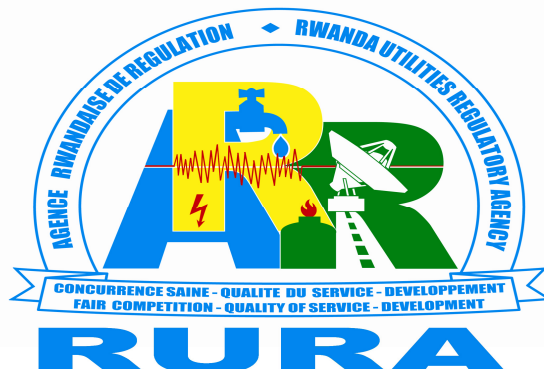


# REPUBLIC OF RWANDA



## RWANDA UTILITIES REGULATORY AGENCY

---

### GUIDELINES FOR SITING AND SHARING OF TELECOMMUNICATION BASE STATION INFRASTRUCTURE

---

DOCUMENT CONTROL	
Reference Number	RURA/ICT InfraDev/ G02/2011.
Originator	Rwanda Utilities Regulatory Agency
Print Version	V 1.5
Date of Issue	1 April 2011
Date of Amendment	09 June 2011

P.O Box 7289 KIGALI - RWANDA

<http://www.rura.gov.rw>

Phone/Fax: (250) 252 58 45 63

E-mail: [dgoffice@rura.gov.rw](mailto:dgoffice@rura.gov.rw)

## Table of Contents

Background.....	iii
1. Short title, extent and commencement.....	2
2. Definitions .....	2
3. Objectives.....	3
4. Minimum Requirements and Guidelines.....	4
4.1 Site positioning.....	4
4.1.1 General guidelines.....	4
4.1.2 Towers and antenna design requirements .....	4
4.1.3 Tower setbacks .....	5
4.1.4 Inspection.....	5
4.1.5 Parking.....	6
4.1.6 Security of wireless communication facility.....	6
4.1.7 Facility replacement.....	6
4.1.8 Removal of abandoned or unusable facility .....	7
4.1.9 Non-conforming structures .....	7
4.1.10 Removal of non-conforming structures .....	8
4.1.11 Separation.....	8
4.1.12 Maintenance .....	8
4.1.13 Public Exposure to the Electromagnetic Radiation (EMR).....	9
4.1.14 Pre-existing facility, towers or antennas.....	9
4.2 Site sharing for communication facilities.....	10
4.2.1 Siting alternatives hierarchy .....	10
4.2.2 Co-location requirements .....	10
4.2.3 Co-location guidelines .....	10
4.2.4 Inventory of towers and location specifications.....	11
4.2.5 Co-location on existing infrastructures .....	12
5. Price-Setting for Passive Infrastructure Sharing.....	13
5.1 Site categories .....	13
5.2 Price setting methodologies.....	13
5.3 Fully allocated cost approach.....	14
5.4 Implementation of maximum service prices.....	15
6. Contractual Arrangements and Timelines.....	17
6.1 Reference Contract.....	17
6.2 Basic Process and Timing for Site Sharing .....	17
6.3 Coming into Force of Guidelines and Pricing.....	18
6.4 Procedure in case of non-payment of invoices.....	18
Annexes.....	20

## Background

Rwanda Utilities Regulatory Agency (**RURA**) was established by the law N° 39/2001 as an independent national authority to administer different sectors offering public services, promote transparency, protect free competition and provide inclusive service, as well as protect users' rights.

In accordance with the Telecommunication Regulation Law, Rwanda Utilities Regulatory Agency has the mandate to regulate the telecommunications sector, enhance and deploy services in compliance with the most advanced technology to meet user's needs at the most suitable prices.

In addition to the above, Rwanda Utilities Regulatory Agency has the responsibility to ensure that telecommunication infrastructures have no adverse impacts on the environment and people living in their neighborhood.

The increased use of mobile phones and other modern wireless communications devices around the world has raised public interest in the siting and aesthetics of telecommunication masts/towers as well as possible health concerns associated with exposure to electromagnetic emissions. These concerns relate to both handheld devices, base stations, towers and masts. The lack of regulations relevant to these particular points of interest would result in the inadequate siting, construction and modification of numerous telecommunication masts with the risk of introducing possible adverse visual impacts to the landscape and environment

To this respect, RURA has developed guidelines that will set out the procedures to be followed by operators and service providers in the rollout of telecommunications base stations, towers and masts.

These guidelines will seek to minimize these effects as well as address issues that may be of health concern with regards to radiation emissions from the communication facilities.

In exercise of the powers conferred upon the Regulatory Board under **Article 48 of Law No 44/2001 of 30/11/2001 governing Telecommunications** as well as Article 3 (viii) of **Presidential Order N° 04/01 of 15/03/2004 determining Specific Duties of the Regulatory Board in Telecommunications Matters**, Rwanda Utilities Regulatory Agency hereby issues the following guidelines:

## 1. Short title, extent and commencement

i) These guidelines shall be referred to as:

***‘Guidelines for Siting and Sharing of Telecommunication Base Station Infrastructure, 2011.’***

ii) These guidelines shall be applicable to all licensed operators in the telecommunications sector.

iii) These guidelines shall come into force with effect from **1<sup>st</sup> April 2011**

## 2. Definitions

- (a) **Authority:** Means Rwanda Utilities Regulatory Agency (RURA)
- (b) **Emergency service organization:** includes, but is not limited to police forces, fire services, ambulance services...
- (c) **Exclusion zone:** An area around a transmitting station within which exposure limits may be exceeded.
- (d) **Existing Mobile site:** An existing mobile site shall be any mobile site which is fully developed and operational as of the date of issuance of these instructions.
- (e) **Fall zone:** 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.
- (f) **Infrastructure provider:** Means any telecommunication operator who owns or is in control of facility or infrastructure, access to which another operator desires or into an agreement for the purposes of collocation or infrastructure sharing.
- (g) **Infrastructure seeker:** Means any telecommunication operator desirous or into an agreement with other telecommunication operator who own or in control of telecommunication’s infrastructure and facility for the purpose of collocation or infrastructure sharing.
- (h) **Lattice tower:** A telecommunication tower that is constructed to be self-supporting by lattice type supports and without the use of guyed wires or other supports

