The Zambia Information and Communications Technology Authority (ZICTA) is provided for under section 4 of the Information and Communication Technologies (ICT) Act No. 15 of 2009. Section 6 of the Act empowers ZICTA to regulate the provision of electronic communication services and products and monitor the performance of the sector, including the levels of investment and the availability, quality, cost and standards of the electronic communication services. The Authority’s mandate has further been enhanced by the Electronic Communications and Transactions Act No. 21 of 2009.

Under section 67(1) of the ICT Act, all service providers are required, in respect of their specific services, to meet such minimum standards of quality of service as the Authority may specify and publish.

In accordance with the aforementioned sections, the Authority is hereby publishing the Quality of Service (QoS) Guidelines containing standards, methods of measurement and sanctions for breach. These guidelines shall protect the consumers of ICT services and products in the retail and wholesale markets.
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<th>Description</th>
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<td>2G</td>
<td>2nd Generation</td>
</tr>
<tr>
<td>3G</td>
<td>3rd Generation</td>
</tr>
<tr>
<td>4G</td>
<td>4th Generation</td>
</tr>
<tr>
<td>BER</td>
<td>Bit Error Rate</td>
</tr>
<tr>
<td>CS</td>
<td>Circuit Switched</td>
</tr>
<tr>
<td>CSCF</td>
<td>Call Session Control Function</td>
</tr>
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<td>CSFB</td>
<td>Circuit Switch Fall Back</td>
</tr>
<tr>
<td>CSR</td>
<td>Call Setup Rate</td>
</tr>
<tr>
<td>CSSR</td>
<td>Call Setup Success Rate</td>
</tr>
<tr>
<td>DNS</td>
<td>Domain Name Server</td>
</tr>
<tr>
<td>DSL</td>
<td>Digital Subscriber Line</td>
</tr>
<tr>
<td>ETSI</td>
<td>European Telecommunications Standards Institute</td>
</tr>
<tr>
<td>HO</td>
<td>Hand Over</td>
</tr>
<tr>
<td>HTTP</td>
<td>HyperText Transfer Protocol</td>
</tr>
<tr>
<td>IAP</td>
<td>Internet Access Point</td>
</tr>
<tr>
<td>ICMP</td>
<td>Internet Control Messaging Protocol</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
</tr>
<tr>
<td>IMS</td>
<td>IP Multimedia Subsystem</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
</tr>
<tr>
<td>ITU</td>
<td>International Telecommunications Union</td>
</tr>
<tr>
<td>LTE</td>
<td>Long term evolution</td>
</tr>
<tr>
<td>MHz</td>
<td>Mega Hertz</td>
</tr>
<tr>
<td>MMS</td>
<td>Multimedia Messaging System</td>
</tr>
<tr>
<td>MOS</td>
<td>Mean Opinion Score</td>
</tr>
<tr>
<td>MOS-LQ</td>
<td>Mean Opinion Score - Listening Quality</td>
</tr>
<tr>
<td>MSC</td>
<td>Mobile Switching Centre</td>
</tr>
<tr>
<td>MSC</td>
<td>Mobile Switching Centre</td>
</tr>
<tr>
<td>NER</td>
<td>Network Effectiveness Ratio</td>
</tr>
<tr>
<td>NP</td>
<td>Network Performance</td>
</tr>
<tr>
<td>PDP</td>
<td>Packet Data Protocol</td>
</tr>
<tr>
<td>PESQ</td>
<td>Perceptual Evaluation of Speech Quality</td>
</tr>
<tr>
<td>PLMN</td>
<td>Public Land Mobile Network</td>
</tr>
<tr>
<td>POLQA</td>
<td>Perceptual Objective Listening Quality Assessment</td>
</tr>
<tr>
<td>PSTN</td>
<td>Public Switched Telephone Network</td>
</tr>
<tr>
<td>QoE</td>
<td>Quality of Experience</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Form</td>
</tr>
<tr>
<td>---------</td>
<td>-----------</td>
</tr>
<tr>
<td>QoS</td>
<td>Quality of Service</td>
</tr>
<tr>
<td>RAB</td>
<td>Radio Access Bearer</td>
</tr>
<tr>
<td>RRC</td>
<td>Radio Resource Control</td>
</tr>
<tr>
<td>SDCCH</td>
<td>Stand-alone Dedicated Control Channel</td>
</tr>
<tr>
<td>SHO</td>
<td>Soft Hand Over</td>
</tr>
<tr>
<td>SIP</td>
<td>Session Initiation Protocol</td>
</tr>
<tr>
<td>SLA</td>
<td>Service Level Agreement</td>
</tr>
<tr>
<td>SMS</td>
<td>Short Messaging System</td>
</tr>
<tr>
<td>SMSC</td>
<td>Short Messaging System Centre</td>
</tr>
<tr>
<td>TCH</td>
<td>Traffic Channel</td>
</tr>
<tr>
<td>ZICTA</td>
<td>Zambia Information and Communications Technology Authority</td>
</tr>
</tbody>
</table>
PART I

PRELIMINARY

1. DEFINITIONS
In these guidelines, unless the context otherwise requires, any word or expression has the meaning assigned to it in the Act-

“Act” means the Information and Communication Technologies Act No. 15 of 2009;

“Authority” has the meaning assigned to it under the Act;

“breach” means any failure to comply with the target values prescribed in these Guidelines;

“committed information rate” means the specific information or data rate the service provider commits or guarantees to the consumer

“consumer” means a person to whom an electronic communications service is rendered, and includes any person who purchases electronic communications products otherwise than for the purpose of re-sale, but does not include a person who purchases any electronic communications products for the purposes of using them in the production and manufacture of any other goods or articles for sale;

“electronic communications network” has the same meaning assigned to it under the Act;

“electronic communications service” means a service provided by means of one or more electronic communications networks;

“examination” means any action undertaken by the officers of the Authority, staff of the Authority or other persons appointed for that purpose to establish whether there are reasonable grounds for a suspicion that a licensee and/or a person concerned in the management of the licensee is committing or has committed a prescribed contravention

“fault” means a state where the network does not meet the service specifications and some repair action is required;
“fixed telephony service” means a Telephony service that is not a Mobile Telephony Service;

“licence” means licence issued by the Authority;

“licensee” means the holder of a network licence, service licence, class licence or individual licence;

“measurement” means a numerical value that is obtained by measuring using a measurement method;

“measurement method” means the method of measuring a parameter that is prescribed in these guidelines;

“measurement point” means the end points where end-users access and experience the service or any other points in the network where measurement is performed. Measurement points will generally be located within limits of published coverage maps, signal strength being as outlined under QoS parameter “network coverage”

“Network accessibility” means the probability that the user of a service after a request (to a network) receives the proceed-to-select signal within specified conditions.

“Network availability” means the probability that the services are offered to a user via a network infrastructure.

“network termination point” means a point at which a Customer has physical access through terminal devices or other customer premises equipment to a network of a Licensee;

“operating time” means the total operating time of a service in a network during the reporting period;

“parameter” means a measurable characterization of the quality of an aspect of a service as prescribed in these guidelines;

“prescribed contravention” means a breach for purposes of these guidelines.

“published measurement” means a Measurement that is intended for publication with content and format that are prescribed in these Guidelines;

“QoS delivered/achieved by provider” means a statement of the level of the actual quality achieved and delivered to the consumer;
“QoS perceived by user/consumer” means a statement expressing the level of quality that a consumer believes they have experienced;

“QoS offered/planned by provider” means a statement of the level of quality expected to be offered to the consumer by the service provider;

“QoS requirement by user/consumer” means a statement of the level of quality required by the applications of consumers/users of a service, which may be expressed non-technically;

“quality” means the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs (ISO 8402);

“quality of experience (QoE)” means overall acceptability of an application or service, as perceived subjectively by the end user

“quality of service (QoS)” means the totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service. (ITU T Rec. E.800);

“reporting area” means the geographical area for which Measurements are taken and recorded;

“reporting period” means the period of time over which Measurements are taken and recorded when the authority, licensee or an appointed agent performs quality of service measurements, reporting, and record keeping tasks once for each Reporting area, parameter and service;

“sample size” means the minimum ‘number of tests’ or samples to be deemed a true reflection of the actual performance of the network as if the entire population or real traffic was measured. The sample size shall be determined as prescribed in Rec. ITU-T E.802 Amendment 1 (03/2017).

“service access” means a set of functions offered to a user by an organisation constitutes a service.

“service integrity” means the degree to which a service is provided without excessive impairments, once obtained.

“service retainability” means the termination of services (in accordance with or against the will of the user).

“service provider” means an entity licensed to provide an electronic communication network or service in accordance with the Act; and
“target” means a numerical value that must be reached by a Published Measurement (Key Performance Indicator, KPI) of the relevant service prescribed in these Guidelines.

2. SCOPE OF QUALITY OF SERVICE ASSESSMENT:

The scope of quality of ICT service assessment, shall constitute the following functional components:

a) Network Performance (NP);
b) Quality of Service (QoS); and
c) Quality of Experience (QoE).

Recommendation ITU-T E.804 illustrates the QoS functional components above, and are shown in Schedule 1.

2.1. Network Performance

Overall Network Performance shall be determined by undertaking an overall performance assessment of a network between two network interfaces. This process excludes the effect of the end-user devices.

The Network Performance data may be collected by counters from the core network.

2.2. Quality of Service

QoS shall be determined by undertaking assessment of the overall service performance within a network from a user’s perspective, including the end-user devices.

2.3. Quality of Experience

QoE shall be determined using objective statistical measurements and analysis through-

a) non-technical means by conducting Customer Satisfaction Surveys; and
b) Technical means using PESQ/POLQA as per Recommendation ITU-T P.862 and Recommendation ITU-T P.863.1 respectively.

In measuring QoS, the following factors prescribed in Recommendation ITU-T E.804 shall be taken into account:

a) Network availability
b) Network accessibility
c) Service availability
d) Service accessibility  

e) Service integrity  

f) Service retainability  

QoS shall be measured by either the Authority, the licensee, or an authorised agent as prescribed in Schedule 3.

3. **OVERVIEW OF QoS PARAMETERS**

3.1 The parameters to be monitored shall relate to the aspects of services that have impact on users as a whole, and not those which have minimal usage.

3.2 The following four perspectives are the basis upon which QoS parameters shall be defined and measured (Recommendation ITU-T G.1000):

a) Consumer's QoS Requirements;  
b) QoS offered by Licensee;  
c) QoS achieved by Licensee; and  
d) QoS perceived by Consumer.

3.3. For the avoidance of doubt, the Quality of Service parameters shall be measured and reported from the end user’s perspective.

3.4 Network performance parameters shall be measured and reported from the perspective as QoS achieved by the licensee.

3.5 A licensee shall establish measurement systems consistent with these guidelines.
PART II

PARAMETERS FOR QUALITY OF SERVICE

4. PSTN SERVICES

The following shall be the QoS parameters for PSTN Services:

4.1. SERVICE FUNCTION: Service Provisioning

<table>
<thead>
<tr>
<th>1. CATEGORY:</th>
<th>speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) QOS PARAMETER NAME:</td>
<td>Order of Completion Time</td>
</tr>
<tr>
<td>i. DESCRIPTION:</td>
<td>This is the time taken to provide a service in a location where a service is offered. It refers to the maximum waiting time for connection of service and is applicable to all licensees in this category</td>
</tr>
<tr>
<td>ii. MEASUREMENT METHOD:</td>
<td></td>
</tr>
<tr>
<td>The order completion/service supply time should be measured as the elapsed time (not the working time) from when a service request is accepted by an operator to when a service is provided. Service requests that are unable to be fulfilled because the operator does not offer that particular service in the requested location are excluded.</td>
<td></td>
</tr>
<tr>
<td>If the operator and the customer agree that more than one service will be provided at a location or that a service will be provided at more than one location, the provision of each service at each location should be counted as a separate service request. Otherwise, service requests concerning single physical connections should be counted as a single service request, regardless of the number of channels activated or affected; multiple lines sharing the same physical path to a customer should be regarded as a single physical connection. Where a customer orders service to be provided at several sites, the provision of service at each site counts as a separate customer order for measurement purposes. The installation of supplementary services is excluded from the measurement. The supply of any customer premises equipment as part of or in conjunction with the order may be excluded from the measurement.</td>
<td></td>
</tr>
<tr>
<td>Statistics should include all connections supplied in the data collection period, but exclude:-</td>
<td></td>
</tr>
<tr>
<td>A. Cancelled orders;</td>
<td></td>
</tr>
<tr>
<td>B. Wrong address given by the customer;</td>
<td></td>
</tr>
<tr>
<td>C. Network infrastructure damaged due to natural disaster or by third party;</td>
<td></td>
</tr>
<tr>
<td>D. Customer premises closed or inaccessible;</td>
<td></td>
</tr>
</tbody>
</table>
E. Customer internal wiring not ready at the committed or agreed time; and  
F. Installation order withheld due to payment difficulties (e.g., deposit and any upfront payments).

