Regulations for Quality of Service of cellular mobile and fixed networks services

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TABLE OF CONTENTS

PREAMBLE

The Regulatory Board of RURA;

Pursuant to Law N° 44/2001 of 30 November 2001 governing Telecommunications, especially in Articles 9 and 22;

Pursuant to Law N° 39/2001 of 13 September 2001 establishing the Rwanda Utilities Regulatory Agency, especially in Article 48;

Given the Presidential Order No 04/01 of 15/03/2004 determining specific duties of the Regulatory Board in Telecommunications matters, especially in Article 3;

Having reviewed the current Quality of service of cellular mobile and fixed networks services in Rwanda;

Recognizing the importance of improving the Quality of service from cellular mobile and fixed networks services and the potentialimpact of these services on internal and international market access for all users;

AFTER its deliberations in its meeting of.....

HEREBY issues the following regulations for "*Quality of Service of Cellular Mobile and Fixed Networks Services".*

ARTICLE 1: PURPOSE OF THESE REGULATIONS

These regulations determine the quality of service of cellular mobile and fixed networks services in Rwanda.

ARTICLE 2: DEFINITIONS OF TERMS

In these regulations, unless the context otherwise requires, thefollowing terms shall be defined as follows:

a) **CELL:** is the radio frequency coverage area of a site in radio access network which is part of a cellular mobile telephone network and In case it is an Omni-site, it is synonymous with the site; and at a sectored site, it is synonymous with the sector;
b) **CELLULAR MOBILE NETWORK SERVICE:** is the service derived from a public land mobile network;

c) **CONSUMER:** is any natural person or legal entity using a telecommunications network and/or service;

d) **FIXED NETWORK SERVICE:** covers collection, carriage, transmission and delivery of voice or non-voice messages over licensee's Public Switched Telephone Network in licensed service area and includes provision of all types of services except those requiring a separate license;

e) **INTERCONNECTION:** refers to reciprocal services (but not necessary the same services) offered by two operators providing a public telephone service in order to allow all users to communicate freely amongst themselves, regardless of the communications networks to which they are connected or the telecommunications services they use;

f) **KPI:** Key Performance Indicator

g) **LICENSE:** is a document or instrument issued by the Regulatory Authority authorizing any person to provide service in the manner described in such document or instrument;

h) **LICENSEE:** is any person or legal Entity holding an operating license to provide telecommunication services issued by the Regulatory Authority;

i) **MOC:** is a mobile Originated Call;

j) **MOS-LQO**:Opinion Score - Listening speech Quality Objective;

k) **MTC:** Mobile Terminated Call;

l) **OMC:** Operation and Maintenance Centre;

m) **PDP:** Packet Data Protocol;

n) **PLMN:** Public Land Mobile Network;

o) **POI:**Point of Interconnection;

p) **POINT OF INTERCONNECTION:** is a mutually agreed upon point of demarcation where the exchange of traffic between the networks of two service providers takes place;

q) **PS:** Packet Switched;

r) **PSTN:** Public Switched Telephone Network;

s) **PUBLIC SWITCHED TELEPHONE NETWORK :** is a fixed specified switched public telephone network providing a two-way switched telecommunication services to the general public;

t) **PUBLIC LAND MOBILE NETWORK :** is a network set up and operated by any of the licensed telecom operators, for the purpose of providing land based mobile communication services to the public and which provides communication facilities to subscribers using mobile stations;

u) **QUALITY OF SERVICE :** is the main indicator of the performance of a telecommunication network and of the degree to which such network conforms to the standards of such quality of service as specified in these regulations for specified parameters;

v) **QOS:** Quality of Service;

w) **REGULATORY AUTHORITY:** is the Rwanda Utilities Regulatory Agency established by LawN°39/2001 of 13/09/2001 for the regulation of certain public utilities includingTelecommunications networks and /or telecommunications services;

x) **SMSC:**Short Message Service Centre;

y) **TELECOM OPERATORS:** are all licensees holding the "fixed" and/or "cellular mobile" licenses and are under the regulation of the Regulatory Authority in the Republic of Rwanda.

z) **SMS:** Short Message Service.