- (i) **New Mobile site:** A new Mobile site shall be any mobile site which is not fully developed and operational as of the date of issuance of these instructions.
- (j) **Passive Infrastructure sharing:** Passive infrastructure sharing is the sharing of non-electronic infrastructure and facility. It includes sharing of physical sites, buildings, shelters, towers/masts, electric power supply and battery backup, grounding/earthing, air conditioning, security arrangement, poles, ducts, trenches.
- (k) **Active infrastructure Sharing:** Active infrastructure sharing is the sharing of electronic infrastructure and facility. It includes sharing of Base Transceiver Station (BTS), spectrum, antenna, feeder cable, Radio Access Network (RAN), microwave radio equipment, billing platform, switching centers, router, Base Station Controller (BSC) /Radio Network Controller (RNC), optical Fiber/ wired access and backbone transmission network, database etc.
- (l) **Telecommunication facility:** Any cables, wires, lines, wave guides, antennas and any other equipment that is used or associated with the provision of one or more telecommunications services.
- (m) **Mobile site with grid access:** A mobile site, which has and makes use of access to the national electricity grid. Power generators (and/or batteries) are only used as a backup in case of power failure from the electricity grid.
- (n) **Mobile site without grid access:** A mobile site, which does not have access to the national electricity grid. In this case, power is provided by on-site (usually diesel-powered) generators.

### 3. Objectives

The objectives of these guidelines are as follows:

- To protect the social and physical environment from potential negative impacts, while at the same time not restricting the development of essential telecommunications infrastructure.
- Minimize disturbance to the environment and loss of amenity in the provision of the telecommunications infrastructure.
- To protect the environment by reducing the land use as well as infrastructure and facility installations thereby not changing the aesthetic of the country's landscape.
- To maximize the use of network facilities including but not limited to network capacity and capabilities, base station sites, backbone, towers etc.
- To proportionate infrastructure ownership that shall enhance sharing and reduce dependency, as well as duplication of investment for network facilities. In this context "Infrastructure sharing means the joint use of telecommunication infrastructures and facilities by two or more

- operators. The term “Infrastructure sharing” for the purposes of these guidelines refers to the Passive Infrastructure sharing.
- To promote the availability of wide range of high quality, efficient, cost effective, and competitive telecommunication services throughout the country by ensuring optimum utilization of telecommunication resources.
  - To optimize operator’s capital expenditure on supporting infrastructure.
  - To set maximum prices for monthly access to passive infrastructure sharing.

## 4. Minimum Requirements and Guidelines

### 4.1 Site positioning

#### 4.1.1 General guidelines

All wireless communication towers, except communication infrastructure used by defense organizations for defense purposes and communication infrastructure used by emergency services organization to provide emergency services, erected, constructed or located within Rwanda shall comply with the terms of these guidelines.

Annex B and C provide respective documents and statutory requirements necessary for a complete application for relevant approvals and permits for a site building and installation of wireless communication infrastructure.

#### 4.1.2 Towers and antenna design requirements

**4.1.2.1** Proposed new or modified towers and antennas shall meet the following design requirements:

**4.1.2.1.1** Where possible the proposed development should be designed to blend into the environment so as to minimize its visual impact on the environment. Operators shall consider the use of materials, colors and design that would minimize obtrusiveness. An example of telecommunication facility camouflage can be found on annex E.

**4.1.2.1.2** Guyed structures are discouraged and may only be allowed if the applicant demonstrates to the satisfaction of the Authority that no other type of communication facility structure will provide an equivalent level of service.

**4.1.2.1.3** Height of all telecommunication towers shall be limited to a maximum of 60m unless the applicant can demonstrate to the satisfaction of

the Authority that a greater height is necessary to provide coverage required. The applicant must demonstrate that there are no other feasible locations within 1km radius of the proposed site that would functionally provide equivalent services within the set maximum height requirement.

**4.1.2.1.4** Mobile Base Transceiver Station Masts/Towers shall be subjected to the following maximum heights:

- a) Rural areas: 60m
- b) Commercial areas: 45m
- c) Residential areas: 36m

**4.1.2.1.5** Microwave transmission system Masts/Towers: Facilities in this category shall take into account technical requirements for line of sight and height but must, in any case, comply with civil aviation requirements where applicable.

**4.1.2.1.5** The maximum height for towers and poles on building rooftops shall not exceed 7m above the building height.

### **4.1.3 Tower setbacks**

All proposed towers and any other proposed wireless communication facility support structures shall be set back from adjoining parcels, road and streets lines by the following distances:

**4.1.3.1** To minimize the risk posed by collapsing towers, towers shall be set back from a distance equal to the tower height plus 5m from any residential structure, roads and/or streets.

**4.1.3.2** The site area of the base station shall be a minimum of 200 square meters for self support towers. The foremost part of each mast/tower shall be a minimum of 3 meters from the physical barrier. Where the size and setbacks proposed does not meet the required standard a written explanation shall be submitted along with the application.

### **4.1.4 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 conditions, records containing such details shall be kept and submitted to RURA.

RURA 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 30 days to bring the facility into compliance unless a time extension has been granted for good cause by the Authority. Failure to do so shall constitute grounds for the removal of the facility at the operator's expense.

#### 4.1.4 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 the foregoing, the following warning signs shall be utilized in connection with the tower or antenna site, as applicable:

**4.1.4.1** 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.

**4.1.4.2** The warning sign on wireless communication facilities shall be readable from 5m and shall not be larger than 0.36m<sup>2</sup> in order to provide adequate notification to persons in the immediate area of the presence of an antenna. Sign shall contain the name(s) of the owner(s) and operators of the antenna as well as emergency phone number(s).

#### 4.1.5 Parking

Adequate parking spaces shall be provided for use by maintenance personnel on each site so that right-of-way for parking on a public road will not be necessary. A minimum of one parking space shall be provided per user located on the facility site.

#### 4.1.6 Security of wireless communication facility

Exclusion zone should be determined and defined by acceptable physical barriers and appropriate gating. The physical barrier shall be of a minimum of 3 meters in height to prevent intrusion.

#### 4.1.7 Facility replacement

##### 4.1.7.1 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 as a new tower and shall meet all of the applicable requirements.