The mean, standard deviation and 95th percentile of the distribution of service supply times, and the number of service supply times, should be provided as measurements. The measurements should include all service requests fulfilled during the reporting period for the reporting area.

### iii. Published Measurement:

- **A.** Mean time in days elapsed after successful application before installation of service (Measurement shall be made according to ETSI EG 201 769-1)  
- **B.** Percentage of installations completed by the date agreed with customer  
- **C.** Mean time elapsed after application for service alteration or reconnection in days

Mean time in days taken to fulfil service requests in the reporting period, rounded to the nearest whole number.

### iv. Parameter Targets:

- **A.** No more than five (5) days from successful application to installation of service.  
- **B.** No less than 95% installations must be completed by the date agreed with customer  
- **C.** No more than one (1) day from application to alteration or reconnection of service

### v. Measuring Agent:

The parameter shall be measured by the Authority and the Licensee

### vi. Sanctions:

Non-compliance shall attract **any** of the sanctions provided under **PART III**.
4.2. SERVICE FUNCTION:  Service Support

<table>
<thead>
<tr>
<th>1. CATEGORY: speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) QOS PARAMETER NAME: Response Time for Call Centre Services</td>
</tr>
<tr>
<td>i. DESCRIPTION:</td>
</tr>
<tr>
<td>The parameter ascertains the quality of experience of customers as well as assesses performance of the operator services. It shall be applicable to all retail services and all Licensees.</td>
</tr>
<tr>
<td>ii. MEASUREMENT METHOD:</td>
</tr>
<tr>
<td>The duration from the instant when the address information required for setting up a call is received by the network (e.g. recognized on the calling user’s access line) to the instant the human operator answers the calling user to provide the service requested. The period in this definition includes waiting times and times for going through voice response systems to reach the operator. Services provided wholly automatically, e.g. by voice response systems as well as emergency services are excluded.</td>
</tr>
</tbody>
</table>

A. PUBLISHED MEASUREMENT:  
B. Mean time to answer in seconds
C. Percentage of calls answered electronically within 5 seconds
D. Percentage of calls answered by attendant (voice-to-voice) within 30 seconds
E. Percentage of calls answered by attendant (voice-to-voice) within 60 seconds
F. Service availability in hours and days
G. Time taken to be attended to by customer care agent after answer in seconds

iii. PARAMETER TARGETS:  
A. Mean time to answer should be five (5) seconds
B. No less than 95% of calls should be answered electronically within five (5) seconds
C. No less than 85% of calls should be answered by attendant (voice-to-voice) within 30 seconds
D. No less than 95% of calls should be answered by attendants (voice-to-voice) within 60 seconds
E. Operator services should be available 24 hours a day and 7 days a week (24/7)
F. Time taken to be attended to by customer care agent after answer should be no more than 30 seconds
iv. **MEASURING AGENT:**
The parameter shall be measured by the Authority and the licensee

v. **SANCTIONS:**
Non-compliance shall attract ANY of the sanctions provided under PART III.

---

2. **CATEGORY:** Speed  
   a) **QoS PARAMETER NAME:** Complaint Resolution Time  
   i. **DESCRIPTION:**
   Time taken for a service provider to resolve a complaint. It is applicable to all licensees in this category.

   ii. **MEASUREMENT METHOD:**
   Duration from the time a customer complaint is notified to the published point of contact of a service provider and is not found to be invalid to the time the cause for the complaint has been resolved (**ETSI EG 202 057-1**).

   
   \[
   \text{Percentage of complaints resolved} = \left( \frac{\text{Number of valid complaints resolved}}{\text{Total number of valid complaints received}} \right) \times 100\%
   \]

   iii. **PUBLISHED MEASUREMENT:**
   
   A. *Percentage of complaints resolved within 1 week*
   
   B. *Total number of valid complaints received in 1 week.*

   iv. **PARAMETER TARGETS:**
   
   A. *Average percentage of complaints resolved within 1 week over the reporting period shall be 100%*

   v. **MEASURING AGENT:**
   The parameter shall be measured by the licensee

   vi. **SANCTIONS:**
   Non-compliance shall attract ANY of the sanctions provided under PART III.
4.3. **SERVICE FUNCTION:** Repair

<table>
<thead>
<tr>
<th>1. <strong>CATEGORY:</strong></th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) <strong>QOS PARAMETER NAME:</strong></td>
<td>Fault Repair Time</td>
</tr>
<tr>
<td>i. <strong>DESCRIPTION:</strong></td>
<td>It measures time taken to restore a service to working order after receiving valid fault reports. It is applicable to <em>all licensees in this category.</em></td>
</tr>
<tr>
<td>ii. <strong>MEASUREMENT METHOD:</strong></td>
<td></td>
</tr>
<tr>
<td>A.</td>
<td>The mean, standard deviation and 95th percentile of the distribution of fault repair times, and the number of fault repair times, should be provided as measurements. The measurements should include all faults cleared during the reporting period for the reporting area, but exclude those traced to other networks or to customer equipment behind network termination points of the operator.</td>
</tr>
<tr>
<td>B.</td>
<td>The statistics should be based on faults cleared in the data collection period, irrespective of when they are reported.</td>
</tr>
<tr>
<td>C.</td>
<td>Time elapsed for fault repair time is based on working hours for receiving and registering customer complaining a fault, from 8:00am to 5:00pm. All fault complaints received after 5:00pm will be considered as next day faults.</td>
</tr>
<tr>
<td>D.</td>
<td>Elapsed time for fault repair is based on round the clock, 24 hours a day, 7 days per week following receipt of repair order.</td>
</tr>
</tbody>
</table>

Where service providers quote a standard accuracy for keeping appointments (e.g., they quote anytime within an hour or a half day) this period should also be provided. The following statistics should be provided:-

The time by which 75 % and 95 % of all valid faults (see target values) are repaired (expressed in clock or calendar hours); and

The percentage of faults cleared in the time stated as an objective by the service provider.

<table>
<thead>
<tr>
<th>iii. <strong>PUBLISHED MEASUREMENT:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td><em>Time taken in hours to repair 80% of faults</em></td>
</tr>
<tr>
<td>B.</td>
<td><em>Mean Time to Repair in hours</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>iv. <strong>PARAMETER TARGETS:</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td><em>No less than 80% in two working days</em></td>
</tr>
<tr>
<td>B.</td>
<td><em>No less than 90% in three working days</em></td>
</tr>
<tr>
<td>C.</td>
<td><em>No less than 100% in five working days</em></td>
</tr>
<tr>
<td>D.</td>
<td><em>Mean time to repair a fault no lee than 2 days</em></td>
</tr>
</tbody>
</table>

| v. **MEASURING AGENT:** | The parameter shall be measured by the Licensee. |

| vi. **SANCTIONS:** | Non-compliance shall attract **ANY** of the sanctions provided under **PART III.** |
### 4.4. SERVICE FUNCTION: Network Service/Management

<table>
<thead>
<tr>
<th>1. <strong>CATEGORY:</strong></th>
<th>Simplicity/Service Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) <strong>QOS PARAMETER NAME:</strong></td>
<td>Customer Reported Faults</td>
</tr>
<tr>
<td>i. <strong>DESCRIPTION:</strong></td>
<td>The number of valid fault reports received by an operator per customer per reporting period. It is applicable to all licensees in this category.</td>
</tr>
<tr>
<td>ii. <strong>MEASUREMENT METHOD:</strong></td>
<td>A fault report is a report of disrupted or degraded service that a customer submits to the point of contact of the service provider. A fault report may be submitted by telephone or by personal contact at a customer service center. Faults that are due to other networks or to customer equipment behind network termination points and faults that are attributable to the core network or other networks are excluded. Faults reported for single physical connections should be counted as a single fault, regardless of the number of channels activated or affected; multiple lines sharing the same physical path to a customer should be regarded as a single physical connection. The number of valid fault reports received during the reporting period should be divided by the average number of customers for the service during the same period. The result should be provided as a measurement. Also, separate numbers might be provided as measurements for particular classes of fault report. Fault reports for which the faults are found to be cleared when tested should be counted as valid unless the operator has reason to believe that the faults did not occur. Statistics should include all valid fault reports in the data collection period, except reports of:-</td>
</tr>
<tr>
<td>iii. <strong>PUBLISHED MEASUREMENT:</strong></td>
<td>A. Number of faults received by the operator per reporting period - fault incident rate per 100 customers.</td>
</tr>
<tr>
<td>iv. <strong>PARAMETER TARGETS:</strong></td>
<td>A. No more than 5% of customers for the service in the reporting period</td>
</tr>
<tr>
<td>v. <strong>MEASURING AGENT:</strong></td>
<td>The parameter shall be measured by the Licensee.</td>
</tr>
<tr>
<td>vi. <strong>SANCTIONS:</strong></td>
<td>Non-compliance shall attract ANY of the sanctions provided under PART III.</td>
</tr>
</tbody>
</table>
4.5. **SERVICE FUNCTION:** Connection Establishment

1. **CATEGORY:** Speed /Availability
   
a) **QOS PARAMETER NAME:** Call Setup Time

i. **DESCRIPTION:**

The call set-up time is the time interval from the instant when the calling party (user) initiates a connection request to when the address information required for setting up a call is received by the network and finishing when the call disposition (called party busy tone or ringing tone or answer signal) is received by the calling party/user. It is applicable to all licensees in this category.

ii. **MEASUREMENT METHOD:**

The call set up time comprises the post selection delay (authentication, transfer of routing number, paging) and the synchronization delays of the interworking elements of the network.

The following statistics should be provided separately;

a) The Measurement should reflect time in seconds or as configured in the routing tables of the switching devices totaled to 98% of calls successful.

b) Carrying test measurements with specific time durations and specified call set up times. Measurements should reflect accurately traffic variations over the hours of a day, the days of the week and the months of the year.

iii. **PUBLISHED MEASUREMENT:**

   A. **Mean Value in seconds**

iv. **PARAMETER TARGETS:**

   A. **For INTRA NETWORK must be no more than 3 Seconds at normal load**
   
   B. **For FIXED TO MOBILE it must be no more than 9 seconds at normal load.**

v. **MEASURING AGENT:**

The parameter shall be measured by the Licensee

vi. **SANCTIONS:**

Non-compliance shall attract ANY of the sanctions provided under **PART III.**
Call Setup Success rate is defined as the ratio of total number of successful calls to the total number of call attempts in a specified time period. A successful call is a call attempt to a valid telephone number, properly dialled from a location where the service is offered by the operator to a location where the service is offered by the same or a different operator, in which the called party busy tone, ringing tone or answer signal is recognized at the calling network termination point within 30 seconds from when the last digit of the destination subscriber number is received by the network. This parameter is applicable to all licensees in this category.

