAS reports are reviewed
- Comments from DEOs, lead agencies and the EIAS report are examined
- Review comments (issues) are sent to the proponent to address.
- EIA processing time stops running
- Once issues are adequately addressed conditions for approval are prepared and sent to proponent for acceptance

12. EIAS Report Review Outcome - Approval

- Letter forwarding approval conditions prepared and sent to proponent

13. EIAS Report Review Outcome - Rejection

- A letter with reasons for rejection is sent to the proponent

14. EIAS Report Review Outcome - Appeal

- Proponent can appeal to NET

15. Appeal on EIAS Review Outcome

- Proponent appeals to the National Environment Tribunal

16. NET Outcome

- NET can recommend approval of the project
- EIA licence issued to proponent

17. NET Outcome

- NET recommends rejection of the project
- No EIA licence

18. Approval Conditions

- Letter forwarding approval conditions prepared

19. Appeal to High Court

- Proponent appeals to the High Court on NET decision

20. High Court Outcome

- High Court recommends approval of the application
- EIA licence issued to proponent

21. High Court Outcome

- High Court recommends rejection of the application
- No EIA licence

Annex F (Normative) — Factors considered in granting special exemption

1. Height of the proposed tower/antenna.
2. Proximity of the tower/antenna to residential structures and residential district boundaries;
3. Nature of uses on adjacent and nearby properties;
4. Surrounding topography;
5. Surrounding tree coverage and foliage;
6. Design of the tower/antenna, with particular reference to design characteristics that have the effect of reducing or eliminating visual obtrusiveness;
7. Proposed ingress and egress; and
8. Availability of suitable existing towers, buildings and other structures, in order to avoid the siting of new towers or structures, as discussed in 6.3.2.1.

Annex G (informative) – Radiofrequency radiations and health concerns

1. The issues

There are concerns regarding this topic from a number of viewpoints. From the public perspective the concerns relate to the extent to which radio frequency (RF) emissions from mobile phone base stations (MPBS) pose a health hazard and whether masts should be positioned away from sensitive sites such as schools and nurseries.

The main issues from the scientific view point relate to determining the significance of reported effects on cells, tissues and laboratory animals from very low level mobile phone band RF emissions in experimental situations and assessing the relevance of these effects to human health.

From regulatory and policy stand points the issues relate to determining which guidelines are appropriate for regulating the output of MPBS masts and deciding whether there is a case for applying a "precautionary approach" to the siting of masts.

2. General

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

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

RF field exposures from base stations beyond the "near field" (i.e. the "far field" which exists more than about 30 cm from the antenna) fall off very rapidly, and by about 10 metres from the antenna are usually orders of magnitude lower than the exposures which can result from using a mobile phone. The power output from a base station is not constant and varies according to the number of separate channels (ranging from 20 to 50) in use at any one point and the power output per channel. The maximum output will occur when all channels are in use simultaneously linking to distant mobile phone handsets.

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

— The power output, frequency and type of RF transmitter.

— The type of antenna and beam direction.

— The distance between a person and the antenna.

— The location of a person relative to the beam.

— The proximity of structures near a person which may reflect signals or shield them from the beam.

— The time spent in the RF field.

3. Health effects

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

There is however, a growing body of scientific evidence which suggests that other effects can occur in cells and tissues following exposure to RF fields, which occur at levels considerably below the intensities normally associated with the known "thermal" effects. These very low level effects are termed "non-thermal" effects. They occur at levels

so low that there is not enough energy to increase the temperature of a cell, tissue or organism and yet they appear to generate physical or bio-chemical changes.

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

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

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

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

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

4. Principles of good practice

The current UK guidelines on the safe use of mobile phone technology have been developed by the National Radiological Protection Board (NRPB). These are based on NRPB's assessment of existing, conclusive, scientific evidence. This guidance sets standards which, if adhered to, should prevent the risk of being exposed to thermal effects from RF fields. The derivation of guideline limits is complex and a variety of measurement units are used. The favoured unit of measurement relates energy deposition to tissue mass, known as the Specific Absorption Rate (SAR) expressed as watts per kilogram (Wkg^{-1}). NRPB advises restricting RF emissions such that human exposure should be less than 0.4 Wkg^{-1}. As it is not possible to measure SAR in the environment, other parameters are used instead, primarily "power density" expressed as watts per square meter (Wm^{-2}) or field strength, expressed as volts per metre (Vm^{-1}). The SAR limits set by NRPB equate to limiting the power density levels from a base station to 33 Wm^{-2} (or 112Vm^{-1}) for 900 MHz emissions and 100 Wm^{-2} (or 194Vm^{-1}) for 1800 MHz emissions. The aim of these guidelines is to limit any potential temperature rise in human tissue, following exposure, to less than 0.1 °C.

The International Committee on Non-Ionizing Radiation Protection (ICNIRP) has also produced guidelines, based on the same data as used by NRPB. The ICNIRP accept that 0.4 Wkg^{-1} is a suitable limit for occupational exposure based on an 8 hour working day. The ICNIRP however also concluded that in order to protect groups who could be more vulnerable to thermal effects, such as children and the elderly, the guideline for the general public should be 0.08 Wkg^{-1} or one fifth of the NRPB limit. The general public were assumed to be potentially exposed for longer periods and hence to need an additional safety reduction factor built in. NRPB reject the ICNIRP reasoning for a lower limit to protect the general public and insist there is no scientific basis for any further safety reduction factor.

Much of Europe, North America and Australasia have adopted the ICNIRP limits which are stricter than those of NRPB. Italy has recently enacted legislation setting considerably stricter guidance and has also set threshold limits based on the proximity of masts to vulnerable sites including schools, nurseries and hospitals.

A variety of comprehensive reviews of this topic have been undertaken internationally including by The Royal Society of Canada, and the WHO International EMF Project and NRPB. The consistent conclusion of such reviews is

that there is insufficiently robust data on low level effects to form the basis for credible safety limits. They maintain that the only valid criteria to base safety limits on are the recognized, accepted and conclusive "thermal effects".

It is generally accepted that energy levels measured in the "far field" will be orders of magnitude below either the NRBP or ICNIRP guideline limits. Studies have found that exposures at ground level near single base stations have generally been in the region of 10 milliwatts per square meter (mWm^{-2}) or less and highest measured exposures have occurred between 30 and 250 meters from the base of a tower. Levels inside apartments with antennas mounted on the outside walls, and in top flats with windows facing antennas at about the same height on adjacent buildings, have been measured as high as 15 Vm^{-1} (600 mWm^{-2}), although such high levels are rare. The measurements at sites where there are multiple co-located antennae will be considerably higher than those from a single installation.

Setting simple distance limits as a means of regulating mast locations is problematic. In densely populated urban areas, a simple distance limit may not be practical. It is more important to ensure that energy levels are minimized (i.e. significantly below current NRPB guidelines) for example by ensuring that masts are high enough to minimize energy levels at points where the beams reach ground level or impinge on surrounding buildings.

Although measured levels are considerably below existing (thermal effect based) guideline thresholds, the levels are in the ranges where non-thermal biological effects could theoretically occur. The case for much stricter guidelines is based on maintaining emission levels below those at which even non-thermal effects may occur. The strictest guideline currently in operation in Western Europe is in Italy, which has set a level of 6 Vm^{-1} (0.1 Wm^{-2}) in urban areas explicitly to take account of non-thermal effects.

There is debate about which aspect of RF emissions is the most significant in terms of non-thermal effects. Measures of power density are considered by some to be less meaningful than measures of field strength. Fluctuations in field strength (Vm^{-1}) may be more important in terms of generating biological effects at the very low energy levels such as those encountered from base stations, whereas power density is likely to be more relevant at the higher energy levels associated with thermal effects.

Levels even lower than the Italian limit of 6 Vm^{-1} are also advocated. A limit of 3 Vm^{-1} has been proposed on the basis that this is current regulation level to which sensitive electronic equipment is built to withstand. Such equipment has to be able to cope with 3 Vm^{-1} without its performance being affected. This is a limit which the industry already has to work to and is therefore a practical and technically achievable target with existing technology.

In essence the debate centres on whether guidelines should be based on the "precautionary principle". This suggests that, given the degree of scientific uncertainty, exposure levels should be set at the absolute minimum to minimize any potential non-thermal adverse effects, rather than being set at the higher threshold level derived on the basis of known thermal effects.

5. Recent developments

The existing planning system has enabled mobile phone companies to erect masts in sites which could be deemed "sensitive" and against the wishes of local residents. This has in part lead to anxiety and concern being expressed particularly where sites are close to schools. Irrespective of the grounds for such concerns, such anxiety and worry could in itself be deemed an adverse health effect consequent upon the mobile phone companies' decisions to use the authority of the planning system to site masts where they chose.