#### **4.1.7.2 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 capacity 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 as a new facility that shall meet all of the applicable requirements. A damaged or destroyed tower not rebuilt in 180 days shall be considered abandoned.

#### **4.1.8 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 RURA 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.

**4.1.8.1** 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 shall remove it within ninety days of receipt of written notice to remove from RURA. Failure to remove an abandoned tower or facility within 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.

#### **4.1.9 Non-conforming structures**

After coming into force of these guidelines, any wireless communication facilities, which have been located, constructed or modified without first obtaining the required permit or any necessary authorization, shall be ordered to be removed.

#### 4.1.10 Removal of non-conforming structures

**4.1.10.1** In the event that a communication structure is not compliant or is not brought into compliance as required under 4.1.8 and 4.1.9 above, within 30 days of a notice issued to a facility owner, RURA may provide notice to the owner requiring the communication facility to be removed, and in the event that such communication facility is not removed within 30 days of receipt of such notice, RURA may remove such facility and the facility owner shall bear the cost of removal.

**4.1.10.2** If RURA removes, or causes to be removed, wireless communication facilities, and the owner of the wireless communication facilities doesn't claim within ten (10) working days, then RURA may take steps to declare the wireless communication facilities abandoned, and sell the facilities and their components.

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

#### 4.1.11 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 1Km of an existing tower in rural area and 500m in urban area shall be subject to approval from RURA.

#### 4.1.12 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 accident which are likely to cause damage, injuries or nuisance to the public.
- B) All towers, communication facilities and antenna support structures shall at all times be kept and maintained in good conditions, order, and repair so that they shall not menace or endanger the life or property of any person.
- C) Licensed maintenance and construction personnel shall perform all maintenance or construction of towers, communication facilities or antenna support structures.

#### 4.1.13 Public Exposure to the Electromagnetic Radiation (EMR)

- a) The operator shall comply with the guidelines established by International Commission on Non-Ionizing Radiation Protection (ICNIRP) for public exposure to radiation as outlined in annex A.
- b) Timely independent random audits shall be carried out by RURA to ensure conformity to ICNIRP guidelines. Schools, nurseries and other sensitive sites shall be audited more frequently.
- c) The beam of greatest radio frequency intensity from a base station sited within or near education facilities or hospitals (health facilities) shall not be permitted to fall on any part of the grounds or buildings of the institution without the consultation of the Authority (RURA).
- d) The operator shall avoid siting towers in or near wetlands, near known bird concentration areas or in habitat of listed as threatened or endangered species or in migratory bird's routes.
- e) 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. Refer to annex C
- f) Antenna sites should be designed in such a way that the public cannot access such areas, the nearest the public can be from an antenna should not be less than 3 m.
- g) 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.
- h) The antenna should not be less than 15m from the ground.
- i) For roof mounted antennas, the transmitting antennas should be kept away from the areas where people are most likely to be.
- j) For the purpose of annual audit, all the operators shall provide to RURA details of all their base stations countrywide. This shall include the name of operating company; their emissions; the height of the antenna above ground level; the date that transmission started; the frequency range and signal transmission characteristics. Both the Authority and Operator shall keep this information.
- k) The Authority shall conduct both random and regular inspections of communication masts and facilities to ensure compliance to these guidelines.

#### 4.1.14 Pre-existing facility, towers or antennas

All wireless communication facilities existing on or before the effective date of these guidelines shall be allowed to continue as they presently exist except in the case described by 4.2.5.1, provided however, that any significant modification on an existing wireless communication facility must comply with these guidelines, including submitting an application for such modifications. 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, RURA shall take appropriate action pursuant to the terms of these guidelines.

## ***4.2 Site sharing for communication facilities***

### **4.2.1 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 4.2.1.1, 4.2.1.2, 4.2.1.3. Where a lower ranked alternative is proposed, the applicant must demonstrate by substantial evidence that higher ranked options are not technically feasible or available.

**4.2.1.1** Co-location on existing communication tower

**4.2.1.2** Co-location on existing building/ other structure

**4.2.1.3** Development of new communication tower

### **4.2.2 Co-location requirements**

**4.2.2.1** Placement of antennas on existing towers or other 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.

**4.2.2.2** Certification from a licensed engineer that certifies that the structure can support the additional load due to the co-location of facilities.

### **4.2.3 Co-location guidelines**

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

**4.2.3.2** The design, construction and installation of towers over 30 meters shall be done in such a way as to accommodate a minimum of three service providers. Towers whose height is between 18m and 30m will accommodate at least 2 service providers. The power rating of grid access, as well as the power rating of (backup) generator shall be dimensioned to accommodate (or allow for easy upgrade to accommodate) a minimum of three service providers.

**4.2.3.3** Licensees developing any new mobile site shall develop that new mobile site in accordance with the joint specifications which are to be agreed between the Licensees in order to ensure that the new mobile site is capable of accommodating the requirements of both Licensees.

**4.2.3.4** These guidelines recommend the co-location of Passive infrastructures but the Authority (RURA) will not encourage and promote sharing of active infrastructures.

#### **4.2.4 Inventory of towers and location specifications**

Each applicant shall submit a complete 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 1km of the location.

The inventory of tower locations and specifications to be provided by each operator/service provider has to show at least the following data:

- Exact location (address and GPS co-ordinates)
- Mechanical tower specifications (type, height, maximum load)
- Site specification (size in square meters, characteristics such as fencing, gates, shelters or equipment room, ...)
- Specification of electricity access (grid access, generator rating)
- Current usage (tower load, number of antennas, square meters occupied by equipment, current electricity rating, ... )
- Current spare capacity (tower load, number of antennas, square meters available for additional equipment, spare electricity, ... )

RURA will maintain a database with all tower locations and specifications. Upon written request, licensed operators in Rwanda can obtain a copy of this database from RURA.

Upon request by another licensee, each operator/service provider must provide complete information on tower locations and specifications within a maximum of 10 working days. Within another 10 working days, a licensee must grant escorted access to a potential sharing site upon request by other licensees, who seek to share passive infrastructure.