### ii. MEASUREMENT METHOD:

The number of unsuccessful call attempts should be divided by the total number of call attempts. The following category statistics should be provided separately:

- A. The percentage of unsuccessful calls for local calls/on-net
- B. The percentage of unsuccessful calls for national calls cross-network
- C. The statistics should be calculated from Measurements on all real traffic; or
- D. Measurements on real traffic for outgoing calls in a representative population of local exchanges to a representative set of destinations; or
- E. Test calls in a representative population of local exchanges or Network Termination Points to a representative set of destinations; or

A combination of the above.

Formula:

\[
\text{Call Setup Success Rate} \, [\%] = \frac{\text{Total Number of calls successfully established}}{\text{Total number of call attempts}} \times 100
\]

### iii. PUBLISHED MEASUREMENT:

- **A. Number of successful calls setup expressed as a percentage of total call attempts**

### iv. PARAMETER TARGETS:

- **A. No less than 95% for national calls**
- **B. No less than 95% for international calls**

### v. MEASURING AGENT:

The parameter shall be measured by the licensee

### vi. SANCTIONS:

Non-compliance shall attract **ANY** of the sanctions provided under PART III.
### 4.6. SERVICE FUNCTION: Information Transfer

<table>
<thead>
<tr>
<th>1. CATEGORY: Service Integrity</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) QOS PARAMETER NAME: Listening Voice Quality</td>
</tr>
<tr>
<td>i. DESCRIPTION:</td>
</tr>
<tr>
<td>Listening voice quality is the quality of voice calls produced in a conversation and assessed by the listening party during speech connection in a network. It is applicable to all licensees.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ii. MEASUREMENT METHOD:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Technical assessment: This shall be measured by use of an appointed evaluation group or by carrying out a consumer satisfaction survey.</td>
</tr>
</tbody>
</table>

Technical assessment: The criteria shall follow either the PESQ or POLQA methodology.

The MOS scores are 5, 4, 3, 2 and 1 for Best, High, Medium, Low and Poor voice quality respectively.

Recommendation ITU-T P.800, Recommendation ITU-T P.862 and Recommendation ITU-T P.863.1

<table>
<thead>
<tr>
<th>iii. PUBLISHED MEASUREMENT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Mean Opinion Score (MOS)</td>
</tr>
<tr>
<td>The average of MOS scale score.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>iv. PARAMETER TARGETS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. No less than a score of 3 on the MOS scale.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>v. MEASURING AGENT:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The parameter shall be measured by both the Authority and the licensee.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>vi. SANCTIONS:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance shall attract ANY of the sanctions provided under PART III.</td>
</tr>
</tbody>
</table>

### 4.7. SERVICE FUNCTION: Billing

<table>
<thead>
<tr>
<th>1. CATEGORY: Speed/Service Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) QOS PARAMETER NAME: Billing Complaint Rate</td>
</tr>
<tr>
<td>i. DESCRIPTION:</td>
</tr>
</tbody>
</table>
The proportion of bills resulting in a customer complaint about the correctness of a given bill. It is applicable to all licensees in this category.

ii. **MEASUREMENT METHOD:**

The number of account/bill complaints received during the reporting period should be divided by the total number of bills issued during the same period. The result should be provided as a measurement. Also, separate numbers might be provided as measurements for particular classes of account complaint. The measurements should include all account complaints received during the reporting period for the reporting area, regardless of the validity of the complaint, the extent to which the complaint repeats an earlier one, and the dates of calls or any other occurrences that are the subject of the complaint.

iii. **PUBLISHED MEASUREMENT:**

- Percentage of billing complaints per 100 bills issued
- Billing frequency in days

Percentage of customers for the service making account complaints in the reporting period rounded to nearest percentage point.

iv. **PARAMETER TARGETS:**

- No more than 0.1% of customers for the service in the reporting period
- No more than 30 days billing frequency

v. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and licensee.

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Speed /Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>b) <strong>QOS PARAMETER NAME:</strong></td>
<td>Tariff Validation</td>
</tr>
<tr>
<td>i. <strong>DESCRIPTION:</strong></td>
<td>The test evaluates the discrepancy between a theoretical cost (using Tariff information and CDR generated by the service test) and real cost (generated as the difference between balance before and after the service test). It is applicable to all licensees in this category.</td>
</tr>
<tr>
<td>ii. <strong>MEASUREMENT METHOD:</strong></td>
<td></td>
</tr>
</tbody>
</table>
  
  \[
  \text{Percentage deviation from approved tariff} = \left( \frac{\text{Actual tariff} - \text{Approved tariff}}{\text{Approved tariff}} \right) \times 100\%
  \]  
  
  The KPIs provided are Tariff Success Rate, Overcharging and Undercharging Rate |
<p>| iii. <strong>PUBLISHED MEASUREMENT:</strong> | |</p>
<table>
<thead>
<tr>
<th>iv. <strong>PARAMETER TARGETS:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>A. <strong>100% tariff accuracy in the reporting period</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>v. <strong>MEASURING AGENT:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>The parameter shall be measured by both the Authority and the licensee.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>vi. <strong>SANCTIONS:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-compliance shall attract <strong>ANY</strong> of the sanctions provided under <strong>PART III</strong>.</td>
</tr>
</tbody>
</table>
5. PLMN SERVICES

The following shall be the QoS parameters for PLMN services:

5.1. SERVICE FUNCTION: Service provisioning

<table>
<thead>
<tr>
<th>CATEGORY:</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) QOS PARAMETER NAME:</td>
<td>Order of Completion Time</td>
</tr>
<tr>
<td>i. DESCRIPTION:</td>
<td></td>
</tr>
<tr>
<td>This is the time taken to provide a service in a location where a service is offered. It refers to the maximum waiting time for connection of service and is applicable to all licensees in this category.</td>
<td></td>
</tr>
<tr>
<td>ii. MEASUREMENT METHOD:</td>
<td></td>
</tr>
<tr>
<td>The order completion/service supply time should be measured as the elapsed time (not the working time) from when a service request is accepted by an operator to when a service is provided. Service requests that are unable to be fulfilled because the operator does not offer that particular service in the requested location are excluded.</td>
<td></td>
</tr>
</tbody>
</table>

If the operator and the customer agree that more than one service will be provided at a location or that a service will be provided at more than one location, the provision of each service at each location should be counted as a separate service request. Otherwise, service requests concerning single physical connections should be counted as a single service request, regardless of the number of channels activated or affected; multiple lines sharing the same physical path to a customer should be regarded as a single physical connection. Where a customer orders service to be provided at several sites, the provision of service at each site counts as a separate customer order for measurement purposes. The installation of supplementary services is excluded from the measurement. The supply of any customer premises equipment as part of or in conjunction with the order may be excluded from the measurement.

Statistics should include all connections supplied in the data collection period, but exclude:

A. Cancelled orders;
B. Wrong address given by the customer;
C. Network infrastructure damaged due to natural disaster or by third party;
D. Customer premises closed or inaccessible;
E. Customer internal wiring not ready at the committed or agreed time; and
F. Installation order withheld due to payment difficulties (such as deposit and any upfront payments).

The mean, standard deviation and 95th percentile of the distribution of service supply times, and the number of service supply times, should be provided as measurements. The measurements should include all service requests fulfilled during the reporting period for the reporting area.
### iii. PUBLISHED MEASUREMENT:

A. Maximum waiting time for connection of service in hours  
B. Maximum waiting time for SIM card activation in hours  
C. Mean time in days taken to fulfil service requests in the reporting period,

### iv. PARAMETER TARGET:

A. No more than 48 hours waiting time for connection of service.  
B. No more than 24 hours for SIM registration.

### v. MEASURING AGENT:

The parameter shall be measured by the Authority and the licensee

### vi. SANCTIONS:

Non-compliance shall attract ANY of the sanctions provided under PART III.

### 5.2. SERVICE FUNCTION: Service Support

1. **CATEGORY:** Speed/Service availability  

   a) **QOS PARAMETER NAME:** Response Time for Call Centre Services  

   i. **DESCRIPTION:**  
   The parameter ascertains the quality of experience of customers as well as assesses performance of operator services. It is applicable to all licensees

   ii. **MEASUREMENT METHOD:**  
   The duration from the instant when the address information required for setting up a call is received by the network (e.g. recognized on the calling user’s access line) to the instant the human operator answers the calling user to provide the service requested. The period in this definition includes waiting times and times for going through voice response systems to reach the operator. Services provided wholly automatically, such as by voice response systems as well as emergency services are excluded.

   iii. **PUBLISHED MEASUREMENT:**  
   A. Mean time to answer in seconds  
   B. Percentage of calls answered electronically within 5 seconds  
   C. Percentage of calls answered by attendant (voice-to-voice) within 30 seconds  
   D. Percentage of calls answered by attendant (voice-to-voice) within 60 seconds  
   E. Service availability in hours and days  
   F. Time taken to be attended to by customer care agent after answer in seconds

   iv. **PARAMETER TARGETS:**
| A. Mean time to answer should be no more than five (5) seconds  
| B. No less than 95% of calls should be answered electronically within five (5) seconds  
| C. No less than 85% of calls should be answered by attendant (voice-to-voice) within 30 seconds  
| D. No less than 95% of calls should be answered by attendants (voice-to-voice) within 60 seconds  
| E. Call centre services should be available 24 hours a day and 7 days a week (24/7)  
| F. Time taken to be attended to by customer care agent after answer should be no more than 30 seconds |

v. MEASURING AGENT:

The parameter shall be measured by the Authority and the licensee

vi. SANCTIONS:

Non-compliance shall attract ANY of the sanctions provided under PART III.

---

2. CATEGORY: Speed

a) QOS PARAMETER NAME: Complaint Resolution Time

i. DESCRIPTION:

The duration from the time a customer complaint is notified to the published point of contact of a service provider and is not found to be invalid to the time the cause for the complaint has been resolved. It is applicable to all licensees in this category.

ii. MEASUREMENT METHOD:

Duration from the time a customer complaint is notified to the published point of contact of a service provider and is not found to be invalid to the time the cause for the complaint has been resolved (ETSI EG 202 057-1).

\[
\text{Percentage of complaints resolved} = \left( \frac{\text{Number of valid complaints resolved}}{\text{Total number of valid complaints received}} \right) \times 100\%
\]

iii. PUBLISHED MEASUREMENT:

A. Percentage of complaints resolved within 1 week  
B. Total number of valid complaints received in 1 week.

iv. PARAMETER TARGETS:

A. Average percentage of complaints resolved within 1 week over the reporting period shall be 100%

v. MEASURING AGENT:

The parameter shall be measured by the Licensee.
vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