6. Recommended approaches

Local Authorities and Health Boards have to determine what constitutes a reasonable approach to this issue for their local population.

The case for adopting a "precautionary approach" is persuasive. The basic precautionary principle of maintaining RF emissions at the lowest possible levels, which are technically achievable and practicable, is entirely justifiable from a public health protection standpoint. Adoption of such an approach allows for flexibility in the future to raise thresholds when sufficiently robust scientific evidence of safe levels becomes available. A "precautionary approach" would ensure that in the meantime any risk of potential adverse health effects, no matter how small, is kept to the absolute minimum. This is a fundamentally different approach to using existing scientific knowledge as the basis for setting upper limits, which will only be revised downward on the basis of further conclusive scientific evidence of harmful effects. The approach currently advocated by NRPB may be deemed scientifically rigorous. However, it could not be deemed consistent with the precautionary principle.

There is a reasonable case therefore, for revising current guidelines downwards. As a first step to establishing revised guidelines, the minimum standards in the UK should be made consistent with the recommendations of the ICNIRP, and as recommended by the House of Commons Select Committee on Science and Technology in 1999. Consideration should then be given to establishing guideline levels for the UK which take account of the non-thermal biological effects and which minimize the potential exposure of the general public to RF fields from mobile phone technology. Levels in the order of 3 Vm^{-1} to 6 Vm^{-1} should be considered to achieve this aim.

On the basis of existing information the following are suggestions for action at local level:

— Fixed Wireless and Mobile phone companies should be encouraged to provide monitoring data proving that their installations meet with, at the very minimum, existing guidelines.

— Fixed Wireless , Mobile phone companies and other communication service providers should be encouraged to seek the views of local residents regarding the siting of new masts and should be encouraged to show sensitivity to their concerns.

— Fixed Wireless , Mobile phone companies and other communication service providers should be encouraged to look for sites which minimize potential exposure of local residents as far as is practically possible and avoid proximity to sensitive sites.

— Fixed Wireless, Mobile phone companies and other communication service providers should be encouraged to consider technical options to minimize the need for additional masts, such as mast sharing.

— The siting of existing masts particularly where these are on, or near, sensitive sites should be reviewed and mobile phone companies should be encouraged to find alternative sites where possible. Any existing masts on such sensitive sites should be high enough to ensure minimal energy exposures at ground level.

— Mounting of antennas on building walls should be discouraged where rooms immediately behind such walls will be occupied by people on a regular basis.

— Consideration should be given to developing a monitoring strategy, particularly within city areas, in order to monitor trends over time in the background levels of RF emissions.

7. Radiations from mobile phones

The Stewart Group in UK has concluded that the balance of evidence suggests that for mobile phone users, the exposure to radiofrequency radiation below guideline levels given in the EU Council Recommendation of 12 July 1999 on the limitation of exposure of the general public to electromagnetic fields (0 Hz to 300 GHz) does not cause adverse health effects to the general population. *However, the Stewart Group has also concluded that there is now scientific evidence that there may be biological effects occurring at exposures below these guidelines. This does not necessarily mean that these effects lead to disease or injury but this is important information that needs further study*.

The Stewart Group concluded that it is not possible at present to say that exposure to RF radiation, even at levels below national guidelines, is totally without potential adverse health effects, and that the gaps in knowledge are sufficient to justify a precautionary approach.

Studies by the World Health Organisation have found the following:

8. Health Concerns

Scientific evidence indicates that exposure to RF fields, such as those emitted by mobile phones and their base stations, is unlikely to induce or promote cancers. (WHO fact sheet No. 193, revised June 2000). Since 1960s many epidemiological studies have been done on the health effects associated with exposure to non-ionising radiation. The focus of these studies have included cancer and non-cancer effects on adults and children both occupationally and residentially exposed. These studies conclude that:

a) No clear evidence has been found to suggest that exposure to electromagnetic radiation can cause cancer.

b) Most recent studies find no association of any childhood cancer with exposure to electromagnetic radiation.

c) Results of studies indicating that exposure to radio frequency (RF) fields causes or influences cancer are inconclusive.

(Review conducted by WHO in November 1999, Royal Society of Canada (1995)

One of the effects of radio frequency radiation is heat due to absorption by the body tissue. However, this does not pose a health risk as the body's normal thermo-regulatory process carries that heat away. Reports have also been made of symptoms such as nervousness, disturbed sleep and fatigue associated with use of the mobile phone. However, studies done to prove the association between use of the mobile phone and the above mentioned symptoms remain inconclusive. Further studies continue to be done in the area.

9. Use of mobile phones by children

Studies that have been published by sources of the said normative references in Clause 2 above have concluded that the use of mobile phones by children below 16 years for non-essential calls should be discouraged. The UK Stewart Report has authoritatively said that:

"If there are currently unrecognised adverse health effects from the use of mobile phones, children may be more vulnerable because of their developing nervous system, the greater absorption of energy in the tissues of the head and a longer lifetime of exposure".

10. Use of mobile phones by drivers

Studies that have been published by sources of the said normative references have concluded that the use of mobile phones in cars, even when hands-free kit are used, can increase the chance of accidents due to lack of concentration while driving.

11. Use of mobile phones near essential hospital / medical equipment

Use of mobile phones has been shown to cause interference with vital medical equipment such as cardiac pacemakers and other equipment that produce or employ the use of electromagnetic radiation. In such cases use of the mobile phones, even through hands-free kit, can be hazardous.

There have been numerous studies, discussions, meetings, publications and suggestions regarding the use of portable communication equipment in the vicinity of medical equipment over several years.

General guidance from these forums recommend:

a) Rational management of wireless telecommunication devices in or near hospitals.

b) Pre-market testing of medical equipment susceptibility to electromagnetic radiation.

c) Stringent shielding requirements for medical equipment.

d) Preventing known sources of interference (e.g. cellular phones, handheld transceivers) from coming too close to patient monitors and other sensitive medical devices.

When an electromagnetic interference problem is suspected the device manufacturer should be contacted for assistance.

Annex H (informative) — SAR and power density computation

A mass of body tissue m with density ρ and conductivity σ exposed to an Electric Field strength E will have a specific energy absorption rate given as;

$$\text{SAR} = \frac{\sigma E^2}{\rho} \text{ (W/kg)} \quad \text{(i)}$$

The Specific energy Absorption Rate is averaged over an exposure time and a specified mass of tissue, depending on the tissue region. Averaging times are specified because of the time taken for the temperature of tissues to equilibrate when they are exposed to the radiation. The temperature equilibrium is reached when heat input to the body is balanced by the rate at which it is removed mostly by blood flowing to and from the various parts of the body as discussed earlier in the above document.

Power density *S* is expressed in terms of the Effective Isotropic Radiated Power (EIRP) for an isotropic radiator and the distance *R* from the antenna to give the power density at any point *R* away from the antenna. The expression, called the "inverse square law" is given as;

$$\text{Power density (S)} = \frac{\text{EIRP}}{4\pi R^2} \text{ (W/m}^2\text{)} \quad \text{(ii)}$$

Where Power Density is the power per unit area normal to the direction of propagation/body. EIRP is the product of the transmitter power output and the antenna gain and R is the ground distance from the antenna.

Using the "inverse square law" and Poynting theorem, a relationship can be developed between SAR and EIRP, so that given an EIRP from an antenna, it is possible to calculate the SAR (though not an accurate measure of SAR) on a given mass of tissue at some distance R from the antenna.