ARTICLE 3: SCOPEOF THESE REGULATIONS

These regulations shall apply to any licensed Cellular and Fixed Networks Telecom Operators within Rwanda.

All Licensed Cellular and Fixed Networks Telecom Operators shall be bound by the provisions of these regulations in sofar as their business activities are intended to provide cellular mobile and fixed networks services.

ARTICLE 4: OBJECTIVES OF THESE REGULATIONS

These regulations shall have the following objectives:

i. To improve service quality;
ii. To maintain service quality, while recognizing environmental and operating conditions;
iii. To make QoS information available to Customers;
iv. To improve operation and performance of interconnected networks;
v. To assist the development of related telecommunications markets.

ARTICLE 5: MEASUREMENTS, REPORTING AND RECORDING

(a) Telecom operator shall make measurements of network KPIs 24 hours/7 days a week. However, the Regulatory Authority may request the measurements of network KPIs during the busy hour. In that case, Telecom Operator shall choose the right hour within the peak periods of the day, provided such chosen busy hour is approved by the Regulatory Authority.

(b) Unless otherwise stated in these regulations, the reports on measurements taken and recorded shall be submitted to the Regulatory Authority on quarterly basis. The quarterly reports shall be delivered respectively from 31st March, 30th June, 30th September and 31st December, but not later than 15 working days counting from the specified dates. The Regulatory Authority may review from time to time the periodicity and the format of such report. Each operator must provide both hard copy and editable electronic (MS Word / Excel) versions of the reports.

(c) Formeasurements and verification functions, the Regulatory Authority shall use the following methods to audittelecommunication operators' networks,but not limited to: Drive test, Consumer survey, Data acquired from Network Operating Centers (NOCs)/Network Management Centers (NMCs) etc and data submitted by Licensees.

(d) The reporting areas, which are the geographic areas for which measurements are taken and recorded, shall be in the Republic of Rwanda, and shall be reported on National, each Province and Kigali-city basis taken separately. Unless the Regulatory Authority permits in writing; two or more reporting areas shall not be combined into one reporting area for particular Licensees, parameters, services and reporting periods.

(e) For each parameter which is reportable for a service, for each reporting area and for each reporting period, a Licensee shall perform the following tasks during measurement, reporting and recording:

i. Taking the measurements according to the measurement methods defined for the parameter as specified into APPENDIX 2 Measurement Methods.
ii. Submitting any additional information requested by the Regulatory Authority, including details of the times, places and other details of the measurements, within one (1) month after the end of the reporting period or as may be otherwise directed by the Regulatory Authority;
iii. Retaining quality of service data, including all measurements and related records (log files), for a minimum of three (3) months after the end of reporting period or as may be otherwise directed by the Regulatory Authority.

ARTICLE 6: PUBLICATION OF MEASUREMENT RESULTS

(a) The Regulatory Authority shall publish the measurement results within two (2) months after the end of the reporting period to which the measurements apply with or without additional notes or commentsdepending on the measurement verification results.

(b) For each parameter which is reportable for a service, for each reporting area and for each reporting period, measurement results to be published by the Regulatory Authority shall be set out in tables that contain, for each Licensee:

i. The name for the service used by the Licensee;
ii. An identification of the reporting area for which the measurements were taken;
iii. An indication of any target for the parameter and the service that has not been reached by the Licensee;
iv. Any other information or comparison of service quality that the Regulatory Authority determines to be appropriate, possibly including information to help customers to assess the performance of competing Licensees.

(c) In considering whether to approve explanatory Note by a Licensee, the Regulatory Authority

may take into account factors including but not limited to:

i. Any service deficiencies which arise partially or wholly from the services of another Licensee;
ii. Any changes in environmental or operating conditions that could not have been reasonably foreseen by the Licensee; and
iii. Any expectations about quality of service which are appropriate to the tariffs and other commercial terms for the services of the Licensee.

ARTICLE 7: AUDIT

(a) The Regulatory Authority may audit some or all of the quality of service data retained by Licensees. In doing so the Regulatory Authority may vary the regularity and frequency of the audits, as well as the Licensees, services, parameters, reporting areas and reporting periods that require audits.