---

### 5.3. SERVICE FUNCTION: Connection Establishment

<table>
<thead>
<tr>
<th>1. <strong>CATEGORY:</strong></th>
<th>Speed/Service Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) <strong>QOS PARAMETER NAME:</strong></td>
<td>Call Set-up Time</td>
</tr>
<tr>
<td>i. <strong>DESCRIPTION:</strong></td>
<td></td>
</tr>
<tr>
<td>The <strong>call set-up time</strong> is the time interval from the instant when the calling party (user) initiates a connection request to when the address information required for setting up a call is received by the network and finishing when the call disposition (called party busy tone or ringing tone or answer signal) is received by the calling party/user. It is applicable to all licensees in this category.</td>
<td></td>
</tr>
<tr>
<td>ii. <strong>MEASUREMENT METHOD:</strong></td>
<td></td>
</tr>
<tr>
<td>The call set up time comprises the post selection delay (authentication, transfer of routing number, paging) and the synchronization delays of the interworking elements of the network. Measurement shall be only measured from mobile to mobile and intra-network</td>
<td></td>
</tr>
<tr>
<td>The following statistics should be provided separately;</td>
<td></td>
</tr>
<tr>
<td>a) The total number of measurements conducted</td>
<td></td>
</tr>
<tr>
<td>b) The total number of successful calls</td>
<td></td>
</tr>
<tr>
<td>c) The average time duration for the total successful calls</td>
<td></td>
</tr>
<tr>
<td>Measurements should reflect accurately traffic variations over the hours of a day, the days of the week and the months of the year. (Recommendation ITU-T E.802)</td>
<td></td>
</tr>
<tr>
<td>iii. <strong>PUBLISHED MEASUREMENT:</strong></td>
<td></td>
</tr>
<tr>
<td>A. Mean time (seconds) for voice and video call set-up</td>
<td></td>
</tr>
<tr>
<td>B. Mean time (seconds) within which the fastest 95% of calls are set-up.</td>
<td></td>
</tr>
<tr>
<td>The average time taken to setup a call between a calling party and a called party rounded to the nearest second.</td>
<td></td>
</tr>
<tr>
<td>iv. <strong>PARAMETER TARGETS:</strong></td>
<td></td>
</tr>
<tr>
<td>A. Mean time (seconds) for voice and video call setup should be no more than 10 seconds</td>
<td></td>
</tr>
<tr>
<td>B. Mean time (seconds) within which the fastest 95% of call are setup should be no more than 8 seconds</td>
<td></td>
</tr>
<tr>
<td>v. <strong>MEASURING AGENT:</strong></td>
<td></td>
</tr>
</tbody>
</table>
The parameter shall be measured by both the Authority and licensee

vi. **SANCTIONS:**
Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

---

**CATEGORY** Speed/Service Availability

**b) QOS PARAMETER NAME:** Call Setup Success Rate

i. **DESCRIPTION:**
Call Setup Success rate is defined as the ratio of total number of successful calls to the total number of call attempts in a specified time period. A successful call is a call attempt to a valid telephone number, properly dialled from a location where the service is offered by the operator to a location where the service is offered by the same or a different operator, in which the called party busy tone, ringing tone or answer signal is recognized at the calling network termination point within 30 seconds from when the last digit of the destination subscriber number is received by the network. This parameter is applicable to all licensees.

ii. **MEASUREMENT METHOD:**
The total number of successful call attempts should be divided by the total number of call attempts. The following categories of statistics should be provided separately:-

a) The percentage of successful calls for local calls/on-net
b) The percentage of successful calls for national calls cross-network
c) The statistics should be calculated from measurements on all real traffic; or
d) Measurements on real traffic for outgoing calls in a representative population of local exchanges to a representative set of destinations; or
e) Test calls in a representative population of local exchanges or Network Termination Points to a representative set of destinations; or

A combination of the above.

Formula:

\[ \text{Call Setup Success Rate} \left[ \% \right] = \frac{\text{Total Number of calls successfully established}}{\text{Total number of call attempts}} \times 100 \]

iii. **PUBLISHED MEASUREMENT:**

**B. Number of successful calls setup expressed as a percentage of total attempts**

Percentage of successful calls setup, rounded to the nearest percentage

iv. **PARAMETER TARGETS:**

**A. No less than 99% of successful calls for national services**

**B. No less than 98% of successful international calls**

v. **MEASURING AGENT:**
The parameter shall be measured by both the Authority and the licensee.

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III.**

---

**CATEGORY : SERVICE AVAILABILITY**

c) **QOS PARAMETER NAME:** VoLTE session setup success ratio

i. **DESCRIPTION:**

The ability for the VoLTE terminal to setup a session. *End to end service availability in terms of capacity to establish calls from, and to, a VoLTE customer.*

ii. **MEASUREMENT METHOD:**

The percentage of successful session setup attempts to the total number of measured session setup attempts

\[
\text{session setup success ratio} = \frac{\text{successful VoLTE attempts}}{\text{total VoLTE session setup attempts}} \times 100\%
\]

*Equivalent to 1-(VoLTE session setup failure ratio) as defined in ETSI TR 103 219*

iii. **PUBLISHED MEASUREMENT:**

A. **Percentage of successful VoLTE session setup**

iv. **PARAMETER TARGETS:**

A. **No less than 99% VoLTE session setup**

v. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and the Licensee.

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III.**

d) **QOS PARAMETER NAME:** LTE Post Dialling Delay

i. **DESCRIPTION:**

Post Dialling Delay (PDD) time interval between the end of user or terminal equipment dialling and the reception of the appropriate network response (Recommendation ITU-T E.431).

ii. **MEASUREMENT METHOD:**

In general PDD can be measured using test calls and/or by monitoring live traffic.
### iii. Published Measurement:

A. Mean interval in seconds between the time the end user finishes dialing to the reception time of the first response from the network.

*Equivalent to call setup time, as defined in Recommendation ITU-T E.800*

### iv. Parameter Targets:

A. LTE to LTE no more than 3.5 seconds
B. LTE to legacy no more than 6.0 seconds

### v. Measuring Agent:

The parameter shall be measured by both the operator and regulator.

### vi. Sanctions:

Non-compliance shall attract ANY of the sanctions provided under PART III.

---

e) **QoS Parameter Name:** Circuit switch Fall Back (CSFB) Success Rate

### i. Description:

Circuit Switch Fall Back Success Rate [%] to denote whether the CSFB procedure ends successfully in such a way that the mobile can continue with the actual call setup signalling. In analogy, CSFB Time [s] indicates the duration of the CSFB procedure until the actual call setup signalling can be initiated. Finally, right after the call is completed the network is expected to move the end user equipment back to 4G network to re-establish the desired data service experience for the users.

Therefore the CSFB is Success Rate is a Circuit switch Fall back (CSFB) is a mechanism which starts when a calling party initiates the call from a 4G/LTE (packet switched) network and ends when the call is switched and attached to a 2G/3G (legacy) network.

### ii. Measurement Method:

Number of calls successfully established on a 4G/LTE network that are successfully switched to a 2G/3G network divided by total call attempts expressed as a percentage

\[
\text{fall back success rate} = \left( 1 - \frac{\text{unsuccessful CSFB attempts}}{\text{total number of CSFB back attempts}} \right) \times 100\%
\]

as defined in [ETSI TR 103 219]

### iii. Published Measurement:

Number of successful establishment divided by total attempts expressed as a percentage

### iv. Parameter Targets:

A. No more than 5.0 seconds fall back time
B. No less than 98% success rate

v. **MEASURING AGENT:**

The parameter shall be measured by both the operator and regulator.

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III.**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Speed/Service Availability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>f) QOS PARAMETER NAME:</strong> Return to 4G time (LTE Networks)</td>
</tr>
<tr>
<td>i.</td>
<td><strong>DESCRIPTION:</strong> Return to 4G/LTE time is when a user is running a 4G/LTE data session (e.g. listening to digital radio, downloading an App, and alike) and receives an incoming call on its single-radio terminal. In this case, Circuit Switch Fall Back procedure starts, the call is established and the data session is transferred to 2/3 legacy technology - with potential detriment of user perceived performance. When the call is terminated, user data session should be handed back to LTE if network coverage is adequate, so that the user can benefit again from higher data rates. However, this reselection to LTE may be delayed to different extents depending on network implementation and configuration.</td>
</tr>
</tbody>
</table>
| ii.      | **MEASUREMENT METHOD:** Return to 4G/LTE time is the average time (in seconds) it takes for a 4G/LTE call to return to from a legacy (2/3G) network after a call has ended as defined in [ETSI TR 103 219] \[
    \text{Return to 4G/LTE [s]} = t_{\text{first System information block in LTE received}} - t_{\text{call disconnected}}
\] |
| iii.     | **PUBLISHED MEASUREMENT:** A. Average time to return to 4G from legacy network in seconds |
| iv.      | **PARAMETER TARGETS:** A. No more than 5.0 seconds fall back time from active state B. No more than 10 seconds fall back time from idle state C. No more than 10 seconds fall back depending on the state No less than 98% successful registration rate |
| v.       | **MEASURING AGENT:** The parameter shall be measured by the Authority and the licensee |
| vi.      | **SANCTIONS:** Non-compliance shall attract **ANY** of the sanctions provided under **PART III.** |
**CATEGORY**  Speed/Service Availability

**g) QOS PARAMETER NAME:** LTE Registration Success Rate (LRSR)

i. **DESCRIPTION:** LTE Registration Success Rate is the number of successful LTE session establishment to the number of attempted originating session establishment and the ratio of the number of successful terminating session establishment to the number of attempted terminating session establishment for LTE network and is used to evaluate accessibility performance provided.

ii. **MEASUREMENT METHOD:**

\[
\text{VoLTE Registration Success Rate} \%= \frac{\text{successful VoLTE registration attempts}}{\text{total number of registration attempts}} \times 100\%
\]

**NOTE:**
On first registration after terminal equipment switches on, the proxy CSCF will respond to the first SIP "REGISTER" message with SIP "401 UNAUTHORIZED" containing an authorization challenge. Then terminal equipment will issue a second SIP "REGISTER" containing the authentication response. In case of success, P-CSCF will acknowledge the authentication with a SIP "200 OK (REGISTER)". The above triggers remain valid for both registration types with or without authentication challenge.

Equivalent to IMS registration success ratio as defined in [ETSI TR 103 219] KPI related to IMS and based on P-CSCF

iii. **PUBLISHED MEASUREMENT:**

A. Percentage of Rate of successful registration attempts in the VoLTE service.

iv. **PARAMETER TARGETS:**

A. No less than 98% successful registration rate

v. **MEASURING AGENT:**

The parameter shall be measured by the Authority and the licensee

vi. **SANCTIONS:**

Non-compliance shall attract ANY of the sanctions provided under **PART III**.

---

**2. CATEGORY:**  Speed/Service availability

a) **QOS PARAMETER NAME:**  Network Efficiency Ratio
i. **DESCRIPTION:**

Percentage of seizures resulting in answer signal or user failure. It is applicable to *international voice call retail services and Gateways.*

ii. **MEASUREMENT METHOD:**

Measurements shall be as per Recommendation ITU-T E.425 and Recommendation ITU-T E.426.

The relationship between the number of seizures and the sum of the number of seizures resulting in either an answer message, or a user busy, or a ring no answer, or in the case of ISDN a terminal rejection/unavailability. Network Efficiency Ratio (NER) is calculated as a percentage of seizures resulting in answer message or user failure to total seizures, specifically, seizures of international circuits. A seizure will be said to have taken place, if the originating international switch has reserved a trunk for a specific call and has begun the signalling procedure to establish a call over that trunk. If an answer is received for a seizure, this seizure should be categorized as a network established call whatever the Cause Value received.

\[
\text{NER} = \frac{\text{Seizures resulting in Answer message or User Failure}}{\text{Total Seizures}}
\]

Call attempts that do not complete due to network screening should not contribute to NER. For example, a call attempt to a network vacant code caused by customer dialling error that is detected by screening shall not result in a seizure being counted for NER, and will not produce an answer, user busy, ring no answer or terminal reject disposition. Improved network screening can serve to increase the NER of a network.

NER under this parameter shall also apply to seizures across national networks leading to a parameter termed ‘Quality of Interconnection’. This will seek to portray the quality of interconnection across networks.

iii. **PUBLISHED MEASUREMENT:**

- A. *Network Efficiency Ratio (NER) expressed as a percentage*
- B. *Quality of Interconnection (QoI) rating*

Average NER rounded to the nearest percentage over the reporting period.

iv. **PARAMETER TARGETS:**

- A. No less than a 60% NER is permissible
- B. QoI greater than 60% deemed fair interconnection

v. **MEASURING AGENT:**

The parameter shall be measured by both the operator and regulator.

vi. **SANCTIONS:**
Non-compliance shall attract **ANY** of the sanctions provided under **PART III.**

## 3. CATEGORY: Speed/Service Reliability

### a) QOS PARAMETER NAME: Call Drop Rate

#### i. DESCRIPTION:

The proportion of successfully established voice calls that are dropped by the network before they can be ended normally by the user. Call Drop Rate is the probability of a call terminating without the user causing it. It is applicable to all licensees.