The operator/service provider will provide updates, from time to time, on additional facilities installed by other operators that opt to co-locate on the operator's facility after approval has been granted. Non new tower shall be permitted or major communication facility approved unless the applicant demonstrates to the satisfaction of RURA by substantial evidence that no existing facility (whether or not owned by 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 a 1km radius in rural area or 500 m in urban area of the proposed tower site, as determined by a qualified radio frequency engineer.
- b) An affidavit demonstrating that existing towers and structures located within a 1 km radius (rural area) or 500 m (urban area) of the proposed tower site don't have the capacity to provide reasonable technical service consistent with the applicant's technical system.
- c) Written technical evidence from a qualified structural engineer that existing towers and structures within a 1km radius (rural area) or 500 m (urban area) of the proposed tower site are not of sufficient height to meet the applicable requirements.
- d) Written technical evidence from a qualified structural engineer that existing towers and structures within the area don't have sufficient structural strength to support the proposed facility.
- e) A written statement from a qualified telecommunications engineer submitting technical evidence showing that the existing towers and structures within the geographic search area are incompatible due to electromagnetic /radiofrequency interference 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 or costs required by the owner to share an existing tower or structure within geographic search area, or to adapt an existing tower or structure within the area 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 a 1km radius (rural area) or 500m (urban area) of the proposed tower site unsuitable.

#### 4.2.5 Co-location on existing infrastructures

**4.2.5.1** RURA also requires that existing mobile sites are similarly be made available for site sharing. Accordingly, a Licensee may request to share an existing mobile site of another Licensee. In this regard, the licensees shall endeavor to cooperate in order to facilitate the prompt and efficient

completion of all tasks related to establishing a joint presence at the existing mobile site.

**4.2.5.2** The cost of adapting an existing mobile site to accommodate another Licensee's facilities shall be borne by the Licensee which is requesting to share the existing mobile site save costs for depreciated materials.

## **5. Price-Setting for Passive Infrastructure Sharing**

### **5.1 Site categories**

**5.1.1** In order to determine maximum prices for passive infrastructure sharing, RURA examined the actual cost of passive infrastructure sharing for access to towers as well as access to electricity (both, grid and generator power). This cost study has taken into consideration the most common configurations based on lattice towers in three categories for heights, and site configurations with and without access to the electricity grid.

**5.1.2** The three categories for lattice towers are:

- towers with heights below 30 meters
- towers with heights between 30 and 50 meters
- towers with heights above 50 meters

**5.1.3** The categories for power access are:

- mobile sites with equipment room and access to the electricity grid
- mobile sites with outdoor installations and with access to the electricity grid
- mobile sites with outdoor installations and without electricity grid access

### **5.2 Price setting methodologies**

**5.2.1** When determining the maximum prices for tower and electricity access sharing, RURA took into consideration different approaches for price setting, such as

- leaving price-setting to the market, i.e. based on negotiations between licensees
- price-setting based on benchmarking
- cost-based price setting

**5.2.2 Negotiation-based price setting** is most adequate, if there is an efficient market of players with similar market power. However, in case of one (or few) dominant players, negotiation-based prices will lead to sub-optimal results, as dominant players can exert their market power to determine actual price levels. In addition, negotiation-based price setting is often highly intransparent and the public interest is usually not taken into consideration.

**5.2.3 Price-setting by benchmarking** is an often used efficient method e.g. to quickly reduce prices to (international) best-practice prices. One major problem with benchmarking is the choice of reference countries, which can lead to widely varying results and gives an additional difficulty of how to adjust prices to local market circumstances.

**5.2.4 Cost-based price-setting** is a most widely used approach by regulators to set prices at levels of an efficient operator. The two main approaches (each of which comes with different variants) are Long-Run-Incremental Cost (LRIC) and Fully-Allocated Cost (FAC). According to economic theory, both approaches will converge to the same results, if they are based on current costs of an efficient operator and use a full-service (or long-run average) increment. However, in most cases, LRIC-based cost models lead to lower prices, by using a more narrow definition of the actual service increment or by applying forward-looking efficiency improvements.

### **5.3 Fully allocated cost approach**

**5.3.1** In the case of price-setting for tower and electricity access sharing, RURA applies - in an initial approach - a fully-allocated cost methodology, using actual cost figures provided by all main operators in Rwanda.

This approach uses weighted-average capital-expenditures (CAPEX) figures with different categories for asset life time and weighted-average operating costs (OPEX) as submitted by the operators to determine monthly cost-based infrastructure sharing prices (see Annex F for detailed CAPEX and OPEX figures derived from operator data submissions).

**5.3.2** A cost-based service price is defined as:

$$\text{SERVICE COST} = \text{OPEX} + \text{DEPRECIATION} + \text{RETURN ON CAPITAL}$$

While operating costs can be determined relatively straight-forward, return on capital and depreciation charges can be based on different approaches, depending on the form of depreciation. Most commonly used approaches are straight-line depreciation (used in most accounting systems) and annuities.



**5.3.3 Straight-line depreciation** has the advantage, that it can be easily based on operator accounts. However, the main disadvantage is that the return on capital changes significantly over time: As return on capital is based on the net book value of an asset, this net book value decreases over the life time of an asset to zero, leading to a very high price at the beginning of the asset life time and a zero price at the end.

**5.3.4** A more adequate approach for service price setting are **annuities**, as they keep the combination of depreciation and return on capital constant over the life-time of an asset.

The formula for calculating the annualization factor of annuities is:

$$\text{Cost of capital} / \{1 - [1 / (1 + \text{cost of capital})]^{\text{asset life}}\}$$

## **5.4 Implementation of maximum service prices**

The results for maximum service prices for passive infrastructure sharing are shown in **Annex F**. This Annex also shows, how operator cost inputs have been applied to arrive at the maximum service prices.

**5.4.1 Annex F section (I.)** shows the maximum monthly service prices for **tower sharing** for the three different lattice tower categories. These prices are applicable, if an infrastructure seeker only wants to share access to a tower and can provide his own electricity supply.

**5.4.2 Annex F section (II.)** shows the **additional** maximum monthly service price for **sharing electricity** from the infrastructure provider. These prices include all charges for electricity and fuel usage and are in addition to the applicable tower sharing price of Annex F section (I.).