ARTICLE 8: INVESTIGATION OF THE QUALITY OF SERVICE

(b) The Regulatory Authority may investigate at any time the quality of service measurement; reporting and recording procedures of a Licensee**.** In doing so the Regulatory Authority may exercise its powers of monitoring and enforcement of obligations.

ARTICLE 9: REPEALING PROVISIONS

All prior provisions contrary to these regulations are hereby repealed.

ARTICLE 10: COMMENCEMENT

These regulations shall come into force on the date of its signature.

KIGALI, ON MAY 9,2013

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EUGENE KAZIGE

CHAIRPERSON OF THE REGULATORY BOARD

APPENDIX 1- KEY PERFORMANCE INDICATORS

Appendix 1 includes two tables, namely table 1 and table2. Table 1 illustrates all KPIs for both voice 3G Data and SMS services provided via Cellular mobile networks by Telecom Operators. On the other side, table 2 illustrates all KPIs for the voice service provided by Telecom Operators via Fixed networks.

Table 1: Cellular Mobile Networks Voice and SMS Services

S/N	PERFORMANCE INDICATORS	THRESHOLD	AVERAGED OVER A PERIOD OF:
VOICE SERVICE			
1.	Call Setup Success Rate (CSSR)	≥95 %	One quarter
2.	Call set up time (CST)	≤ 9 sec in ≥ 90% of the cases (2013-2014)	One quarter
		≤ 9 sec in ≥ 95% of the cases (from 2015)	
3.	Call Drop Rate (CDR)	≤2%	One quarter
4.	Speech Quality (MOS)	For ≥92% of cases ≥3 using MOS, PESQ or POLQA algorithms	One quarter
5.	Service coverage Area (Out-door signal level)	≥ -95 dBm The percentage of area to be covered shall depend on each operator business plan	One quarter
SMS SERVICE			
6.	SMS service accessibility	≥ 99%	One quarter
7.	SMS end-to-end delivery time	5 seconds, for≥99% of the cases. **Conditions:** The receiving mobile equipment should be ON, have coverage and the storage capacity is not FULL	One quarter

8.	SMS Completion Ratio	≥ 95%	One quarter
	3G DATA SERVICES		
9.	Attach failure ratio	≤ 2%	One quarter
10.	Attach Setup time	≥98% of successful attach attempts should be completed within 2 seconds	One quarter
11.	PDP Context Activation Failure Ratio	≤ 4%	One quarter
12.	PDP Context Activation Time	≥98% of successful attach attempts should be completed within 2 seconds.	One quarter
13.	PDP Context Cut-off Ratio	≤ 1%	One quarter

Table 2: Fixed Networks Voice Service

S/N	PERFORMANCE INDICATORS	THRESHOLD	AVERAGED OVER A PERIOD OF:
1.	Call setup success rate	≥ 98%	One quarter
2.	Call set up time	≤ 9 seconds, for ≥ 98 % of the cases	One quarter
3.	Fault repair time	≥ 95%	One quarter

APPENDIX 2- MEASUREMENT METHODS

Table 3: Measurement Methods of both Cellular Mobile (voice, 3G DataandSMSservices), and Fixed (voice service) Networks.

Parameter Name	Measurement Method
MOBILE NETWORKS	
Voice Service	
Call Setup Success Rate (CSSR)	**Definition:** The CSSR denotes the probability that the end-user can access the mobile telephony service when requested if it is offered by display of the network indicator on the user equipment. **Equation:** $$\text{Call Setup Success Rate} = [1 - (\text{Telephone service Non\_Accessibility})] \times 100\%$$ Where: $$\text{Telephone service Non\_Accessibility} = \frac{\text{Unsuccessful Call Attempt}}{\text{All call Attempt}}$$ Refer to ETSI TS 102 250-2 V2.2.1 (2011-04), Page 102-107 **Note 1:** Due to network problems and despite MTC being not busy (see preconditions for measurement), it may even be possible for the MOC to receive a busy or not reachable signal. In this case, since no ALERTING message will be sent, the test sample will be treated as a failure.
Call Setup Time (CST)	**Definition:** The call setup time describes the time period between sending of complete address information by the MOC and receipt of call set-up notification or an alerting message. **Equation:** $$\text{Call Setup Time} = (\text{Tconnect established} - \text{Tuser presses send button on UE})[s]$$ Refer to ETSI TS 102 250-2 V2.2.1 (2011-04), Page 108. **Note 2:** This parameter is not calculated unless the telephony call setup attempt is successful. It is assumed that early traffic channel assignment is used.
Call Drop Rate (CDR)	**Definition:** The call drop rate denotes the probability that a successful established attempt is ended unintentionally by MOC or MTC party.