#### ii. MEASUREMENT METHOD:

The number of dropped calls should be divided by the number of successfully established calls. The result, and the number of successfully established calls, should be provided as measurements.

\[
\text{Call Drop Rate } [\%] = \frac{\text{Total Number of calls terminated unwillingly}}{\text{Total number of successfully established calls}} \times 100 \%
\]

Note: Calls ended as a result of depleted credit shall be excluded from the numerator and denominator.

#### iii. PUBLISHED MEASUREMENT:

- **A. Number of successfully established calls**
- **B. Percentage of voice and video call drops or unwillingly terminated**

Percentage of successfully established voice calls that are dropped, rounded to the nearest percentage.

#### iv. PARAMETER TARGETS:

- **A. No more than 5% of successfully established voice calls should be dropped**
- **B. No more than 5% of successfully established video calls should be dropped**

#### v. MEASURING AGENT:

The parameter shall be measured by both the Authority and the licensee.

#### vi. SANCTIONS:

Non-compliance shall attract **ANY** of the sanctions provided under **PART III.**

---

### b) QOS PARAMETER NAME: Hand Over Success Rate (HOSR)

#### i. DESCRIPTION:
The process by which a mobile telephone call is transferred from one base station to another as the subscriber passes the boundary of a cell.

Recommendation ITU-T Q.1005

ii. **MEASUREMENT METHOD:**

\[
\text{Handover Success Rate} \left[ \% \right] = \frac{\text{total number of successful handovers}}{\text{total number of handover requests}} \times 100
\]

iii. **PUBLISHED MEASUREMENT:**

A. Percentage of successful handovers

iv. **PARAMETER TARGETS:**

A. No less than 98% of handover requests must be successful

v. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and the licensee

vi. **SANCTIONS:**

Non-compliance shall attract ANY of the sanctions provided under PART III.

5.4. **SERVICE FUNCTION:** Information Transfer

1. **CATEGORY:** Speed

   a) **QoS PARAMETER NAME:** SMS Delivery Time

   i. **DESCRIPTION:**

   The delivery time, in seconds, is the period starting when sending an SMS from a terminal equipment to an SMSC and finishing when receiving the very same SMS on another terminal equipment. It is applicable to all licensees

   ii. **MEASUREMENT METHOD:**

   The following statistics should be provided separately:
   
   A. The mean value in seconds for sending and receiving short messages;
   B. The time in seconds within which the fastest 95% of short messages are sent and received;
   C. The number of observations performed.

   iii. **PUBLISHED MEASUREMENT:**

   A. Time in seconds within which SMS is delivered end to end
iv. **PARAMETER TARGETS:**

   **B. Time, in seconds, within which SMS is delivered should be no more than ten (10) seconds**

v. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and the licensee

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III.**

2. **CATEGORY:** speed /Service Reliability

   a) **QOS PARAMETER NAME:** Successful SMS Ratio

   i. **DESCRIPTION:**

   The proportion of text messages that are transmitted successfully. A successful message transmission is a message transmission to a valid telephone number, properly dialled from a location where the service is offered by the operator to a location where the service is offered by the same or a different operator, in which the message is transmitted completely without errors between the network termination points, irrespective of whether the receiving network termination point is connected to its network when the message reaches its network. It is applicable to **all licensees**

   ii. **MEASUREMENT METHOD:**

   Successful SMS ratio is the probability that a user can send an SMS successfully from one terminal equipment to another terminal equipment end-to-end.

   The number of successful end-to-end message transmissions should be divided by the total number of messages sent.

   $$\text{Successful SMS ratio}\% = \frac{\text{total number of SMSs successfully delivered end-to-end}}{\text{total number of SMSs sent}} \times 100\%$$

   iii. **PUBLISHED MEASUREMENT:**

   The total number of successfully delivered messages, and the total number of messages sent, should be provided as measurements:

   - **A. Percentage of SMS successfully delivered**
   - **B. Total number of successfully delivered messages**
   - **C. Total number of measurements (observations) conducted**
iv. **PARAMETER TARGETS:**

   A. No less than 98% of SMS are successfully delivered.

v. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and the licensee.

vi. **SANCTIONS:**

Non-compliance shall attract ANY of the sanctions provided under **PART III**.

---

3. **CATEGORY:** Service Reliability

   a) **QOS PARAMETER NAME:** Listening Voice Quality

   i. **DESCRIPTION:**

   Listening voice quality is the quality of voice calls produced in a conversation and assessed by the listening party during speech connection in a network. It is applicable to all licensees.

   ii. **MEASUREMENT METHOD:**

   Non-Technical assessment: This shall be measured by use of an appointed evaluation group or by carrying out a consumer satisfaction survey.

   Technical assessment: The criteria shall follow either the PESQ or POLQA methodology.

   The MOS scores are 5, 4, 3, 2 and 1 for Best, High, Medium, Low and Poor voice quality respectively.

   Recommendation ITU-T P.800, Recommendation ITU-T P.862 and Recommendation ITU-T P.863.1

   iii. **PUBLISHED MEASUREMENT:**

   A. Mean Opinion Score (MOS)
   B. Mean Opinion Score – Listening Quality (MOS – LQ)

   The average of MOS scale score.

   iv. **PARAMETER TARGETS:**

   A. No less than a score of 3 on the MOS scale.

   v. **MEASURING AGENT:**

   The parameter shall be measured by both the Authority and the licensee.
vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

---

### 5.5. SERVICE FUNCTION: Billing

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>Speed/Reliability</th>
</tr>
</thead>
</table>

a) **QOS PARAMETER NAME:** Billing Complaint Rate

i. **DESCRIPTION:**

The proportion of bills resulting in a customer complaint about the correctness of a given bill. It is applicable to **all licensees**

ii. **MEASUREMENT METHOD:**

The number of account/bill complaints received during the reporting period should be divided by the total number of bills issued during the same period. The result should be provided as a measurement. Also, separate numbers might be provided as measurements for particular classes of account complaint. The measurements should include all account complaints received during the reporting period for the reporting area, regardless of the validity of the complaint, the extent to which the complaint repeats an earlier one, and the dates of calls or any other occurrences that are the subject of the complaint.

iii. **PUBLISHED MEASUREMENT:**

- A. Percentage of billing complaints per 100 bills issued
- B. Billing frequency in days

Percentage of customers for the service making account complaints in the reporting period rounded to nearest percentage point.

iv. **PARAMETER TARGETS:**

- A. No more than 0.1% of customers should complain for the service in the reporting period
- B. No more than 30 days billing frequency for post-paid accounts

v. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and the licensee.

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

---

**CATEGORY**  **RELIABILITY**

b) **QOS PARAMETER NAME:** Tariff Validation
vii. **DESCRIPTION:**

The test evaluates the discrepancy between a theoretical cost (using Tariff information and CDR generated by the service test) and real cost (generated as the difference between balance before and after the service test). It is applicable to all licensees in this category.

viii. **MEASUREMENT METHOD:**

\[
\text{Percentage deviation from approved tariff} = \left( \frac{\text{Actual tariff} - \text{Approved tariff}}{\text{Approved tariff}} \right) \times 100\%
\]

The KPIs provided are Tariff Success Rate, Overcharging and Undercharging Rate

ix. **PUBLISHED MEASUREMENT:**

   E. Mean tariff deviation
   F. Percentage deviation from approved tariff
   G. Number of invalid tariffs per 100 tests
   H. Scheduled observations on scheduled tariffs per quarter

x. **PARAMETER TARGETS:**

   B. 100% tariff accuracy in the reporting period

xi. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and the licensee.

xii. **SANCTIONS:**

Non-compliance shall attract ANY of the sanctions provided under PART III.

---

5.6. **SERVICE FUNCTION:** Network Service/ Management

1. **CATEGORY:** Service Availability

   a) **QoS PARAMETER NAME:** Availability of the Network

   i. **DESCRIPTION:**

   Availability of the Network is the ratio of time the network has been operative to the total time of the measurement period. It is applicable to all licensees.

   ii. **MEASUREMENT METHOD:**

   The measurement must be made via an automatic data collection system, based on the fault management system of the network that register the appropriate information (alarms and events with the time stamp when a network element is out of service and when it becomes operative again).
   The Network availability shall be calculated as follows;
Percentage Network Availability = \left[1 - \frac{T_i}{T_t}\right] \times 100\%

Where:-
\(T_i\) - the total time for the inoperative network element in hours
\(T_t\) - the total time for measurement period in hours (including weekends and public holidays).

This parameter also applies to availability of transmission networks/internet.

### iii. Published Measurement:

A. Time radio access network is available to the consumer per reporting period
B. Time transmission network is available to the consumer per reporting period
C. Time Internet network is available to the consumer per reporting period
D. Time core network is available to the consumer per reporting period

### iv. Parameter Targets:

A. No less than 98.99% radio access network availability per reporting period
B. 99.999% transmission network availability
C. 98% Internet network availability
D. 99.999% core network availability

### v. Measuring Agent:

The parameter shall be measured by both the Authority and the licensee.

### vi. Sanctions:

Non-compliance shall attract ANY of the sanctions provided under PART III.

---

b) QoS Parameter Name: Network Coverage

i. Description:

Network Coverage is the geographical land area where there is outdoor signal level (at street level) from the control channels to give access to the network as outlined in the table below:
<table>
<thead>
<tr>
<th>Technology (MHz)</th>
<th>CS[kHz]</th>
<th>SENS(dBm)</th>
<th>FS(dBμV/m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSM 900</td>
<td>200</td>
<td>-104</td>
<td>30</td>
</tr>
<tr>
<td>GSM 1,800</td>
<td>200</td>
<td>-104</td>
<td>36</td>
</tr>
<tr>
<td>UMTS 2,100</td>
<td>5000</td>
<td>-80</td>
<td>61</td>
</tr>
<tr>
<td>LTE 700/800</td>
<td>10000</td>
<td>-77</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>20000</td>
<td>-74</td>
<td>67</td>
</tr>
<tr>
<td>LTE-TDD* 2,300/2,600</td>
<td>5000</td>
<td>-80</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>10000</td>
<td>-77</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>20000</td>
<td>-74</td>
<td>69</td>
</tr>
<tr>
<td>WiMAX* 2,300/2,600</td>
<td>5000</td>
<td>-80</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>10000</td>
<td>-77</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>20000</td>
<td>-74</td>
<td>69</td>
</tr>
<tr>
<td>WiMAX* 3,500</td>
<td>5000</td>
<td>-80</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>10000</td>
<td>-77</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>20000</td>
<td>-74</td>
<td>72</td>
</tr>
<tr>
<td>WiMAX* 5,400</td>
<td>5000</td>
<td>-80</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>10000</td>
<td>-77</td>
<td>73</td>
</tr>
<tr>
<td></td>
<td>20000</td>
<td>-74</td>
<td>76</td>
</tr>
<tr>
<td>WiMAX* 10,500</td>
<td>5000</td>
<td>-80</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td>10000</td>
<td>-77</td>
<td>79</td>
</tr>
<tr>
<td></td>
<td>20000</td>
<td>-74</td>
<td>82</td>
</tr>
</tbody>
</table>

It is applicable to all licensees in this category.

ii. **MEASUREMENT METHOD:**

Coverage area shall be calculated with radio modelling tools of the access network and radio parameters such as power, antenna height, and topography information. The calculated results shall be verified by mobile test tools with antenna configuration and radio sensitivity representative of mobile terminals placed in the market.

iii. **PUBLISHED MEASUREMENT:**

   A. The ratio of the geographical land area where there is coverage to the total (country) land area combined for all the technologies.
   
   B. The ratio of the geographical land area where there is coverage to the total (country) land area for each technology where applicable.