Prices in Annex F section (II.) are based on the assumption, that the on-site power generator has sufficient spare capacity to cater for the needs of both, the infrastructure provider and the infrastructure seeker.

**5.4.3** In the case that the existing on-site generator of the infrastructure provider does not have sufficient capacity to supply the additional power for an infrastructure seeker, both parties need to agree on one of the following two options for upgrading the on-site generator:

**5.4.3.1 Option (1) for generator upgrade:** The infrastructure provider arranges and pays for the generator upgrade. In this case the infrastructure provider can charge an additional monthly fee for annualized cost of the generator upgrade. **Annex F section (III.)** shows this **additional monthly fee** for this generator upgrade.

**5.4.3.2 Option (2) for generator upgrade:** If the infrastructure provider does not wish to provide for the generator upgrade, the infrastructure seeker will need to pay for the generator upgrade. In case of the existing generator having a Net Book Value greater than 0, one of the following two options should be applied:

(a) The infrastructure provider reimburses the net book value to the infrastructure seeker; or

(b) The infrastructure provider transfers the old generator to the infrastructure seeker.

In either case, the infrastructure provider will be responsible for operation and maintenance of the upgraded generator and the monthly fees of Annex F section (II.) are applicable.

**5.4.4** Considering that infrastructure costs show relatively small variations over time (in Dollar terms), and since these infrastructure costs comprise the largest part of the service cost, RURA expects that the **service prices in Annex F remain valid for a 3 year period**, starting with the effective date of these guidelines. RURA reserves the right to review prices at any time, if sufficient evidence arises to justify a modification.

## 6. Contractual Arrangements and Timelines

### 6.1 Reference Contract

**6.1.1** RURA encourages infrastructure providers and infrastructure seekers to develop a reference contract, which is in line with the provisions of these Guidelines.

**6.1.2** This reference contract should be submitted to RURA for review and filing purposes.

### 6.2 Basic Process and Timing for Site Sharing

All installations of wireless communications systems must comply with the Procedural Guidelines for Permitting of Site Building and Installation of Wireless Communication Infrastructure as laid out in Annex C.

In addition, Infrastructure providers and infrastructure seekers should develop a process for site sharing, which should include - as a minimum - the following steps:

**6.2.1** In case of site sharing, which does not require an upgrade of the power generator:

- Infrastructure seeker requests site details, infrastructure provider must submit an answer within a maximum of 10 working days.
- Infrastructure seeker requests a site visit, which must be granted within 10 working days.
- Once the Infrastructure seeker decided to use a site of an Infrastructure provider, he issues a purchase order.
- Infrastructure provider must confirm the purchase order and issue an invoice within a maximum of 10 working days.
- Infrastructure seeker gets access to the site immediately after payment of invoice.
- Payment terms should cover an upfront payment for a period of 6 months.

**6.2.2** In cases where a generator upgrade is necessary, the following preparatory steps should be followed:

- Infrastructure seeker requests site details, infrastructure provider must submit an answer within a maximum of 10 working days.

- Infrastructure seeker requests site visit, which must be granted within 10 working days.
- Both parties agree on the generator upgrade specifications (see next section 6.2.3 for further options and details)
- The generator upgrade must be installed within a maximum of 10 weeks
- Infrastructure seeker issues purchase order for site sharing, infrastructure provider issues invoice, and infrastructure seeker gets site access, as soon as invoice is paid.

**6.2.3** As described in section 5.4.3 and sub-sections 5.4.3.1 and 5.4.3.2, there are two basic options for the generator upgrade:

- (1) the infrastructure provider arranges and pays for the generator upgrade, in which case an additional monthly charge becomes applicable (see section 5.4.3.1); or
- (2) the infrastructure seeker will pay for the generator upgrade, in which case either the Net Book Value of the existing generator will be reimbursed by the infrastructure provider, or the existing generator will be transferred to the infrastructure seeker (see section 5.4.3.2).

In all cases, the infrastructure provider will be responsible for operation and maintenance of the generator.

## ***6.3 Coming into Force of Guidelines and Pricing***

**6.3.1** With the effective date of these Guidelines, all provisions of these Guidelines including the maximum prices will come into force.

**6.3.2** For currently existing site-sharing agreements, there will be no retro-active adjustment of prices paid for sites shared before the effective date of these Guidelines.

**6.3.3** If an existing site-sharing agreement covers a period beyond the effective date of these Guidelines, already paid fees should be adjusted to the maximum prices of these Guidelines as of the effective date of these Guidelines. This adjustment could either be done through a re-imbursement or through offsetting the difference against invoices of future site-sharing agreements.

## ***6.4 Procedure in case of non-payment of invoices***

In case of non-payment of a site-sharing invoice, the following procedures shall be applied:

**6.4.1** In case of a first-time agreement on site-sharing, access to the site will only be granted after full payment of the initial invoice has been received.

**6.4.2** In case of non-payment of subsequent invoices for shared sites, the following steps are applicable:

- Infrastructure provider sends three monthly reminders
- After 3rd month, a final 1 month notice is given with copy to RURA
- If full payment is still not received after a total of 4 months, infrastructure provider has the right to remove the equipment of the infrastructure seeker from the affected site

## Annexes

### Annex A

ICNIRP reference levels for public exposure (ICNIRP, 1998)

Frequency (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (W/m <sup>2</sup> )
Up to 1Hz	-----	$3.2 \times 10^4$	-----
1-8Hz	10,000	$3.2 \times 10^4 / f^2$	-----
8-25Hz	10,000	$4,000 / f$	-----
0.025-0.8KHz	$250 / f$	$4 / f$	-----
0.8-3KHz	$250 / f$	5	-----
3-150KHz	87	5	-----
0.15-1MHz	87	$0.73 / f$	-----
1-10MHz	$87 / f^{1/2}$	$0.73 / f$	-----
10-400MHz	28	0.073	2
400-2000	$1.375 f^{1/2}$	$0.0037 f^{1/2}$	$f / 200$
2000-3000	61	0.16	10