Power density **S = E.H** (poynting theorem) (iii)

The amplitude ratio of Electric field to the magnetic field at any time is always a constant and is the free space resistivity given as;

$$\frac{E}{H} = \frac{\sqrt{\mu_0}}{\sqrt{\varepsilon_0}} = 120\pi = 377\Omega = Z_0 \quad \text{(iv)}$$

Permittivity of free space ε_0 8.854 x 10^{-12} F/m

Permeability of free space μ_0 4μ x 10^{-7} H/m

Impedance of free space Z_0 120π or 377 Ω

Therefore, from Eqn (iv)

$$H = \frac{E}{120\pi} \quad \text{(v)}$$

Substituting for H in Eqn. (iii)

$$\text{Power density, S} = \frac{E^2}{120\pi} \quad \text{(vi)}$$

With a measured power density or calculated at some point R from the antenna the value of E from Eqn. (vi) will be

$$\text{E} = \sqrt{(120\pi \times \text{S})} \quad \text{(vii)}$$

and therefore SAR can be given as;

$$\text{SAR} = \frac{\sigma \times (120\pi \times \text{S})}{\rho} \qquad \text{(viii)}$$

Substituting the value of S from Eqn. (ii) into Eqn. (viii)

$$\text{SAR} = \frac{30\sigma \times \text{EIRP}}{\rho \text{R}^2} \qquad \text{(ix)}$$

Where

σ is the conductivity of the mass tissue
ρ is the density of the mass tissue
S is the power density

Annex I (informative) — Checklist for environmental impact report by operators

Item		Comment
1	Type of Facility and location	Location of the facility (antenna and ground installation).
2	Purpose and need for the proposed facility	The need for the facility and its role within a network.
		The anticipated need for, and likely locations of, further installations to provide an overall appreciation of the impact.
		Liaison with other carriers.
		The feasibility of co-location, etc.
		Siting options.
		Installation option.
3	Design	Design drawings of the facility: antenna(s), towers, ground installation, etc.
		Explain choice of structure.
		Details of adjacent land uses.
		Details of any adjacent structures.
		Details of access (roads, etc).
		Description of materials and finishes.
		Details of existing vegetation to be removed or damaged in the vicinity, including identification of any trees to be removed.
		Details of revegetation and site stabilization.
		Arrangement of provision of power to site.
		Details of any external lighting.
4	Description of the physical environment and possible physical impacts	Address potential impacts arising from the construction and maintenance of the facility, (e.g. Flora, fauna, noise, erosion and runoff control, construction of access and power supply, areas of special significance).
		Focus on aspects which are particular to the site.
		Details of measures to protect local environment (including flora and fauna) during construction (e.g. erosion and runoff control, vehicle management, stockpiling and storage).
5	EME [Electromagnetic Energy]	Projected EME levels for proposed sites.
6	Visual Assessment	Assessment of the impact of the proposal in visual terms. Refer to separate checklist.
7	Social Issues (if appropriate)	Discussion of community concerns.
		Impact on areas of special significance.
8	Consultations	Details of consultations with the land owners/occupants.
		Carriers must consult with owners before lodging application.
9	Conclusion and	Summary of the relevant issues.
	Recommendations	Alternative technical and design options.
		Alternative locations including co-location options.
		Discussion of cumulative impacts.
		Recommend actions to mitigate or minimize impacts.
		Justification of the proposal.
		Conclusions.
10	Plans	Location plan.
		Site Plan/Landscape Plan
		Design of facility (plan and elevations of antenna and ground installation).

Annex J (informative) — Principles of the precautionary approach

Terms used in the context of risk assessment are the Precautionary Principle, the Precautionary Approach, Prudent Avoidance and ALARA (As Low As Reasonably Achievable).

For the purpose of this document the Precautionary Principle could be seen as the fundamental precepts upon which a practical precautionary approach could be based.

The issue of risk assessment can be summarized as the weighing up of likely harm based on all available scientific evidence, with the cost of commercial adjustment by the Operator.

The fundamental concept of the Precautionary Principle was summed up in 1992 at the UN Conference on Environment and Development (UNCED) in Rio de Janeiro.

Here, the Precautionary Principle was explicitly recognized and included in the Rio Declaration. It is listed as Principle 15 among the principle of general rights and obligations of national authorities.

"In order to protect the environment, the precautionary approach should be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

The application of the Precautionary Principle requires commitment to the idea that scientific proof of a causal link between human activities and its effect is not required.

1. Australia's Inter-governmental Agreement on the Environment (IGAE) notes:

> *"Essentially, the precautionary principle offers administrators advice about how to act responsibly in the face of uncertainty and lack of full scientific knowledge. Under this Principle, policy makers are advised to use great care when authorizing resource use where the outcomes of that use cannot be predicted with confidence, where one or more of the possible outcomes could have extremely adverse implications for future generations, or where no known substitutes exist for the resource being used."*

And that:

- *Careful evaluation to avoid, wherever practicable serious or irreversible damage to the environment; and*
- *An assessment of the risk-weighted consequences of various actions.*

2. However the European Commission Communication on the Precautionary Principle attempts to establish more detailed guidelines for its application, and to this end notes that:

> *"The Precautionary Principle should be considered within a structured approach to the analysis of risk which comprises three elements: risk assessment, risk management, risk communication. The Precautionary Principle is particularly relevant to the management of risk."*

The Summary notes that:

> *"The issue of when and how to use the precautionary principle, both within the European Union and internationally, is giving rise to much debate, and to mixed, and sometimes contradictory views. Thus, decision-makers are constantly faced with the dilemma of balancing the freedom and rights of individuals, industry and organizations with the need to reduce the risk of adverse effects to the environment, human, animal or plant health. Therefore finding the correct balance so that the proportionate, non-discriminatory, transparent and coherent actions can be taken, requires a structured decision-making process with detailed scientific and other objective information."*

But also that:

> *"The Precautionary Principle applies where scientific evidence is insufficient, inconclusive or uncertain — and preliminary scientific evaluation indicates that there are reasonable grounds for concern that the potentially*

dangerous effects on the environment, human, animal or plant health may be inconsistent with the high level of protection chosen by the EU."

And that:

"In some cases, the right answer may be not to act or at least not to introduce a binding legal measure. A wide range of initiatives is available in the case of action, going from a legally binding measure to a research project or a recommendation.

Where action is deemed necessary, measures based on the precautionary principle should be, inter alia:

— *proportional to the chosen level of protection;*

— *non-discriminatory in their application;*

— *consistent with similar measures already taken;*

— *based on an examination of the potential benefits and costs of action or lack of action;*

— *subject to review, in the light of new scientific data; and*

— *capable of assigning responsibility for producing the scientific evidence necessary for a more comprehensive risk assessment.*

The application of the Precautionary Principle to the siting of radiocommunications infrastructure should include a consideration of the uncertainty of the science on a-thermal effects.

There is a need to balance the requirement for the communication industry to provide adequate service with the need of the community to be ensured of living in an environment that will not be a potential threat to health.

3. The World Health Organization's advice on electromagnetic fields and public health with respect to mobile telephones and their base stations (fact sheet 193 June 2000) includes the following precautionary measures

Precautionary measures

— ***Government****: If regulatory authorities have adopted health-based guidelines but, because of public concerns, would like to introduce additional precautionary measures to reduce exposure to RF fields, they should not undermine the science base of the guidelines by incorporating arbitrary additional safety factors into the exposure limits. Precautionary measures should be introduced as a separate policy that encourages, through voluntary means, the reduction of RF fields by equipment manufacturers and the public. Details of such measures are given in a separate WHO Background document.*

— ***Individuals****: Present scientific information does not indicate the need for any special precautions for use of mobile phones. If individuals are concerned, they might choose to limit their own or their children's' RF exposure by limiting the length of calls, or using "hands-free" devices to keep mobile phones away from the head and body.*

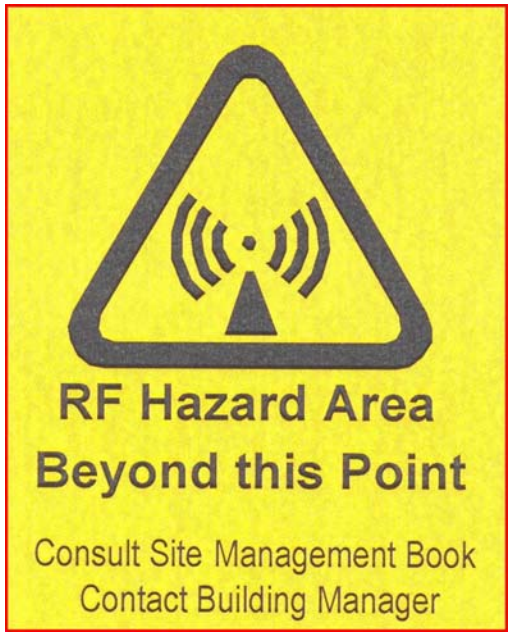
Annex K (informative) — RF Signage

The following are typical examples of signs used to inform and warn of RF radiation hazards at transmitter sites.

1. RF EMR awareness signs

RF EMR warning signs are used to identify areas that may exceed the general public exposure limits.