Geographical coverage maps shall also be provided.

iv. **PARAMETER TARGETS:**

   A. 70% coverage for combined the technologies deployed.

v. **MEASURING AGENT:**
The parameter shall be measured by both the Authority and the Licensee

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

2. **CATEGORY:** Service Accessibility

   a) **QoS PARAMETER NAME:** Call Block Rate

   i. **DESCRIPTION:**

   Percentage number of calls that are blocked after call setup, due to a lack of network & radio resources (end to end blocking). It is applicable to **all licensees in this category**.

   ii. **MEASUREMENT METHOD:**

   A. This quality indicator shall be measured by drive tests
   B. This is the percentage congestion of the TCH measured at the busy hour and is given by:

   
   \[
   \text{Percentage TCH Congest} = \frac{\text{Busy Hour TCH Traffic (Erlang)} - \text{Av. TCH Traffic (Erlang)}}{\text{Busy Hour TCH Traffic (Erlang)}} \times 100%
   \]

   iii. **PUBLISHED MEASUREMENT:**

<table>
<thead>
<tr>
<th>2G</th>
<th>3G</th>
<th>4G/LTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. TCH Congestion</td>
<td>A. RAB CSR</td>
<td>A. RRC Drop</td>
</tr>
<tr>
<td>B. SDCCH Congestion</td>
<td>B. RAB Drop</td>
<td>B. ERAB Drop</td>
</tr>
<tr>
<td>C. SDCCH Blocking</td>
<td>C. RRC availability</td>
<td>C. RRC availability</td>
</tr>
<tr>
<td>D. SDCCH Drop</td>
<td>D. SHO Success Rate</td>
<td>D. HO Success Rate</td>
</tr>
<tr>
<td>E. TCH Drop</td>
<td>E. CSSR</td>
<td>E. CSSR</td>
</tr>
<tr>
<td>F. TCH Assignment</td>
<td></td>
<td>F. CDR</td>
</tr>
<tr>
<td>G. HO Success Rate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   iv. **PARAMETER TARGETS:**

<table>
<thead>
<tr>
<th>2G</th>
<th>3G</th>
<th>4G/LTE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. No more than 2% for TCH congestion.</td>
<td>A. No less than 98% CSR.</td>
<td>A. No more than 1.2% RRC drop rate</td>
</tr>
<tr>
<td>B. No more than 0.8% for SDCCH congestion.</td>
<td>B. No more than 2.0% for RAB Drop rate.</td>
<td>B. No more than 1.5% for ERAB Drop rate</td>
</tr>
<tr>
<td>C. No more than 0.5% for SDCCH blocking.</td>
<td>C. No less than 98% RRC availability.</td>
<td>C. No less than 98% RRC availability</td>
</tr>
<tr>
<td>D. No more than 1.2% for SDCCH drop.</td>
<td>D. No less than 98% SHO success rate.</td>
<td>D. No less than 98% HO success rate</td>
</tr>
<tr>
<td>E. No more than 2.0% for TCH Drop.</td>
<td>E. No less than 2.0% CSSR.</td>
<td>E. No less than 2.0% CSSR</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>F. No less than 98% for TCH Assignment.</td>
<td>F. No less than 2.0% CDR</td>
<td></td>
</tr>
<tr>
<td>☐ No less than 98% for HO success rate.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**v. MEASURING AGENT:**

The parameter shall be measured by the Licensee.

**vi. SANCTIONS:**

Non-compliance shall attract ANY of the sanctions provided under **PART III**.
6. DATA SERVICES

The following shall be the QoS parameters for provision of internet services:

**NOTE:** For purposes of data testing the Authority shall use two servers, where applicable: one at an international IXP (Popular or test lab), the other at a local IXP (public or as authorised by the Authority); the Authority shall identify and allocate the locations.

6.1. SERVICE FUNCTION: Service provisioning

<table>
<thead>
<tr>
<th>1. CATEGORY:</th>
<th>Network / Service Accessibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>i. <strong>QOS PARAMETER NAME:</strong></td>
<td>Order of Completion Time</td>
</tr>
<tr>
<td>ii. <strong>DESCRIPTION:</strong></td>
<td>This is the time taken to provide a service in a location where a service is offered. It refers to the maximum waiting time for connection of service and is applicable to all licensees in this category.</td>
</tr>
<tr>
<td>iii. <strong>MEASUREMENT METHOD:</strong></td>
<td>The order completion/service supply time should be measured as the elapsed time (not the working time) from when a service request is accepted by an operator to when a service is provided. Service requests that are unable to be fulfilled because the operator does not offer that particular service in the requested location are excluded.</td>
</tr>
</tbody>
</table>

If the operator and the customer agree that more than one service will be provided at a location or that a service will be provided at more than one location, the provision of each service at each location should be counted as a separate service request. Otherwise, service requests concerning single physical connections should be counted as a single service request, regardless of the number of channels activated or affected; multiple lines sharing the same physical path to a customer should be regarded as a single physical connection.

Where a customer orders service to be provided at several sites, the provision of service at each site counts as a separate customer order for measurement purposes. The installation of supplementary services is excluded from the measurement. The supply of any customer premises equipment as part of or in conjunction with the order may be excluded from the measurement.

Statistics should include all connections supplied in the data collection period, but exclude:-

A. Cancelled orders;
B. Wrong address given by the customer;
C. Network infrastructure damaged due to natural disaster or by third party;
D. Customer premises closed or inaccessible;
E. Customer internal wiring not ready at the committed or agreed time; and
F. Installation order withheld due to payment difficulties (e.g., deposit and any upfront payments).
The mean, standard deviation and 95th percentile of the distribution of service supply times, and the number of service supply times, should be provided as measurements. The measurements should include all service requests fulfilled during the reporting period for the reporting area.

iv. **PUBLISHED MEASUREMENT:**

A. Time elapsed in days after application for activation of service for DSL wired service  
B. Time elapsed in days after application for activation of service for fixed wireless service  
C. Percentage of installations completed by the date agreed with customer  
D. Time elapsed after application for service alteration involving Software  
E. Time elapsed after application for service alteration involving Hardware

Mean time in days taken to fulfil service requests in the reporting period, rounded down to two numerically significant figures.

v. **PARAMETER TARGET:**

A. No more than five (5) days for service activation for wired DSL service  
B. No more than two (2) days for service activation for fixed wireless service  
C. No less than 99% of installations completed by date agreed with customer  
D. No more than one (1) day for service alteration involving software  
E. No more than five (5) days for service alteration involving hardware

vi. **MEASURING AGENT:**

The parameter shall be measured by the licensee

vii. **SANCTIONS:**

Non-compliance shall attract ANY of the sanctions provided under [PART III](#).

### 6.2. SERVICE FUNCTION: Service Support

1. **CATEGORY:** Speed

   a) **QOS PARAMETER NAME:** Complaint Resolution Time

   i. **DESCRIPTION:**

   The duration from the time a customer complaint is notified to the published point of contact of a service provider and is not found to be invalid to the time the cause for the complaint has been resolved. It is applicable to all licensees in this category.

   ii. **MEASUREMENT METHOD:**
Duration from the time a customer complaint is notified to the published point of contact of a service provider and is not found to be invalid to the time the cause for the complaint has been resolved (ETSIEG 202 057-1).

\[
\text{Percentage of complaints resolved} = \left( \frac{\text{Number of valid complaints resolved}}{\text{Total number of valid complaints received}} \right) \times 100\%
\]

iii. **PUBLISHED MEASUREMENT:**

A. *Percentage of complaints resolved within 1 week*

B. *Average number of complaints resolved within one week over the reporting period.*

iv. **PARAMETER TARGETS:**

A. *No less than 98% of complaints should be resolved within 1 week*

v. **MEASURING AGENT:**

The parameter shall be measured by the operator

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

### 6.3. SERVICE FUNCTION: Repair

1. **CATEGORY:** Speed

   a) **QOS PARAMETER NAME:** Fault Repair Time

   i. **DESCRIPTION:**

   It measures time taken to restore a service to working order after receiving valid fault reports. It is applicable to *all licensees in this category.*

   ii. **MEASUREMENT METHOD:**

   A. The mean, standard deviation and 95th percentile of the distribution of fault repair times, and the number of fault repair times, should be provided as measurements. The measurements should include all faults cleared during the reporting period for the reporting area, but exclude those traced to other networks or to customer equipment behind network termination points of the operator.

   B. The statistics should be based on faults cleared in the data collection period, irrespective of when they are reported.

   C. Time elapsed for fault repair time is based on working hours for receiving and registering customer complaining a fault, from 8h00am to 5h00pm. All fault complaints received after 5h00pm will be considered as next day faults.
D. Elapsed time for fault repair is based on round the clock, 24 hours a day, 7 days per week following receipt of repair order.

Where service providers quote a standard accuracy for keeping appointments (e.g., they quote anytime within an hour or a half day) this period should also be provided. The following statistics should be provided:

iii. **PUBLISHED MEASUREMENT:**

   A. *Time taken in hours to repair 80% of faults*
   B. *Mean Time to repair in hours*

Mean time in days taken to clear faults in the reporting period, rounded down to two numerically significant figures

iv. **PARAMETER TARGETS:**

   A. *No more than 24 hours to repair 80% of faults*
   B. *No more than 12 hours mean time to repair*
   C. *No less than 90% in three working days*
   D. *No less than 100% in five working days*

v. **MEASURING AGENT:**

The parameter shall be measured by the operator

vi. **SANCTIONS:**

Non-compliance shall attract ANY of the sanctions provided under **PART III.**

---

6.4. **SERVICE FUNCTION:** Information Transfer

1. **CATEGORY:** speed/Service accessibility

   a) **QOS PARAMETER NAME:** DNS Host Name Resolution Time

   i. **DESCRIPTION:**

DNS host name resolution time is the time taken for a host name to host address translation. This is the time taken for a DNS host name to translate website names into IP addresses.

When DNS host resolution time is slow, web browsing and other activities depending on the DNS will equally be slow.

   ii. **MEASUREMENT METHOD:**

   

   DNS Host Name Resolution Time \([s] = (t_{\text{standard query response received}} - t_{\text{standard query sent}})[s]\)

   ETSI TS 102 250-2 and Recommendation ITU-Y.1540
iii. **PUBLISHED MEASUREMENT:**

A. The amount of time it takes, in milliseconds (ms), for data packet to reach the receiving end-point (Specified DNS server) after being transmitted from the sending end-point

iv. **PARAMETER TARGETS:**

A. No more than 10ms response time to Specified Licensee’s DNS server

v. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and Licensee.

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

---

2. **CATEGORY:** speed/Service accessibility

a) **QOS PARAMETER NAME:** DNS Host Name Resolution Success Rate

i. **DESCRIPTION:**

DNS host name resolution Success rate is the likelihood for a host name to host address translation of a DNS resolver successfully.

This is the proportion of requests for which the DNS server can translate a domain name to an IP address equivalent DNS and vice versa

ii. **MEASUREMENT METHOD:**

Successful DNS host request divided by the total number of DNS host requests

\[
\text{DNS Host Name Resolution Success Rate} \ [\%] = \frac{\text{successful DNS host name resolution requests}}{\text{Total DNS host name resolution requests}} \times 100
\]

(ETSİ TS 102 250-2)

iii. **PUBLISHED MEASUREMENT:**

A. The percentage of successful DNS host name resolutions
iv. **PARAMETER TARGETS:**

   A. No less than 99% DNS Host resolution success rate

v. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and the licensee

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

---

### 6.5. SERVICE FUNCTION: Network Accessibility

1. **CATEGORY:** Service Integrity

   a) **QOS PARAMETER NAME:** Data Packet Latency

   i. **DESCRIPTION:**

   The amount of time it takes, in milliseconds (ms), for a data packet to reach the receiving end-point after being transmitted from the sending end-point

   (ITU-T Y.1540)

   ii. **MEASUREMENT METHOD:**

   The time it takes data packet to reach the specified address of the specified server and return back.