**Notes:** *f* is for frequency in MHz; *V* is volt; *A* is Ampere

## Annex B

### Application Form for approval to construct communication towers or Masts

Name of Entity wishing to construct Facility: (Property owner, Service provider or Operator )			
Type of license held		License No:	
Type of facility to be constructed:			
<b>Information about person Responsible for the preparation of this application</b>			
Name:			
Position in Organization:			
Professional qualifications:			
Current address information	P.O Box:	Post Code:	Town:
Email:	Mobile Tel No:	Fixed Tel No:	
<b>Information about the property on which the facility is to be constructed</b>			
Name of property owner:			
Current Address (of property owner):	P.O.Box:	Town:	
	Post code:	Email:	
Mobile Tel No:		Fixed Tel No:	
Coordinates of mast or tower		Designation of area in which property is located	
Estate, village or town where property is located:		Size of property (m <sup>2</sup> )	

### 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 in square meter 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.
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 be provided**

1. Provide documentation that demonstrates the need for the wireless communication facility to provide service. Such documentation shall include, but not limited to propagation studies of the proposed site and all existing and proposed sites.
2. Provide a description of the proposed antenna(s) and all related fixtures, structures and apparatus, including height above pre-existing grade, materials and color.
3. Provide the frequency, modulation and class of service of each radio and other transmitting equipment.
4. Provide the actual intended transmission and the maximum effective radiated power of the antenna(s).
5. Provide direction of maximum lobes and associated radiation of the antenna(s).
6. Provide the applicant's proposed tower maintenance and inspection procedures.
7. Provide documentation ensuring that the proposed antenna will not cause interference with other communication devices within the geographical service area.



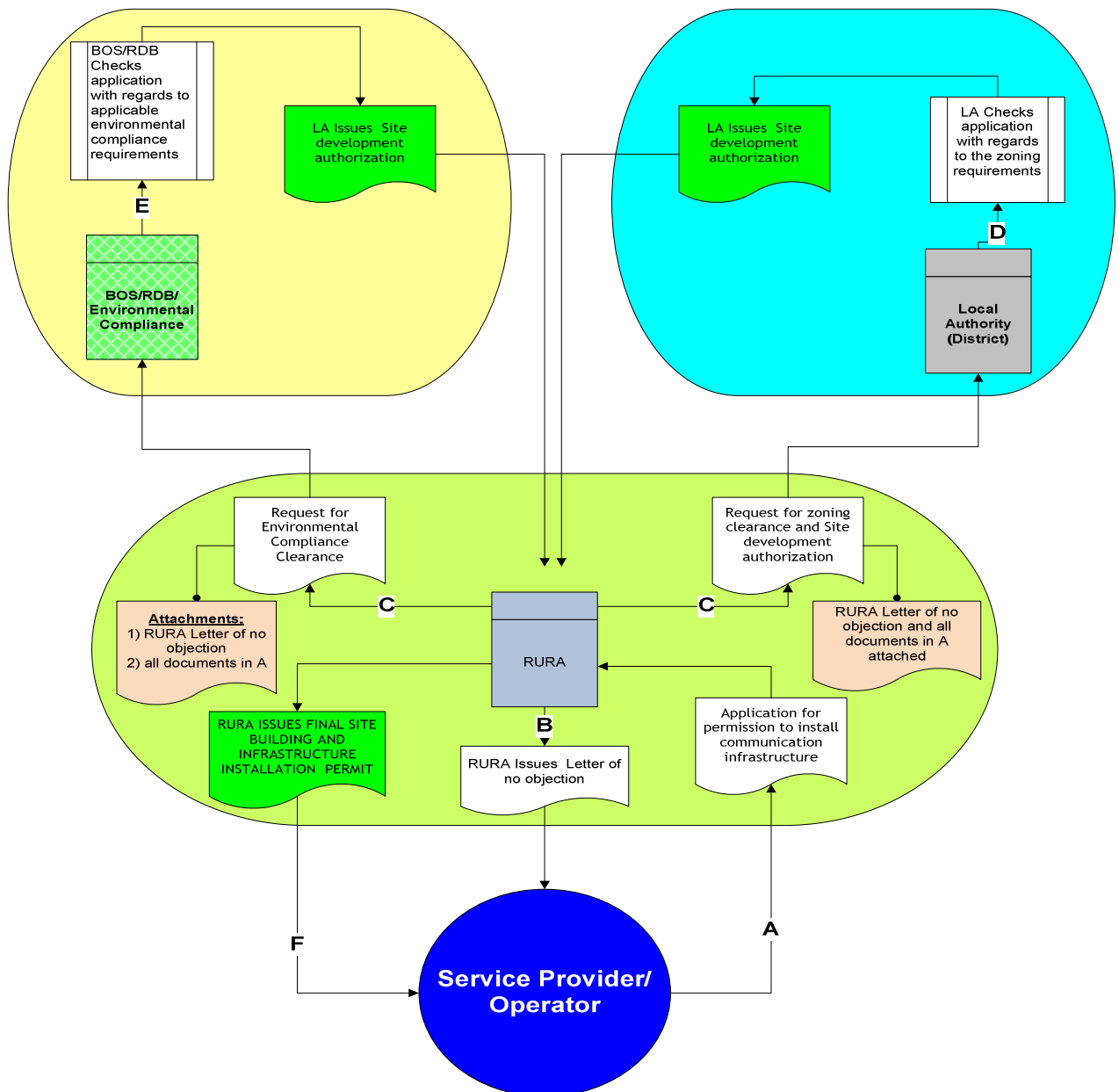
## Annex C

### PROCEDURAL GUIDELINES FOR PERMITTING OF SITE BUILDING AND INSTALLATION OF WIRELESS COMMUNICATION INFRASTRUCTURE

#### I. Assumption(s)

These procedural guidelines are applicable to entities that are already licensed or have authority to build wireless communications infrastructure.

#### II. Procedural flowchart



### III. NOTES ON STEPS AND RATIONALE

- A. Operator applies for permission to install communication infrastructure from the licensing authority (RURA) in accordance with article 47 of the telecom law. The applicants will be required to provide the following set of documents along with their applications to RURA:

#### 1. Site Design Description

- A brief description of the proposed site: Location and size of facilities and accessory equipment, size and boundaries (applicable to the tower only) existing and proposed topography, legal description of the proposed site;
- Structural and engineering designs and drawings at a scale of at least 1:100. These should be prepared by registered engineering firms.
- Architectural elevation drawings (with true north arrow indicated) of all equipment indicating materials, overall exterior dimensions and colors of structures;
- Setback and height requirements of the facility
- Location and size of existing structures, vegetation (if any) and location and size of proposed improvements, including any landscaping, location and size of access roads to the facility;
- Existing utility easements and other rights of way on record (if any)
- Zoning and uses of properties adjacent to the proposed site (i.e. within a radius of 100 meters from the site);
- Landscaping plan showing landscape material, parking, method of fencing, finishing color, if applicable, method of camouflage and illumination.