Perimeter of uncontrolled limits



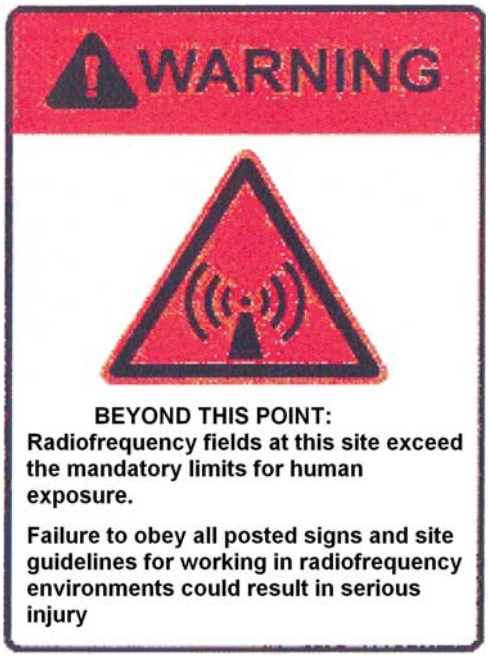
To be installed at point of access restriction

Example 1 — EMR Warning Sign

2. RF EMR hazard identification

RF EMR hazard identification sign is used to identify the boundary point of occupational EMR exposure.

Perimeter of Controlled Limits indicating need for protective measures (e.g., time averaging) [Class III areas: Caution Signs are required]



Time averaging is not feasible to prevent exposures [Class IV areas: Warning Signs are required] Exceeds maximum permissible exposure (MPE)

[Class V areas: Danger Signs are required]

Example 2 — RF Hazard Sign

Where used, the radiation classifications have the following meanings:

— Class I areas: No signs needed.

— Class II areas: Notice Signs are suggested

— Class III areas: Caution Signs are required

— Class IV areas: Warning Signs are required

— Class V areas: Danger Signs are required

Annex L (informative) — Guidelines for quality EMF research

In this annex the term EMF, which is an abbreviation for Electric, Magnetic and Electromagnetic Fields, is used whereas in the Code the term EMR, which is an abbreviation for Electromagnetic Radiation, is used. EMF is a more general term, and is appropriate here, because it makes provision for effects below radio frequencies.

1. Introduction

The following set of guidelines has been summarized from the scientific reviews into the biological effects of EMF exposure held under the International EMF Project (Repacholi, 1998; Repacholi and Greenebaum, 1998). They are intended to assist researchers to complete studies that will be useful to WHO for health risk assessments. Studies with methodology deviating significantly from these guidelines may not provide information useful for health risk assessments. These guidelines have been developed for in vitro, in vivo, human volunteer and epidemiological studies.

2. General experimental design

2.1 The project should test a clearly defined hypothesis, using a detailed protocol that would lead to information directly or indirectly relevant to assessment of health risk from EMF exposure.

2.2 The biological system used should be appropriate to the end-point(s) studied. Threshold and dose-response data (using at least 3 levels of exposure, in addition to sham-exposed controls) are sought where possible.

2.3 Well-characterized biological systems or assays should be used, preferably ones that are well established from the scientific literature available.

2.4 The a priori estimated power of the experiment, based on prior knowledge and the number of tests planned, should be sufficient to detect reliably the expected size of the effect (often as small as 10-20%).

2.5 Good Laboratory Practice (GLP) should be used throughout the design and conduct of the study (see, e.g., FDA, 1993). A specific protocol, consistent with the GLP guidelines, should be established and documented. Any changes instituted during the course of the study should also be documented. The protocol should include randomized, symmetric handling of specimens and their sources, except when precluded by the nature of the experiment or biological system. The protocol should include all appropriate controls (positive, negative, cage controls, sham-exposed etc.). Investigators should be blind to whether they are working with exposed or control materials; human subjects in laboratory experiments should be similarly unaware of their exposure status.

2.6 Quality assurance (QA) procedures should be included in the protocol, including dosimetry and monitoring of the programme by both a team from within the experimental staff and an independent group, as required by GLP.

2.7Experimental System and Dosimetry

2.7.1 Environmental conditions, such as temperature, humidity, light, vibration and sound, and background EMF's, should be measured and recorded periodically. All experimental conditions should be the same for all groups, except for EMF exposure.

2.7.2 EMF's should be fully characterized and remeasured periodically. Waveform, pulse shape and timing, frequency spectrum, harmonics and transients from both continuous sources and from switching exposure systems on and off, should all be measured where appropriate. Background fields, such as ambient, equipment-derived, and cross-over fields from other exposure systems, are also important and need to be characterized. Time-varying and static components should be measured, as well as the polarization and directions of the fields. Field modulation introduced by experimental factors such as motion of sample shakers should be noted and measured whenever possible. Positioning of cultures or animals within exposure systems should be noted and randomised where appropriate.

2.8 Data collection and quality assurance

2.8.1 The full protocol, including QA, should be followed strictly, as should GLP provisions for monitoring this.

2.8.2 Data should be recorded contemporaneously and back-up copies kept.

2.8.3 No data should be discarded without valid reason (e.g. equipment failure, procedures not followed). Reasons for this should be recorded.

2.8.4 As part of the QA programme, at least one independent reassessment should be made of all or an appropriate sample of specimens, when assays require an independent judgement by the investigator (e.g., histological evaluations).

2.8.5 Where possible, samples should be stored for future reference.

2.9 Data analysis

2.9.1 Analysis techniques should be appropriate to the data and hypothesis.

2.8.2 The stored data set should contain all data, and if any data are excluded from an analysis, clear, legitimate reasons for doing so should be recorded.

2.10 Conclusions and reports

2.10.1 Conclusions should be fully supported by the data and include all important implications of the data set.

2.10.2 Reports should include enough data and information concerning materials and methods to allow independent assessment of the conclusions and discussion.

2.10.3 Timely peer-reviewed publication is essential.

3 In vitro studies

3.1 Temperature, atmosphere in CO_2 incubators, vibration, and stray fields from incubator heaters and fans are sources of asymmetry (differences between exposed and control samples) that are often overlooked in cell and tissue culture experiments. These must be measured with appropriate instrumentation and every effort made to ensure that any differences are minimised, except for EMF exposure of the "exposed" samples.

3.2 Contemporaneous positive and negative controls, both maintained under identical circumstances to exposed cultures, sham-sham comparisons of multiple exposure systems, randomized handling of cultures, and blinding, should form part of the study, as appropriate.

3.3 To characterize electric fields or induced currents in cultures, electrode geometry and materials (including agar bridges, etc.), dish shape and dimensions, depth of medium and specimen dimensions, conductivity (RF and ELF) and dielectric constant (RF only) of medium are important. In some ELF studies, field values should be measured directly. Electrophoretic products should be considered and measured, where possible, when electrodes are used.

3.4 ELF magnetic field experiments should consider the factors above as they apply to induced current. The angle between applied field and medium, as well as the angle between applied ELF fields and the local DC field, should be measured.

3.5 When using media, serum or other reagents that may have variation from batch to batch, serious consideration should be given to purchasing and storing sufficient stocks in a single batch for the duration of the experiment. Similarly, the characteristics of cell lines derived from a standard source should not be allowed to diverge over time. There should be backup stocks from the original source.

3.6 For experiments lasting more than a few days and in all cases where samples or stock cultures are maintained for extended periods or data are gathered or stored electronically, backup systems must be installed to protect the work against equipment or power supply failure.

4 In vivo studies

4.1 The protocol must meet the letter and spirit of all relevant guidelines concerning experiments using animals or other whole organisms and must have the prior approval of all relevant review boards.

4.2 Applied EMF field inhomogeneity, temperature, atmosphere (e.g. humidity, room air changes, etc), lighting, vibration and noise asymmetries in cage racks or animal care rooms are often overlooked. These conditions should be measured in each cage location. Randomly rotating cages can overcome any asymmetries within or between exposed and control groups.

4.3 Controls should be maintained under identical circumstances to exposed cultures. Unless the animal is its own control, contemporaneous controls are important. Positive controls as well as negative controls and sentinel ("cage-control") animals should all be used, where appropriate. All personnel handling animals or experimental materials or performing assays should be blind to exposure status except in special circumstances.

4.4 Where possible, sham-sham comparisons of multiple exposure systems and randomized handling of animals, both during experiments and routine cage maintenance, should be considered.

4.5 Cage size, materials, bedding, spacing between animals, and animals' position in the fields, should be specified. Shielding effects of cages, any metal components and rack materials, presence of other animals, and changes in field strength as cages become soiled, should be measured. Micro shocks from cages or drinking apparatus should be eliminated.

4.6 Source, strain and sub-strain of animals should be specified. Specific pathogen free (SPF) animals and animals with special genetic characteristics should be tested prior to use. SPF animals and facilities require special care and trained personnel. The SPF status must be monitored throughout the experiment.

5 Human volunteer studies

5.1 The protocol should meet the letter and spirit of all relevant guidelines concerning experiments using human subjects, and have prior approval of all relevant review boards. Personnel working with volunteers require special training and oversight.