   A standard ping shall be used by pinging the IP address of the specified server (approved by the authority) of the licensee or the international common public site as approved by the Authority

   \[
   \text{Latency (ping roundtrip) = } (t_{\text{packet received}} - t_{\text{packet sent}}) \text{[ms]}
   \]

   (ITU-T Y.1540 and ETSI TS 102 250-2 V2.2.1)

   iii. **PUBLISHED MEASUREMENT:**

   A. *The amount of time it takes, in milliseconds (ms), for a data packet to reach the receiving end-point after being transmitted from the sending end-point*

   *ITU-T Y.1540 (Authority specified local server, and or international popular sites)*

   **Note 1:** The firewalls are not allowed to block these ICMP echo requests for the tested IP address and Port
iv. PARAMETER TARGETS:

   A. Not more than 200ms shall be taken to transmit a data packet end to end from a public server (international IXP)

   B. Not more than 10ms shall be taken to transmit a data packet end to end from a public server (local IXP)

v. MEASURING AGENT:

The parameter shall be measured by both the operator and the regulator.

vi. SANCTIONS: Non-compliance shall attract ANY of the sanctions provided under PART III.

---

2. CATEGORY: Service integrity

a) QOS PARAMETER NAME: Data Packet Jitter

i. DESCRIPTION:

Jitter is measuring time difference in packet inter-arrival time. It is the variation in the latency on data packet inter-arrival time between the sending and receiving points. When some data packets take longer to travel from sending to the receiving end.

The lower the measure of jitter the more stable a connection is and latency is important to VoIP and VoLTE end users.

Jitter results from network congestion, timing drift and route changes

ii. MEASUREMENT METHOD:

Jitter shall be measured by measuring the difference in the end-to-end latency, in milliseconds (ms), between data packets send and received

iii. PUBLISHED MEASUREMENT:

   A. The difference in the end-to-end latency, in milliseconds (ms), between data packets
iv. **PARAMETER TARGETS:**

   A. No more than 200ms difference in the end-to-end latency between data packets local specified server

   B. No more than 20ms difference in the end-to-end latency between data packets international specified server

v. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and the Licensee.

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III.**

---

3. **CATEGORY:** Service Reliability

   a) **QOS PARAMETER NAME:** Ratio of Data Packet Loss

   i. **DESCRIPTION:**

   Ratio of Data packet Loss is the ratio of dropped packets to all packets sent from the source to Destination over a given period of time

   Ratio Data packet loss will affect, VoLTE, VoIP as extended periods of loss lead to choppy and broken-up video and audio.

   It is applicable to all licensees in this category.

   ii. **MEASUREMENT METHOD:**

   The number of data packets lost as a percentage of the total number of packets transmitted

   \[
   \text{Ratio of Data packet loss[\%]} = \left(1 - \frac{\text{Packet sent}}{\text{Packet received}}\right) \times 100
   \]

   **Note 1:** The firewalls are not allowed to block these ICMP echo requests for the tested IP address and Port

   **Note 2:** The IP address should be on the network of licensee which provides service to a subscriber network (gateway, test server, APN)

   (ITU-T Y.1540 and ETSI TS 102 250-2 V2.2.1)

   iii. **PUBLISHED MEASUREMENT:**

   A. The percentage of data packet loss for every 1000 data packet transmitted
iv. **PARAMETER TARGETS:**

   A. No more than 1 in a 1000 data packets transmitted are lost or no more than 0.1% of the transmitted data packets are lost

v. **MEASURING AGENT:**

   The parameter shall be measured by both the Authority and Licensee

vi. **SANCTIONS:**

   Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

---

6.6. **SERVICE FUNCTION:** Connection Establishment

1. **CATEGORY:** Service Reliability

   a) **QOS PARAMETER NAME:** Successful Internet Logins

   i. **DESCRIPTION:**

   The proportion of internet sessions that are logged in successfully. A successful login session is an attempt to contact an internet point of presence that establishes an internet session by accepting properly entered valid security credentials. It is applicable to all licensees in this category.

   ii. **MEASUREMENT METHOD:**

   The calculation of this indicator shall be done according to the following formula:

   \[
   \text{Successful Internet Login ratio} = \frac{\text{Successful Internet Login Sessions}}{\text{Total Number of Internet Login Sessions}} \times 100\%
   \]

   The result, and the number of login sessions, shall be provided as measurements, obtained from end user device to a pre-determined test server. Measurements shall done when both the access network and the Internet Access Point (IAP) network are available and in full working order.

   iii. **PUBLISHED MEASUREMENT:**

   A. Percentage of successful logins.

iv. **PARAMETER TARGETS:**

   A. No less than 98% success rate of successful logins

v. **MEASURING AGENT:**
The parameter shall be measured by both the operator and the regulator.

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III.**

---

**2. CATEGORY:** Service Reliability

a) **QOS PARAMETER NAME:** Internet Session Success Ratio (ISSR)

i. **DESCRIPTION:**

A successful internet session is one which is successfully established and maintained until it completed successfully. It is applicable to all licensees in this category.

ii. **MEASUREMENT METHOD:** ETSI TS 102 250-2

\[
ISSR = \frac{\text{Completed Internet Sessions}}{\text{Successfully Started Internet Sessions}} \times 100\%
\]

**Note 1:** Internet Session Drop Ratio (ISDR) = 1 – ISSR

**Note 2:** Internet sessions that end prematurely shall not be part of the numerator.

**Note 3:** All Internet sessions that started successfully (whether they ended normally or prematurely) shall form part of the denominator.

iii. **PUBLISHED MEASUREMENT:**

A. Percentage of successful internet sessions

B. Percentage of dropped internet sessions

iv. **PARAMETER TARGETS:**

A. No less than 95% success rate

B. No greater than 5% dropped rate

v. **MEASURING AGENT:**

The parameter shall be measured by both the Authority and Licensee.

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III.**

---

b) **QOS PARAMETER NAME:** Internet Session Setup Time

i. **DESCRIPTION:**

Internet Session Setup Time is the period of time in seconds from the time a session is successfully established to the time the service access starts (content starts to be sent or received)

ii. **MEASUREMENT METHOD:**

\[
\text{Internet Session Setup Time (s)} = t_{\text{service access successful}} - t_{\text{service access stats}}
\]
iii. **PUBLISHED MEASUREMENT:**

   A. *Mean Internet session setup time in seconds*

iv. **PARAMETER TARGETS:**

   A. *No more than 5 seconds waiting time*

v. **MEASURING AGENT:**

   The parameter shall be measured by the Authority and Licensee.

vi. **SANCTIONS:**

   Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

---

**6.7. SERVICE FUNCTION: Information Transfer**

1. **CATEGORY:** Speed

   a) **QoS PARAMETER NAME:** Data Transmission Speed Achieved/Throughput

   i. **DESCRIPTION:**

      Data transmission rate that is achieved separately for downloading and uploading specified test files between service provider’s network and a user’s PC’s. It is applicable to all licensees in this category.

   ii. **MEASUREMENT METHOD:**

      The data transmission rate is calculated by dividing the size of the test file by the transmission time required for a complete and error-free transmission.

      The calculation of this indicator shall be done according to the following formula:

      $\text{DTSA} = \frac{\text{Size of the test file}}{\text{The Transmission time required for a complete and error-free transmission}}$

      Where: DTSA = Data Transmission Speed Achieved

      The transmission time is the time period starting when the access network has received the necessary information to start the transmission and ending when the last bit of the test file has been received.
The following statistics should be provided separately for download and upload direction:

a) The highest data transmission rate in Kbit/s achieved.

b) The lowest data transmission rate in Kbit/s achieved.

The mean value and standard deviation of the data transmission rate in Kbit/s.

iii. **PUBLISHED MEASUREMENT:**

   A. *Data Transmission Speed Achieved in Kbit/s or Mbit/s.*
   B. *Guaranteed Speed (Committed Information Rate) to be published by service provider*
   C. *Where service provider advertises by technology (for instance 4G), average specific speed or guaranteed speed MUST be clearly published*

iv. **PARAMETER TARGETS:**

   A. *No less than 90% of the advertised speed*

v. **MEASURING AGENT:**

The parameter shall be measured by the Authority and Licensee.

vi. **SANCTIONS:**

Non-compliance shall attract ANY of the sanctions provided under **PART III.**

### 6.8. SERVICE FUNCTION: Billing

1. **CATEGORY:** Accuracy

   a) **QOS PARAMETER NAME:** Tariff Validation

   i. **DESCRIPTION:**

   The test evaluates the discrepancy between a theoretical cost and real cost. It is applicable to all licensees in this category.

   ii. **MEASUREMENT METHOD:**

   The KPIs provided are Tariff Success Rate, Overcharging and Undercharging Rate.

   iii. **PUBLISHED MEASUREMENT:**

   A. *Percentage of tariff accuracy (mean deviation per tariff)*

   iv. **PARAMETER TARGETS:**

   A. *100% tariff accuracy in the reporting period*

   v. **MEASURING AGENT:**
6.9. **SERVICE FUNCTION:** Network Service Management

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<td>Network Availability</td>
</tr>
<tr>
<td>i. <strong>DESCRIPTION:</strong></td>
<td></td>
</tr>
<tr>
<td>Availability of the Network is the ratio of time the network has been operative to the total time of the measurement period. It is applicable to all licensees.</td>
<td></td>
</tr>
<tr>
<td>ii. <strong>MEASUREMENT METHOD:</strong></td>
<td></td>
</tr>
<tr>
<td>The measurement must be made via an automatic data collection system, based on the fault management system of the network that register the appropriate information (alarms and events with the time stamp when a network element is out of service and when it becomes operative again). The Network availability shall be calculated as follows;</td>
<td></td>
</tr>
</tbody>
</table>
| \[
\text{Percentage Network Availability} = \left[ 1 - \frac{T_i}{T_t} \right] \times 100% 
\]
| Where:- |
| $T_i$ - the total time for the inoperative network element in hours |
| $T_t$ - the total time for measurement period in hours (including weekends and public holidays). |
| | This parameter also applies to availability of transmission networks/internet. |
| iii. **PUBLISHED MEASUREMENT:** | |
| A. **Percentage Network Availability** |
| iv. **PARAMETER TARGETS:** | |
| A. 98% Internet network availability |
| v. **MEASURING AGENT:** | |
| The parameter shall be measured by both the Authority and the licensee. |
| vi. **SANCTIONS:** | |
| Non-compliance shall attract **ANY** of the sanctions provided under **PART III**. |
7. TRANSMISSION SERVICES

The following shall be the QoS parameters for the provision of transmission services:

7.1. SERVICE FUNCTION: Service provisioning

1. CATEGORY: Network / Service Accessibility

   a) QOS PARAMETER NAME: Order of Completion Time

   i. DESCRIPTION:

   Order of completion time is the time taken to provide a service in location where the service is offered. It refers to the maximum waiting time for connection of service and is applicable to all licensees in this category.

   ii. MEASUREMENT METHOD:

   The order completion/service supply time should be measured as the elapsed time (not the working time) from when a service request is accepted by an operator to when a service is provided. Service requests that are unable to be fulfilled because the operator does not offer that particular service in the requested location are excluded.

   If the operator and the customer agree that more than one service will be provided at a location or that a service will be provided at more than one location, the provision of each service at each location should be counted as a separate service request. Otherwise, service requests concerning single physical connections should be counted as a single service request, regardless of the number of channels activated or affected; multiple lines sharing the same physical path to a customer should be regarded as a single physical connection.

   Where a customer orders service to be provided at several sites, the provision of service at each site counts as a separate customer order for measurement purposes. The installation of supplementary services is excluded from the measurement. The supply of any customer premises equipment as part of or in conjunction with the order may be excluded from the measurement.

   Statistics should include all connections supplied in the data collection period, but exclude:

   A. Cancelled orders;
   B. Wrong address given by the customer;
   C. Network infrastructure damaged due to natural disaster or by third party;
   D. Customer premises closed or inaccessible;
   E. Customer internal wiring not ready at the committed or agreed time; and
   F. Installation order withheld due to payment difficulties (e.g., deposit and any upfront payments).