<table>
<tr><td></td><td>Equation:

$$\text{Call drop rate} = \frac{\text{Unintentionally terminated telephony calls}}{\text{Successfuly established attempts}}$$
Refer to ETSI TS 102 250-2 V2.2.1 (2011-04), Page 110</td></tr>
<tr><td>Speech Quality (MOS)</td><td>Definition: The speech quality on call basis is an indicator representing the quantification of the end-to-end speech transmission quality of the mobile telephony service. This parameter computes the speech quality on a sample basis.

Equation: The validation of the end-to-end quality is made using MOS scales. These scales describe the opinion of users with speech transmission and its troubles (noise, robot voice, echo, dropouts, etc.) according to ITU -T Recommendation P.862 in conjunction with ITU-T Recommendation P.862.1, or according to ITU-T Recommendation P.863. The algorithm used should be reported. The speech quality measurement is taken per sample. An aggregation for measurement campaigns or parts of it should be made on speech sample basis.

Listening-quality scale
<table><tr><th>Quality of the speech</th><th>Score</th></tr><tr><td>Excellent</td><td>5</td></tr><tr><td>Good</td><td>4</td></tr><tr><td>Fair</td><td>3</td></tr><tr><td>Poor</td><td>2</td></tr><tr><td>Bad</td><td>1</td></tr></table>
The quantity evaluated from the scores (mean listening-quality opinion score, or simply meanpinion score) is represented by the symbol MOS.

Refer to ITU-T RECOMMENDATION P.800 (08/1996)

Note 3: The acoustic behaviour of terminals is not part of this speech quality measurement.</td></tr>
<tr><td colspan="2">SMS Service</td></tr>
<tr><td>SMS Service Accessibility</td><td>Definition: The SMS service accessibility denotes the probability that the end-user can access the SMS when requested while it is offered by display of the network indicator on the user equipment.

Equation:

$$\text{SMS Service Accessibility} = (1 - \text{SMS Service Non} - \text{Accessibility}) \times 100\%$$
Where:</td></tr>
</table>

	$$\text{SMS Service Non} - \text{Accessibility} = \frac{\text{Unsuccessful SMS service attempts}}{\text{All SMS service attempts}}$$ Refer to ETSI TS 102 250-2 V2.2.1 (2011-04) Page 225
SMS Completion Ratio	**Definition:** The SMS Completion Ratio is the ratio of successfully received and sent messages from the sending user equipment to the receiving user equipment, excluding duplicate received and corrupted messages. **Equation:** $$\text{SMS Completion Ratio}\,[\%] = (1 - \text{SMS Failure Completion Ratio}) \text{x } 100\%$$ Where: $$\text{SMS Completion Failure Ratio} = \frac{\text{Unsuccessfully received SMS}}{\text{All SMS service attempts}}$$ Refer to ETSI TS 102 250-2 V2.2.1 (2011-04), Page 228 **Note 4:** A corrupted SMS is an SMS with at least one bit error in its message part
SMS End-to-End Delivery Time [s]	**Definition:** The SMS end-to-end delivery time is the time period between sending a short message to the network and receiving the very same short message at another UE. **Equation:** $$\text{SMS End to End Delivery Time}\,[s] = (t_{\text{B receive}} - t_{\text{A send}})\ [s]$$ Refer to ETSI TS 102 250-2 V2.2.1 (2011-04), Page 230
DATA SERVICE	
Attach failure ratio	**Definition:** The attach failure ratio denotes the probability that a subscriber cannot attach to the PS network. **Equation:** $$Attach\ Failure\ Ratio[\%] = \frac{Unsuccessful\ Attach\ Attempts}{All\ Attach\ Attemps} \times 100\%$$ ETSI TS 102 250-2 V2.2.1 (2011-04)
Attach Setup time	**Definition:**The attach setup time describes the time period needed to attach to the PS network **Equation:** $$Attach\ Setup\ Time[s] = (T_{attach\ complete} - T_{attach\ request})[s]$$ ETSI TS 102 250-2 V2.2.1 (2011-04)
PDP Context Activation Failure	**Definition:**The PDP context activation failure ratio denotes the probability that the PDP context cannot be activated. It is the proportion of unsuccessful PDP context activation