5.2 Where appropriate, positive as well as negative controls should be used.

6 Epidemiological studies

6.1 The protocol should meet the letter and spirit of all relevant guidelines and have prior approval of all relevant review boards.

6.2 Study designs should recognize that the exposure metric for possible effects of weak ELF and weak RF fields is uncertain. Determinations of subjects' exposures, particularly historical exposures that are often determined via surrogates, should be validated from specific measurements where possible. Data should include as much information relevant to alternate metrics as possible to aid future research. Further information can be obtained from Ahlbom (1996), Beaglehole et al (1993) and Bracken et al (1993).

7 Independent research review and administration

7.1 Independent panels of independent scientists should assess proposed research projects, advise on the best researchers to conduct the studies, monitor progress of studies, and provide advisory first-stage review of the research results.

7.2 Research sponsors perceived to have a vested interest in the outcome of the studies should be isolated from all aspects of the research and the researchers. Sponsors might outline the general nature of the research to be supported. Independent bodies should determine the detailed nature of the studies, select and oversee investigators, and administer the programme, including funding.

8 Coordination of research

Many countries have announced EMF research programmes, and other institutions and organizations are presently conducting or sponsoring well-managed research. Global coordination of this research can help ensure that scarce research funding is not wasted on unnecessary duplication of effort and that all important questions are being studied.

The International EMF Project, in collaboration with the major national and multinational research funding institutions, can provide a useful facility or umbrella for worldwide coordination and exchange of information about plans and on-going projects. An ad hoc Research Coordination Committee has been established under the International EMF Project for this purpose. The Project maintains a database of research projects that seem to fulfil the requirements for WHO's Research Agenda on this world wide web site.

Annex M (informative) — Radiations from Communication Infrastructure

Radiofrequency Electromagnetic Radiation (EMR)

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

- Microwave telephony radio transmitters
- HF radio communication facilities
- Mobile phone base stations
- Broadcast transmitters
- Radar facilities
- Remote controls
- Electrical and electronic equipment
- Magnetic resonance imaging (MRI)

Radiofrequency EMR is non-ionising radiation. This means that it is not able to directly impart enough energy to a molecule or atom to break chemical bonds or remove electrons. It has been known for many years that exposure to sufficiently high levels of RF EMR can heat biological tissue and potentially cause tissue damage. This is because the human body is unable to cope with the excessive heat generated during exposure to very high RF levels. The rate at which the energy is absorbed is measured in watts per kilogram (W/kg) and is called specific absorption rate (SAR).

In contrast, ionising radiation (such as X rays) can strip electrons from atoms and molecules. This process produces molecular changes that can lead to damage in biological tissue.

It is important that the terms *'ionising'* and *'non-ionising'* not be confused when discussing biological effects of EMR. This is because each type of radiation interacts differently with the human body.

The RF fields considered here extend from 300 KHz to 300 GHz. Natural levels of the fields in the environment are low. Numerous uses of this part of the electromagnetic spectrum in various areas of human activity, such as communication, navigation, industry and medicine and have resulted in workers and the general public being exposed to RF fields exceeding the naturally occurring levels. As with any other form of energy RF energy has the potential to interact with biological systems and the outcome may be of no significance, may cause different degrees of harm, or may be beneficial.

In the evaluation of the importance and impact of RF sources on human health the following factors should be taken into consideration.

- The potential hazardous levels of RF radiation under normal operating conditions and under conditions of possible malfunction
- The number of sources in use and
- The number of people who might be exposed and the exposure duration

Exposure of organisms of RF fields results in the induction of RF fields and currents inside the body. The internal rather than the external fields and currents are responsible for interactions with biological systems independently of whether these interactions are thermal or athermal. The interaction of RF fields with biological systems is quantified in terms of Specific Absorption rate (SAR). Two SAR's are frequently used; the average SAR, usually the whole body average, defined as the total energy transferred to the body per unit time divided by the total mass; and the local SAR corresponding to a small volume.

The SAR in a biological body depends on several exposure parameters such as frequency, polarization, intensity, radiation source body configuration (the far field and the near field) and presence of reflecting surfaces nearby. The SAR also depends on the size shape and electrical properties of the body.

The whole body SAR for exposure in the far field is a function of frequency and polarization. Maximum absorption occurs at about 70-80 MHz when the E field is parallel to the main body axis. This frequency is referred to as the resonant frequency for man. A this frequency, the power absorbed is a few times greater than that obtained by multiplying the surface area of the body cross section by the incident power density. For a man stranding in contact with RF ground, the resonant frequency shifts to about 30-40 MHz and the SAR increases to a factor of about two.

Human Studies

According to W.H.O regional publication on Non-ionizing radiation protection, European Series No. 25, present knowledge can be summarized as follows.

- For the broad range of frequencies between 300 KHz and 300 GHz, cutaneous perception of heat and the thermal pain may be an unreliable sensory mechanism for protection against potentially harmful radiation exposure levels. This is because:

  a) RF energy can be absorbed in the tissue below cutaneous thermal receptors and
  b) Adverse effects occur at temperatures below the threshold (45^{o} C)

- Although some studies have associated lens defect with microwave radiation exposure, the present view is that low level chronic exposure to microwave radiation doesn't induce cataracts in man.

- When the human head is exposed to pulsed radiation such as radar, an audible sound described as buzz, chirp, click or knocking sensation is perceived by some individuals; the sound seems to originate within or behind the head, This phenomenon is called "RF hearing" or "RF Sound" and varies with pulse duration and pulse repetition frequency. The peak power density thresholds for RF hearing are 2.66KW/m^2 for 1310MHz and 50KW/m^2 for 2982 MHZ fields and the average power density thresholds are 4 and 20W/m^2, respectively. The highest effective frequency for RF hearing is between 6.5 and 8.9 GHz, and the lowest effective frequency is 216 MHz.

- According to a review conducted by W.H.O. in 1999;

  i) No clear evidence has been found to suggest that exposure to electromagnetic radiation can cause cancer (WHO fact sheet No. 193, revised June 2000),
  ii) Most recent studies find no association for childhood cancer with exposure to electromagnetic radiation
  iii) Results of studies indicating that exposure to RF fields causes or influences cancer are inconclusive

For more technology specific RF radiation information, once can refer to the following papers:

  a) The Stewart report published by the Stewart group in the UK.
  b) The Australian radiation Protection and Nuclear Safety agency (ARPANSA) fact sheet series on Non-Ionizing Radiation.

Until the uncertainties in dose-response relationships for repeated and for continuous –low-level exposure are eliminated, a prudent degree of conservatism will continue to be exercised in control of exposure levels from microwave and RF radiation

- Studies that have been published by sources of the said normative references in Clause 2 above have concluded that the use of mobile phones by children below 16 years for non-essential calls should be discouraged. The UK Stewart Report has authoritatively said that:

  "If there are currently unrecognised adverse health effects from the use of mobile phones, children may be more vulnerable because of their developing nervous system, the greater absorption of energy in the tissues of the head and a longer lifetime of exposure".

- There have been numerous studies, discussions, meetings, publications and suggestions regarding the use of portable communication equipment in the vicinity of medical equipment over several years.

  General guidance from these forums recommend:

  a) Rational management of wireless telecommunication devices in or near hospitals.

b) Pre-market testing of medical equipment susceptibility to electromagnetic radiation.

c) Stringent shielding requirements for medical equipment.

d) Preventing known sources of interference (e.g. cellular phones, handheld transceivers) from coming too close to patient monitors and other sensitive medical devices.

When an electromagnetic interference problem is suspected the device manufacturer should be contacted for assistance.

- One of the effects of radio frequency radiation is heat due to absorption by the body tissue. However, this does not pose a health risk as the body's normal thermo-regulatory process carries that heat away. Reports have also been made of symptoms such as nervousness, disturbed sleep and fatigue associated with use of the mobile phone. However, studies done to prove the association between use of the mobile phone and the above mentioned symptoms remain inconclusive. Further studies continue to be done in the area.

Recommendations on the use of wireless devices

In view of the non-conclusive results of the studies that have been conducted by the said normative sources quoted herein, it is recommended a precautionary approach be taken and the following measures adopted on this matter until further information is available.

- Time is a key factor in how much exposure a person receives, and thus, reducing the amount of time spent on a mobile call will reduce RF exposure. The use of hands free kits should be encouraged to keep the radiations away from the body and thereby reduce exposure.

- By way of a public notice in the media, the public should be advised not to use mobile phones for long periods at a time. The limits of the same are given in KS 1847-1.

- As a precautionary measure against excessive exposure from the usage of mobile handsets, CCK recommends the use of handsets whose SAR value does not exceed 1.6W/Kg.