2. Vicinity Map of the Area: The vicinity map should show the location of existing and planned wireless communication facilities belonging to the applicant or other communication service providers within 1 kilometers of the proposed site.

3. Project Proposal: The project proposal should provide details pertaining to the following in a narrative form:

- The applicant and surface owner's names, addresses, signatures (and designation of agents if applicable) with proof of ownership or lease agreement in a form acceptable to the local district/municipality.
- An explanation of the need for such a facility, operating plan and proposed coverage area.

- An explanation of the applicant's knowledge of alternatives to the proposed site and why these other sites are not preferred to the proposed one.
  - An explanation of how the proposed site infrastructure development blends with natural features in the area and is compatible with surrounding structures (including existing buildings and other towers in the area).
  - An explanation of compatibility with the city masterplan, zoning and urban design guidelines.
  - Visual analysis: All applicants shall provide photo montage (perspective) showing how the site with proposed infrastructure will look on the land so as to identify the potential visual impacts of the proposed facility.
- B. The Letter of no objection from RURA must be obtained before any other authority is approached. This letter should affirm the following:
1. That the proposed facility alone or in combination with other facilities will comply with RURA standards for cumulative field measurements of radio frequency power densities and electromagnetic radiation fields (Referring to ICNIRP Guidelines and ITU standards on EMR thresholds)
  2. That the facility will comply at all times with RURA regulations and ITU standards prohibiting localized interference with other licensed frequency users.
- C. RURA requests for zoning clearance and site development authorization from the local authority (LA) and Environmental Compliance Clearance from RDB/ENVIRONMENTAL COMPLIANCE. The following documents shall be sent by RURA to the LA and RDB/Environmental Compliance:
1. A Letter of no objection from RURA shall be addressed to the LA and RDB/ENVIRONMENTAL COMPLIANCE, recommending the applicant's request for permission to develop the site (article 47 of the telecom law). The applicant shall receive a copy of the request for permission for close follow up.
  2. All documents submitted to RURA by the operator as described in STEP-A above.
- D. The Local authority will subject site development application to all other requirements as is currently the case and grant or deny approval. The applicant must obtain clearance from the LA with regard to zoning requirements before submitting project report to RDB/ENVIRONMENTAL COMPLIANCE. The LA must quote the RURA reference of the letter of no objection and capture site coordinate information in its authorization.

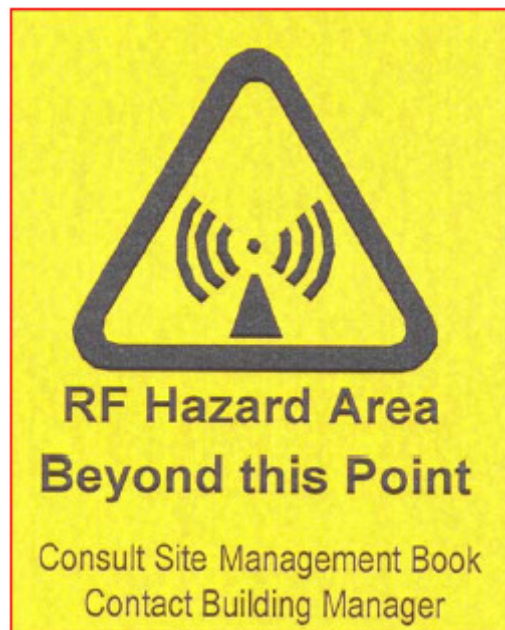
- E. RDB/ENVIRONMENTAL COMPLIANCE will subject the application to applicable environmental management procedures. This can be done concurrently with application to LA. RDB/ENVIRONMENTAL COMPLIANCE checks to ensure that project coordinates and site details match those contained in letter of no objection from RURA and undertakes necessary consultations with relevant parties and thereafter grant/deny clearance.
- F. Upon receipt of the two (2) approvals from LA and RDB/ENVIRONMENTAL COMPLIANCE, RURA issues final permit to build the site and install communication infrastructure.

## Annex D

The following are typical examples of signs used to inform and/or 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.



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.



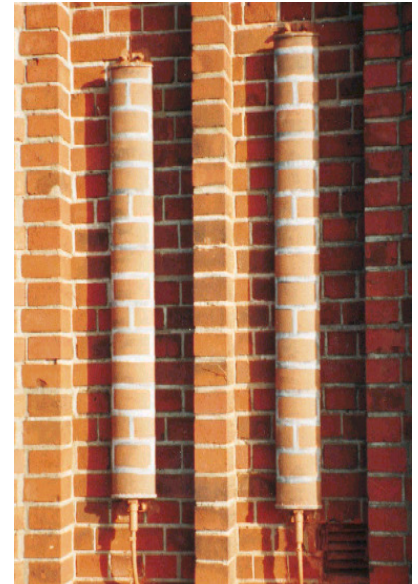
Perimeter of controlled limits indicating need for protective measures



Time averaging is not feasible to prevent exposures

## Annex E

An example of how to blend telecommunication infrastructure in environment



## Annex F

### I. Maximum Monthly Prices for Passive Infrastructure Sharing

The following table shows the maximum monthly prices for Tower Sharing according to section 5 of these Guidelines:

Type of Lattice Tower:	Tower1: <30m	Tower2: 30m..50m	Tower3: >50m
Maximum Monthly Price in USD:	912	971	1,254

### II. Additional Monthly Prices for Sharing of Electricity Access

The following table shows the maximum **additional** monthly prices for sharing of access to electricity according to section 5 of these Guidelines, if there is no need for an upgrade of the electricity generator. These monthly charges include all expenses, such as the cost of capital, maintenance costs as well as monthly electricity and generator fuel expenses:

Type of electricity access:	Equipment room with grid access	External site With grid access	External site <i>without</i> grid access
Maximum Monthly Price in USD:	1,108	1,158	2,391

### III. Additional Monthly Prices for Generator Upgrade

The following table shows - as an example - the **additional** monthly prices, if the infrastructure provider pays for an upgrade of the electricity generator.