Ratio	attempts and the total number of PDP context activation attempts. **Equation:** $$PDP\ Context\ Activation\ Failure\ Ratio[\%] = \frac{Unsuccessful\ PDP\ context\ activation\ attempts}{All\ PDP\ context\ activation\ attempts} \times 100\%$$ ETSI TS 102 250-2 V2.2.1 (2011-04)
PDP Context Activation Time	**Definition:**The PDP context activation time describes the time period needed for activating the PDP context. **Equation:** $$PDP\ Context\ Activation\ Time\ [s] = (T_{PDP\ context\ activation\ accept} - T_{PDP\ context\ activation\ request})[s]$$ **Note 5:** While determining the average PDP context activation time only successful activation attempts are included in the calculations ETSI TS 102 250-2 V2.2.1 (2011-04)
PDP Context Cut-off Ratio	**Definition:** The PDP context cut-off ratio denotes the probability that a PDP context is deactivated without being initiated. **Equation:** $$PDP\ Context\ Cut-off\ Ratio\ [\%] = \frac{PDP\ context\ losses\ not\ initiated\ by\ the\ user}{All\ successfully\ activated\ PDP\ contexts} \times 100\%$$ **Note 6:** Precondition for measuring this parameter is that a PDP context was successfully established first ETSI TS 102 250-2 V2.2.1 (2011-04)
FIXED NETWORKS	
Call Setup Success Rate (CSSR)	**Definition:** Call Setup success rate is defined as the ratio of successful calls to the total number of call attempts in a specified time period. **Equation:** $$\text{Call Setup Success Rate} = [1 - (\text{Unsuccessful Call Ratio})] \times 1$$ Where: $$\text{Unsuccessful Call Ratio} = \frac{\text{Unsuccessful Call Attempt}}{\text{All call Attempt}}$$ **Note 7:** An unsuccessful call is a call attempt to a valid number, properly dialled following dial tone, where neither called party busy tone, nor ringing tone, nor answer signal, is recognized at the access of the calling user within 30 seconds from the instant when the last

	digit of the destination subscriber number is received by the network. Refer to ETSI EG 202 057-2 V1.3.2 (2011-04)
Call Setup Time	**Definition:** The call set up time is the period starting when the address information required for setting up a call is received by the network and finishing when the called party busy tone or ringing tone or answer signal is received by the calling party. Where overlap signalling is used the measurement starts when sufficient address information has been received to allow the network to begin routeing the call. **Equation:** $\text{Post Dialling Delay [s]} = \left(T_{alerting\ tone\ from\ called\ user} - T_{end\ of\ dialing\ by\ the\ caller-user}\right)$ ETSI EG 202 057-2 V1.3.2 (2011-04)
Fault Repair Time	**Definition:**The duration from the instant a fault report has been made to the instant when the service element or service has been restored to normal working order. **Equation:**The percentage of faults cleared in a period ≤ 8Hrs to all faults. In this case the time should be reported together with the percentage. $Fault\ Repair\ Time = \frac{Number\ of\ Faults\ repaired\ in\ less\ than\ 8\ hours}{Total\ Number\ of\ Faults} \times 100\%$ ETSI EG 202 057-1 V1.3.1 (2008-07)

KIGALI, ON MAY 9,2013

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EUGENE KAZIGE

CHAIRPERSON OF THE REGULATORY BOARD