Annex N (informative) – Technology Brief

1. Radio and Television Broadcast Facilities

Broadcasting is the distribution of audio and/or video signals which transmit programs to an audience. The audience may be the general public or a relatively large sub-audience, such as children or young adults.

There are wide variety of broadcasting systems, all of which have different capabilities. The largest broadcasting systems are institutional public address systems, which transmit nonverbal messages and music within a school or hospital, and low-powered broadcasting systems which transmit radio stations or television stations to a small area. National radio and television broadcasters have nationwide coverage, using retransmission towers, satellite systems, and cable distribution systems. Satellite radio and television broadcasters can cover even wider areas, such as entire continents, and Internet channels can distribute text or streamed music worldwide.

The sequencing of content in a broadcast is called a schedule. As with all technological endeavors, a number of technical terms and slang have developed. A list of these terms can be found at list of broadcasting terms. Television and radio programs are distributed through radio broadcasting or cable, often both simultaneously. By coding signals and having decoding equipment in homes, the latter also enables subscription-based channels and pay-per-view services.

The term "broadcast" was coined by early radio engineers from the midwestern United States. Broadcasting forms a very large segment of the mass media. Broadcasting to a very narrow range of audience is called narrowcasting.

Distribution methods

A broadcast may be distributed through several physical means. If coming directly from the studio at a single radio or TV station, it is simply sent through the air chain to the transmitter and thence from the antenna on the tower out to the world. Programming may also come through a communications satellite, played either live or recorded for later transmission. Networks of stations may simulcast the same programming at the same time, originally via microwave link, and now mostly by satellite.

The final leg of broadcast distribution is how the signal gets to the listener or viewer. It may come over the air as with a radio station or TV station to an antenna and receiver, or may come through cable TV [1] or cable radio (or "wireless cable") via the station or directly from a network. The Internet may also bring either radio or TV to the recipient, especially with multicasting allowing the signal and bandwidth to be shared.

2. Microwave Transmission Systems

Microwave radio relay is a technology for transmitting digital and analog signals, such as long-distance telephone calls and the relay of television programs to transmitters, between two locations on a line of sight radio path. In microwave radio relay, radio waves are transmitted between the two locations with directional antennas, forming a fixed radio connection between the two points. Long series of such links form national telephone and/or television communication systems.

How microwave radio relay links are formed

Because a line of sight radio link is made, the radio frequencies used occupy only a narrow path between stations (with the exception of a certain radius of each station). Antennas used must have a high directive effect; these antennas are installed in elevated locations such as large radio towers in order to be able to transmit across long distances. Typical types of antenna used in radio relay link installations are parabolic reflectors, shell antennas and horn radiators, which have a diameter of up to 4 meters. Highly directive antennas permit an economical use of the available frequency spectrum, despite long transmission distances.

Planning considerations

Because of the high frequencies used, a quasi-optical line of sight between the stations is generally required. Additionally, in order to form the line of sight connection between the two stations, the space between transmitters and receivers along a microwave path must be free from obstacles so the radio waves can propagate across a nearly uninterrupted path. Obstacles in the signal field cause unwanted attenuation, and are as a result only acceptable in exceptional cases.

Obstacles, the curvature of the Earth, the geography of the area and reception issues arising from the use of nearby land (such as in manufacturing and forestry) are important issues to consider when planning radio links. In the planning process, it is essential that "path profiles" are produced, which provide information about the terrain and Fresnel zones affecting the transmission path. The presence of a water surface, such as a lake or river, in the mid-path region also must be taken into consideration as it can result in a near-perfect reflection (even modulated by wave or tide motions), creating multipath distortion as the two received signals ("wanted" and "unwanted") swing in and out of phase. Multipath fades are usually deep only in a small spot and a narrow frequency band, so space and frequency Diversity schemes were usually applied in the third quarter of the 20th century.

High intensity rain and snow must also be considered as an impairment factor, especially at frequencies above 10 GHz. All previous factors make it necessary to compute suitable power margins, in order to maintain the link operative for a high percentage of time, like the standard 99.99% or 99.999% used in 'carrier class' services of most telecommunication operators.

Usage of microwave radio relay systems

During the 1950s the AT&T Communications system of TD radio grew to carry the majority of US Long Distance telephone traffic, as well as intercontinental television network signals. Similar systems were soon built in many countries, until the 1980s when the technology lost its share of fixed operation to newer technologies such as fiber-optic cable, optical radio relay links and communication satellites (all of which offer larger data capacities at lower cost per bit). At the turn of the century, microwave radio relay systems are being used increasingly in portable radio applications. The technology is particularly suited to this application because of lower operating costs, a more efficient infrastructure, and provision of direct hardware access to the portable radio operator.

3. Fixed Wireless & Cellular Phone networks

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

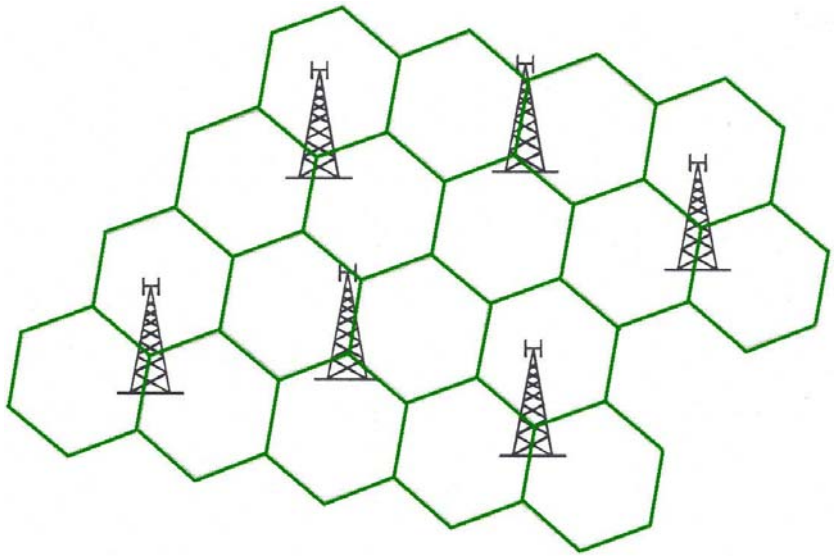


Figure 1 — Theoretical modelling of a network

To communicate with each other, mobile phones and base stations exchange radio signals. The level of these signals is carefully optimized for the network to perform satisfactorily. They are also closely regulated to prevent interference with other radio systems used, for example, by emergency services, taxis as well as radio and television broadcasters. Figure 2 shows a typical siting and coverage area for a base station.

Figure 2 — Example of a base station's coverage area

4.2 How a cellular system works

4.2.1 Mobile phones

When a mobile phone is switched on, it responds to specific control signals from nearby base stations. When it has found the nearest base station 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.

Mobile phones use automatic power control as a means of reducing the transmitted power to the minimum possible whilst maintaining good call quality. The power output from the phone depends on the signal strength. The nearer the phone to the base station, the stronger the signal and hence the less power that is required for quality service (Figure 3). For example, while using the phone the power output can vary between the minimum level of about 0.001 watt up to the maximum level which is less than 1 watt. This feature is designed to prolong battery life and possible talk time.

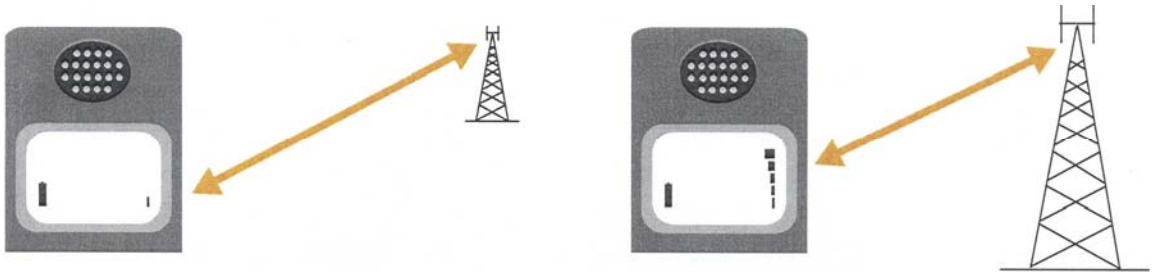


Figure 3 — Signal strength is impacted by a number of factors but proximity to a base station is one of the most important

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 base station to another. This process is called a 'handover' — literally where the network hands over the call from one base station to another, and it is undertaken seamlessly and without the caller being aware of the change.

4.2.2 Base station sites

Transmitted power levels from base stations vary considerably 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 even lower.