	Asset Life (yrs)	Upgrade Cost (USD)	Annualization Factor	Annual Charge (USD)	Monthly Charge (USD)
Upgrade of Backup Generator (grid access):	8	15,000	0.2229	3,343	<b>279</b>
Upgrade of Main Power Generator (no grid access):	4	15,000	0.3503	5,254	<b>438</b>

The annualization factors are based on a cost of capital of 15% (see section IV. below). The example upgrade cost of \$15,000 (incl. material and installation cost) is based on the following two example data sets:

Upgrade of \$15,000 = New Gen. of \$20,000 minus NBV of Old Gen. of \$5,000,  
Upgrade of \$15,000 = New Gen. of \$25,000 minus NBV of Old Gen. of \$10,000



These prices must not be levied in cases where the infrastructure seeker pays for the generator upgrade.

#### **IV. Background and Main Input Data**

The maximum monthly prices in sections (I.), (II.) and (III.) of this Annex F have been calculated by applying the methodology presented in section 5 of this regulation. The overall approach for calculating the monthly prices for tower and electricity access sharing is based on a fully-allocated cost model, using annuities for annualizing the depreciation charges and the return on investment. Through different rounds of industry consultations, RURA collected data from all main operators in Rwanda on the actual cost of passive infrastructure elements.

The service cost is calculated by applying the following formula:

$$\text{Service Cost} = \text{Operating Cost} + \text{Annualization Factor} * \text{Capital Expenditure}$$

Annuities are a commonly used approach for service price setting, as they keep the combination of depreciation and return on capital constant over the life-time of an asset.

The formula for calculating the annualization factors of annuities is:

$$\text{Cost of capital} / \{1 - [1 / (1 + \text{cost of capital})]^{\text{asset life}}\}$$

For the purpose of service price setting of passive infrastructure sharing of mobile towers, RURA applies a cost of capital of 15%, which is based on a review of various operator submissions and a comparison with international benchmarks.

An important element for annualization of service costs is the asset life time. Operator replies on RURA's data request show asset life ranges from 10 to 20 years for tower infrastructure and from 3 to 10 years for power equipment.

For the purpose of cost modeling, RURA decided to apply the following asset life times:

- 15 years for CAPEX on towers (including material costs, installation charges and foundation costs - as well as access roads)
- 8 years for CAPEX on power access in the case of connectivity to the electricity grid
- 4 years for CAPEX in generators for sites with no connectivity to the electricity grid (in this case, generators have a much shorter expected useable life)

Applying the formula for annuities above with a 15% cost of capital, the resulting annualization factors are as follows:

<b>Asset Life:</b>	<b>Annualization Factor:</b>
Land	0.1500
15 years	0.1710
8 years	0.2229
4 years	0.3503

RURA collected data for actual capital expenditures and operating costs from all main operators in Rwanda. These collected data sets have been analyzed and categorized into different cost groups. After categorization of all cost elements, weighted averages have been calculated to arrive at an “average cost” for different classes of towers and access to electricity.

The applied cost categories are as follows:

- CAPEX for towers including material, installation charges, costs for foundations, and - if applicable - additional costs e.g. for access roads
- CAPEX for land acquisition (which has no depreciation, but a return on capital)
- CAPEX for power access, including grid connection, backup generators, backup batteries (if applicable)
- Operating costs for tower maintenance (excluding any maintenance costs for active equipment or antennas)
- Operating costs for power access, including costs of diesel for power generators

The following table shows the results of the weighted average cost categories for building a tower location in Rwanda, based on operator inputs:

	<b>Type of Lattice Tower:</b> <i>(all cost figures in US-Dollar)</i>	<b>Tower1:</b> <b>&lt;30m</b>	<b>Tower2:</b> <b>30m..50m</b>	<b>Tower3:</b> <b>&gt;50m</b>
<b>CAPEX:</b>	Material, Acquisition, Installation, Road construction	84,869	94,138	131,983
	Land Acquisition	19,081	15,699	14,105
<b>OPEX:</b>	Total annual OPEX:	4,522	4,857	5,415

Applying the above annualization factors leads to the following fully-allocated service costs for towers. The monthly costs for tower sharing are derived by dividing these annual costs by 12 and again by 2, assuming sharing between two operators.

Type of Lattice Tower:	Tower1: <30m	Tower2: 30m..50m	Tower3: >50m
<b>TOTAL SERVICE COST (in USD per year)</b>	21,898	23,311	30,102
<b>Monthly Cost when sharing between 2 operators (USD):</b>	912	971	1,254

Regarding access to electrical power, there are three typical configurations (based on operator inputs): locations with an equipment room and access to the electricity grid, locations with outdoor installation and grid access, and outdoor locations without grid access (making use of power generators only). In the latter case, all assets related to power generation have been put in the “short life” category applying a 4 year asset life to the cost annualization.

The following table shows the results of the weighted average cost categories for electricity access at a tower location in Rwanda, based on these operator inputs. OPEX figures include the additional electricity and fuel usage to serve a second operator.

	Type of Electricity Access: <i>(all cost figures in US-Dollar)</i>	Equipment room with grid access	External site with grid access	External site with-out grid access
<b>CAPEX:</b>	Material, Acquisition, Installation (long life)	10,722	11,713	9,856
	Generator, incl. Installation (long life)	16,457	17,942	0
	Generator, incl. Installation (short life)	0	0	16,747
<b>OPEX:</b>	Total annual OPEX:	20,535	21,180	49,311

Applying annualization factors leads to the following fully-allocated service costs for electricity access. The monthly costs for tower sharing are derived by dividing these annual costs by 12 and again by 2, assuming sharing between two operators.

Type of Electricity Access:	Equipment room with grid access	External site with grid access	External site with-out grid access
<b>TOTAL SERVICE COST (annual) [Annuity]</b>	26,592	27,789	57,373
<b>Monthly Cost when sharing between 2 operators:</b>	1,108	1,158	2,391