A base station is comprised of several different components — including an equipment shelter, a tower or mast which provides the necessary height to give better coverage, and the transceivers and antennas which sit atop the tower or mast — or in some cases are attached to the top of buildings, where the building itself provides sufficient height. The antennas are typically about 15-30 cm in width and up to a few metres in length, depending on the frequency of operation.

These antennas emit Radio Frequency (RF) electromagnetic energy (also called radio waves) in beams that are typically very narrow in the vertical direction (height), but quite broad in the horizontal direction (width). Because of this, the RF energy at ground level directly below the antenna is very low.

To help assure that public exposures remain within established limits (see Annex A and Annex B), antennas typically are elevated, and where necessary fences, or other means to restrict access are used together with appropriate signage to ensure that only authorized personnel can access the area immediately around a base station. The consequence of these measures is that in areas around base stations that are accessible to the public, the RF levels are typically within the international safety limits.

4.3 Directivity of antenna

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

Whatever the equipment, the radio wave intensity decreases drastically as it travels away from the antenna. In free space, the intensity decreases to a quarter 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. Annex B sets out the criteria for evaluation of various parameters of RF transmission.

Some people have asked why base station equipment is not always placed in industrial areas or areas remote from habitation. There are several 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. 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 base stations need to be closer together to provide increased capacity rather than coverage, and as a result 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.

Public exposure to RF radiation from mobile telephone base stations

Safety guidelines are set for telecommunication operators to observe and adhere to, as a means of protecting the public from excessive exposure to radiation. Computation and measurements are the means through which compliance of the operators can be checked and safety of the public assured.

There are a few computational formulae that can be used to check radiation exposure levels at a given distance away from the base transceiver stations to confirm compliance to the safety limits. Annex B[F] of this document gives the computation formulae for reference purposes. It is worth mentioning that Specific Absorption Rate (SAR) computations are a little complex, involving tissue modelling and determination of tissue fluid properties among other related processes for accurate computations. The direct computation methods are however meant for obtaining approximate values, which may not be as accurate.

Measurement of SAR on the other hand must be used when the transmitter is operated in close proximity to the human body, but where the transmitter is not normally used in close proximity to the human body, the exposure limits can be derived by defining the exposure levels in terms of power density, electric field intensity and magnetic field intensity.

The calculated results are based on effective isotropic radiated power (EIRP), which is the measure of power in the main beam, and antenna gain, which is the measure of the antenna's directivity in focusing the beam to a particular direction.

A large proportion of power is usually focused into approximately horizontal beam typically about 6° wide in the vertical direction and the rest goes into a series of weak beams called side lobes on either side of the main beam. The main beam is tilted slightly downwards but does not reach ground level until the distance from the tower is at least 100m (usually 100–200 m) as shown in Figure 4.

This implies that directly below or near the base of the antenna, there is very weak signal (side lobes) since the main beam, which has the strongest signal does not reach the ground until at least 100m horizontally away from the base of the mast.

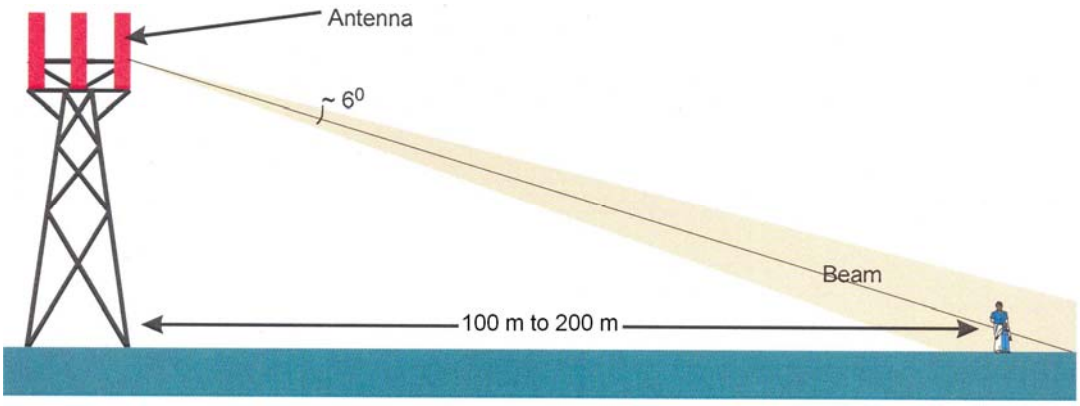


Figure 4 — Main beam from antenna mounted on a tower

It is however the wish of many people to have BTS sited at some distance far away from "sensitive" areas such as schools, hospitals etc, although there is little logic to this argument:

First, the ground level power density does not drop with distance in any regular manner until you get to some several hundred meters away from a base station

Second, people living, working or studying in a building usually get less exposure from a BTS that is on their building than they would from a base station several hundred meters away as discussed above. Horizontal distance from a base station is less of a factor in ground level power density than antenna height, antenna power transmitted and antenna propagation pattern. Therefore, the height of the antenna rather than the horizontal distance from the mast should be of greater concern.
.

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

- Increase the exposure of the users to radiations from their handsets since handsets adjust their power output upwards (Adaptive Power Control) the farther away they are from the base station.
- Require the base station antenna power to be increased so as to reach the intended community.
- Limit the availability of the service to the residents of the area in question

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

Public exposure to RF radiation from mobile handsets

Even though today's mobile phones only emit, on average, a maximum of a few hundred milliwatts, they are held in close proximity to the body and, therefore, expose the user to local levels of EMF exposure that are relatively higher than those from base stations.

The concept of SAR was introduced to quantify the amount of energy being absorbed by the body, and to demonstrate compliance with national and international safety standards.

The SAR of a phone is determined by operating the device near a model of the head or body. The model is filled with a liquid that exhibits the electrical properties of body tissues. A SAR probe is operated inside the model and a 3 dimensional measurement takes place to determine the highest SAR and verify that this is below the limit.

Technically, the mobile phone handset has been designed to reduce power consumption rate and which effectively reduces user's exposure to the radiation from the handset. When the mobile handset communicates with the base station during a call, it radiates RF signals whose power level varies with the distance from the base station. For GSM (900MHz) mobile phones, the maximum power permitted by the present GSM standards for mobile phone RF transmission is 2W, but because of Time Division Multiple Access (TDMA) used, the average powers transmitted by the phones are never more than 0.25W, which is one-eighth of the maximum permitted value.

Furthermore, a GSM phone reduces the average power transmitted to the minimum needed for the base station to receive a clear signal by continuously adjusting the power it transmits through the process called Adaptive Power Control (APC). Still during a call, the mobile handset transmitter does not remain on for all the time of conversation, but uses Discontinuous Transmission (DTX), where the transmitter is switched off when a user stops speaking either because he/she is listening or because neither user is speaking when the call is still in progress. This implies that if each person in the conversation speaks for about half the time, he/she is only exposed to the fields from the phone for half the period of the conversation. The three mobile phone design aspects (TDMA, APC and DTX) all ensure that the user is exposed to minimum radiation from the handset.

The operation of GSM systems (and handsets) is internationally standardized irrespective of the manufacturer producing which network element. However, different handsets from different manufacturers can produce different SAR levels as per their design parameters. For cellular telephones, the radiating antenna is too close to the body to make meaningful power density measurements. The only way to assess exposure from these devices is to estimate the SAR in tissues near the antenna, particularly the ear, head and face. This has been made by a number of laboratories, for different types of mobile handsets.

Federal Communications Commission (FCC) of USA in consultation with FDA and other health and safety agencies has adopted limits for exposure to radiation energy given in terms of specific energy absorption rate (SAR) and recommends that a phone's maximum allowable SAR level must not exceed 1.6W/kg for it to pass FCC certification.

Based on the information obtained from the research groups mentioned earlier, the recommended RF safety limit parameters are given in Tables A.1 and A.2 in annex A. A general overview of electromagnetic radiation is given in Annex N.

Annex O - References

Normative references

The following documents contain provisions, which through reference in these guidelines constitute provisions of these guidelines. In case these reference documents are revised later, the latest edition applies.

- BS 8100-1:1986, *Lattice towers and masts — Code of practice for loading*
- BS 8100-2:1986, *Lattice towers and masts — Guide to the background and use of Part 1 'Code of practice for loading'*
- BS 8100-3:1999, *Lattice towers and masts — Code of practice for strength assessment of members of lattice towers and masts*
- BS 8100-4:1995, *Lattice towers and masts — Code of practice for loading of guyed masts*
- IEGMP (2000): Independent Expert Group on Mobile phones and Health, National Radiological Protection Board (UK) 2000: *Stewart Audit Report (RA website http:// www.rad.gov.uk/)*
- Australia Communications Industry Forum: *Industry code: Deployment of Radiocommunications Infrastructure*
- Royal Society of Canada (1999). *A review of potential health risks of radio frequency fields from wireless telecommunication devices*
- World Health Organisation, Fact Sheet No. 193; *Electromagnetic fields and public health; mobile telephones and their base stations*
- SM Mann, TG Cooper et al (2000): Exposure to radio waves near mobile phone base stations. Natl Radiol Protec Board (U.K.), June 2000.
- *Environmental management & coordination Act*, 1999 Laws of Kenya
- *Environmental Management and Coordination Act*, 1999 (EMCA) and Legal Notice No. 101 of 2003
- The Physical Planning Act Chapter 286 Laws of Kenya
- Building Code 1997; Local Government regulations ,1963
- The Public health Act Chapter 242 Laws of Kenya
- KS 1587; *Kenya Standard — National electrical safety code*
- KS 662; *Kenya Standard — Wiring regulations*
- KS IEC 62209-1:2005: *Kenya Standard — Human exposure to radio frequency fields from handheld and body-mounted wireless communication devices — Human models, instrumentation, and procedures — Part 1: Procedure to determine the specific absorption rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)*
- KS ISO 8528-1, *Kenya standard — Reciprocating internal combustion engine driven alternating current generating sets — Part 1: Application, ratings and performance*
- KS ISO 8528-5, *Kenya standard — Reciprocating internal combustion engine driven alternating current generating sets — Part 5: Generating sets*
- KS ISO 8528-6, *Kenya standard — Reciprocating internal combustion engine driven alternating current generating sets — Part 6: Test methods*

— KS ISO 8528-7, *Kenya standard — Reciprocating internal combustion engine driven alternating current generating sets — Part 7: Technical declarations for specification and design*

— KS ISO 8528-8, *Kenya standard — Reciprocating internal combustion engine driven alternating current generating sets — Part 8: Requirements and tests for low-power generating sets*

— KS ISO 8528-9, *Kenya standard — Reciprocating internal combustion engine driven alternating current generating sets — Part 9: Measurement and evaluation of mechanical vibrations*

— KS ISO 8528-10, *Kenya standard — Reciprocating internal combustion engine driven alternating current generating sets — Part 10: Measurement of airborne noise by the enveloping surface method*

— KS ISO 8528-12, *Kenya standard — Reciprocating internal combustion engine driven alternating current generating sets — Part 12: Emergency power supply to safety services*

— KS 1590-1, *Kenya Standard — Specifications for siting of radiocommunication facilities — Part 1: Low frequency, medium frequency and high frequency transmitting and high frequency receiving facilities*

— KS 1590-2, *Kenya Standard — Specifications for siting of radiocommunication facilities — Part 2: Guidelines for fixed, mobile and broadcasting services operating at frequencies above 30 MHz*

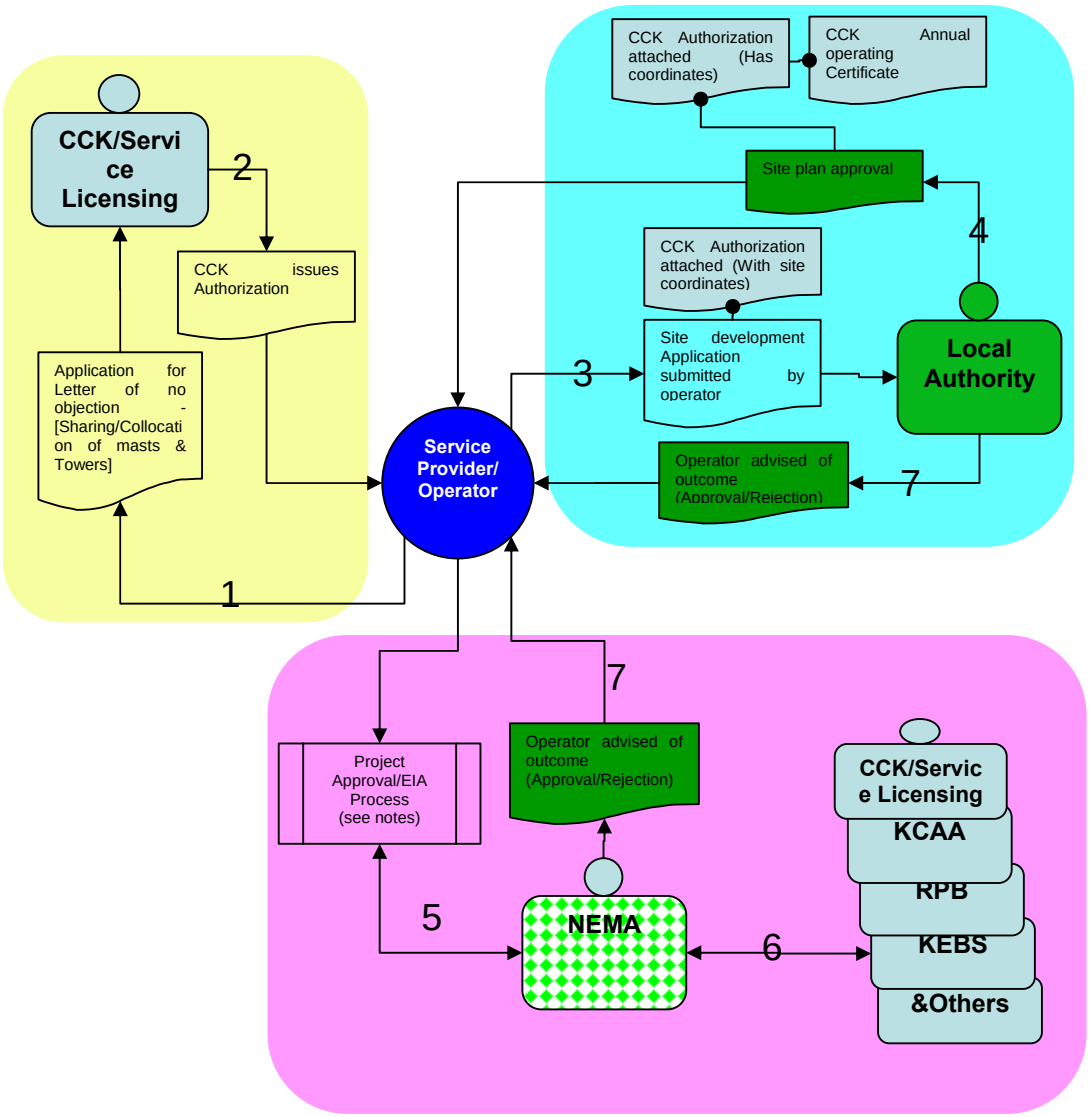
— KS 1847-1, *Kenya Standard — Radiofrequency radiation guidelines — Part 1: Maximum exposure levels to radiofrequency fields — 3 kHz to 300 GHz*

— KS 1847-2, *Kenya Standard — Radiofrequency radiation guidelines — Part 2: Principles and methods of measurements*

Informative References

— ICNIRP Guidelines — *Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz) (1998)*

PROCEDURAL GUIDELINES FLOW CHART



Assumption (s)

These procedural guidelines are applicable to entities that already have authority to build communications infrastructure

Notes on Steps and rationale

- Operator applies for approval to the CCK/Service Licensing Authority on grounds of collocation/facility sharing

- [Other processes (e.g. EIA or LA approval procedures) considered lengthy compared to this phase.]
- This will be a new requirement placed on all operators and service providers licensed under the KCA or other Act (e.g. meteorological dept.).
- The applicants will be required to provide site coordinates in WGS84 format in their applications.
- The Letter of no objection from CCK/Other regulator must be obtained before any other authority is approached.
    - Operator applies to local authority (LA) for permission to develop site
    - Operator provides everything LA requires presently
    - Additionally, Operator provides two copies of the operating certificate issued by CCK for the year during which operator applies and two copies of the CCK letter of no objection, containing the LR reference and geographic coordinates of site in the agreed format (WGS 84).
    - The applicant must obtain clearance from the LA with regard to zoning requirements before submitting project report to NEMA. The LA must quote the CCK reference of the letter of no objection and capture site coordinate information in its authorization.
    - Operator embarks on EIA study/project requirements under the EMCA.
    - This can be done concurrently with application to LA. However, authority regarding zoning in note 2(3) above must be included when submitting the project report to NEMA.
    - NEMA checks to ensure that project coordinates match those contained in letter of no objection from CCK/other regulator.
    - Applicant will proceed and meet NEMA requirements as is presently done.
    - The Local authority will subject site development application to all other requirements as is currently the case and grant or deny approval.
    - NEMA awaits EIA from operator and undertakes necessary consultations with relevant parties and thereafter grant/deny licence.