   The mean, standard deviation and 95th percentile of the distribution of service supply times, and the number of service supply times, should be provided as measurements.
The measurements should include all service requests fulfilled during the reporting period for the reporting area.

iii. **PUBLISHED MEASUREMENT:**

A. Mean time elapsed in days after application before installation
B. Maximum waiting time for connection of service in days
C. Mean time in days taken to fulfil service requests in the reporting period,

Mean time in days taken to fulfil service requests in the reporting period, rounded down to two numerically significant figures.

iv. **PARAMETER TARGET:**

A. No more than three (3) days period is acceptable from application for a service to installation

v. **MEASURING AGENT:**

The parameter shall be measured by the operator

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

---

**7.2. SERVICE FUNCTION: Service Support**

1. **CATEGORY:** service accessibility

   a) **QOS PARAMETER NAME:** Complaint Resolution Time

   i. **DESCRIPTION:**

   Complaint resolution time is the time taken for a service provider to resolve a complaint. It is applicable to **all licensees in this category**.

   ii. **MEASUREMENT METHOD:**

   Duration from the time a customer complaint is notified to the published point of contact of a service provider and is not found to be invalid to the time the cause for the complaint has been resolved (**ETSI EG 202 057-1**).

   \[
   \text{Percentage of complaints resolved} = (\frac{\text{Number of valid complaints resolved}}{\text{Total number of valid complaints received}}) \times 100\%
   \]

   iii. **PUBLISHED MEASUREMENT:**

   A. Total number of valid complaints received per day per week
   B. Average percentage of valid complaints resolved per day per week
iv. **PARAMETER TARGETS:**

A. No less than 99% of complaints should be resolved in a given week.

v. **MEASURING AGENT:**

The parameter shall be measured by the Licensee.

vi. **SANCTIONS:**

Non-compliance shall attract ANY of the sanctions provided under **PART III**.

---

### 7.3. SERVICE FUNCTION: Repair

#### 1. CATEGORY: Speed

a) **QOS PARAMETER NAME:** Fault Repair Time

i. **DESCRIPTION:**

Fault repair time measures the time taken to restore a service to working order after receiving valid fault reports. It is applicable to all licensees in this category.

ii. **MEASUREMENT METHOD:**

a) The mean time to repair a fault, the mean time taken to repair 99% of all valid faults, and the number of fault repair times, should be provided as measurements. The measurements should include all faults cleared during the reporting period for the reporting area, but exclude those traced to other networks or to customer equipment behind network termination points of the operator.

b) The statistics should be based on faults cleared in the data collection period, irrespective of when they are reported.

c) Time elapsed for fault repair time is based on working hours for receiving and registering customer complaining a fault, from 8:00am to 5:00pm. All fault complaints received after 5:00pm will be considered as next day faults.

b) Elapsed time for fault repair is based on round the clock, 24 hours a day, 7 days per week following receipt of repair order.

The following statistics should be provided:

The time by which 99% of all valid faults are repaired (expressed in clock or calendar hours); and the percentage of faults cleared in the time stated as an objective by the service provider.

All service providers must quote a standard accuracy for keeping repair appointments as contained in the respective service level agreement. For example, where the service provider commits to undertake the repair within a specified time period, this period should also be provided.

iii. **PUBLISHED MEASUREMENT:**
A. Mean time (hours) to repair a fault
B. Mean time (hours) by which 99% of all valid faults are repaired
C. Total number of valid reported faults in the reporting period

iv. **PARAMETER TARGETS:**

A. No more than 3 hours mean time to repair within district
B. No more than 8 hours mean time to repair outside district
C. At least 99% of time as committed by Service Level Agreement must be met

v. **MEASURING AGENT:**

The parameter shall be measured by the Licensee.

vi. **SANCTIONS:**

Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

---

### 7.4. SERVICE FUNCTION: Information Transfer

1. **CATEGORY:** speed /Service Reliability

a) **QOS PARAMETER NAME:** Transmission Delay

i. **DESCRIPTION:**

The amount of time it takes, in milliseconds (ms), for a data packet to reach the receiving end-point after being transmitted from the sending end-point

ii. **MEASUREMENT METHOD:**

The time it takes data packet to reach the specified address at the end point and return back.

A standard ping shall be used by pinging the IP address of the specified transmission end point

\[
\text{Transmission Delay (ping roundtrip)} = (t_{packet \text{ received}} - t_{packet \text{ sent}}) \text{[ms]}
\]

(*ITU-T Y.1540 and ETSI TS 102 250-2 V2.2.1*)

iii. **PUBLISHED MEASUREMENT:**

A. The amount of time it takes, in milliseconds (ms), for a data packet to reach the receiving end-point after being transmitted from the sending end-point
**Note 1:** The firewalls are not allowed to block these ICMP echo requests for the tested IP address and Port

iv. **PARAMETER TARGETS:**

   A. *Not more than 50ms shall be taken to transmit a data packet end to end.*

v. **MEASURING AGENT:**

The parameter shall be measured by both the operator and the regulator.

vi. **SANCTIONS:** Non-compliance shall attract **ANY** of the sanctions provided under **PART III**.

### 7.5. SERVICE FUNCTION: Network Service Management

1. **CATEGORY:** Network Availability

   a) **QOS PARAMETER NAME:** Availability of the Transmission Network

   i. **DESCRIPTION:**

   Availability of the transmission network is the ratio of time the transmission network has been operative to the total time of the measurement period. It is applicable to **all licensees in this category.**

   ii. **MEASUREMENT METHOD:**

   The measurement must be made via an automatic data collection system, based on the fault management system of the network that register the appropriate information (alarms and events with the time stamp when a network element is out of service and when it becomes operative again).

   The Network availability shall be calculated as follows;

   \[
   \text{Percentage Transmission Network Availability} = \left[ 1 - \frac{T_i}{T_t} \right] \times 100\%
   \]

   Where:-
   
   \( T_i \) - the total time for the inoperative network element in hours
   
   \( T_t \) - the total time for measurement period in hours (including weekends and public holidays).
### iii. Published Measurement:

**A. Time transmission network is available to the consumer per reporting period**

### iv. Parameter Targets:

**A. 99.999% transmission network availability**

### v. Measuring Agent:

The parameter shall be measured by both the Authority and the licensee.

### vi. Sanctions:

Non-compliance shall attract **any** of the sanctions provided under **Part III**.

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- **A summary of standards & QoS recommendations for PSTN, PLMN and Transmission and data services is highlighted in schedule 4.**

- **A summary of Targets for QoS parameters is shown in Schedule 5.**

## Part III

### Rules of Procedure

#### 8. Provision of Information

1. The Authority may, in the course of carrying out its functions, require a licensee to provide information so as to enable the Authority to-

   (a) monitor and enforce consumer protection, quality of service, competition and other requirements of the Act and related legislation;

   (b) allow for the assessment and allocation of applicable fees and related requirements, if any;

   (c) facilitate the efficient use of scarce resources; or

   (d) collect and compile aggregate information to be used for the purpose of sectoral planning and reporting.
2. Where the Authority requests for information under Sub-clause 1, the Authority shall provide among other things, detailed specifications of its information request, applicable response times and identify a contact person to address queries to in the matter concerned.

9. ENFORCEMENT PROCEDURE

1. A licensee commits a prescribed contravention if they fail to meet any of the Quality of Service target values set out in Part II of these Guidelines.

2. The Authority shall within ten (10 ) working days of the end of each quarter and where applicable, at the end of each monitoring period, produce Quality of Service reports.

3. The Authority shall notify the licensee of the QoS findings and may conduct a validation process of the QoS results in consultation with the licensee within five 5 working days after the production of the report.

4. Where the Licensee fails to meet the set QoS targets, the Authority shall give the Licensee three (3) days to show cause why enforcement action should not be conducted against them.

5. The Authority shall make a determination based on its findings and the information submitted by the Licensee.

6. Where a licensee has been given an opportunity to be heard and they have not responded within the requested period, the Authority shall proceed to mete out any applicable sanctions.

10. ADMINISTRATIVE SANCTIONS

1. Where a prescribed contravention has been committed, the Authority may mete out the following sanctions individually or concurrently:
i. Public apology;
ii. Refund;
iii. Compensation;
iv. Warning (first and second after which suspension of licence);
v. Fine - Compounding of offences in accordance with Section 88 of the ICT Act for failure to adhere to section 67 and 79 of the ICT Act;
vi. Vary licence conditions;
vii. Review of licence tenure; or
viii. Suspension or revocation of licence

2. In determining sanctions to be meted out under these guidelines, the Authority shall take into account the circumstances of the case including the following:

i. nature and seriousness of the prescribed contravention;
ii. the conduct of the licensee after the contravention;
iii. the previous record of the licensee; and
iv. any other relevant considerations

11. SUBMISSION OF QoS REPORTS

1. A Licensee shall submit quarterly QoS Reports to the Authority within the first two weeks of the following quarter. The Authority may also request for a report as and when need arises.

2. A licensee shall submit QoS quarterly reports in a manner prescribed by the Authority.

3. A licensee shall submit QoS reports in a format that is consistent with the format provided in the parameter target.

12. PUBLICATION

All determinations made by the Authority shall be published unless due to the peculiar nature of the matter, it may not be in the interest of the public for the determination to be publicized.

12.1. PUBLICATION OF QoS REPORTS

a) The Authority shall publish results of the quality of service measurements quarterly.
b) A licensee shall submit to the Authority and publish on their respective websites, in all service outlets, in mass-media and any other media, up-to-date coverage maps by technology for the information of consumers in a manner prescribed by the Authority. These coverage maps shall depict the extent of coverage per technology. A guide on the minimum edge signal strength per technology is contained under the QoS parameter “network coverage” in these guidelines.

13. **RECORD KEEPING**

The service provider shall retain Quality of Service data as well as measurement and related records that the service provider collects for a minimum period of 24 months after the end of the reporting period.

14. **QoS AUDITS**

The Authority shall audit the Quality of Service measurements, reporting and record keeping procedures of licensees from time to time to ensure compliance.

15. **APPEAL**

An appeal from the decision of the Authority shall lie to the tribunal established under the provisions of the Act.

16. **CRIMINAL PENALTIES**

1. Section 79(1) of the Act, provides that a person who contravenes or fails to comply with a provision of these guidelines commits an offence and is liable, upon conviction, for each such breach, to a fine not exceeding seventy thousand penalty units or to imprisonment for a period not exceeding six months, or to both, and forty thousand penalty units for each day of continued default.

2. Section 67(1) provides that all service providers shall, in respect of their specific services—

   (a) meet such minimum standards of quality of service as the Authority may specify and publish;

   (b) A person who contravenes Section 67 (1)(a) commits an offence and is liable, upon conviction, to a fine of four million penalty units and to four hundred thousand penalty units for each day during which the offence continues.
SCHEDULE 1:
Illustration of QoS Functional Components

Source: ITU-T E.804
SCHEDULE 2:
Illustration of the 4 layers of QoS parameter sources

Source: ITU-T Rec. E804
### SCHEDULE 3:

**SUMMARY OF PERFORMANCE ASSESSMENT ROLES**

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<td>MNOs/Service providers and/or Regulator, or Contractors assigned by ZICTA</td>
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<tr>
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<tr>
<td></td>
<td>Quality of Experience</td>
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<td></td>
<td>Quality of Service</td>
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## SCHEDULE 4

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<td>1900-2100 MHz</td>
<td>100 ms</td>
<td>14.4 Mbps - DL, 5.8 Mbps - UL</td>
</tr>
<tr>
<td>HSPA+ DC (3.75G)</td>
<td>W-CDMA</td>
<td>64QAM (6 digits per symbol)</td>
<td>1900-2100 MHz</td>
<td>50 ms</td>
<td>42 Mbps - DL, 11 Mbps - UL</td>
</tr>
<tr>
<td>LTE (4G)</td>
<td>OFDM (DL) SC-FDMA (UL)</td>
<td>64QAM (6 digits per symbol)</td>
<td>800/1800/2600 MHz</td>
<td>10 ms</td>
<td>50 Mbps - UL, 150 Mbps - DL</td>
</tr>
<tr>
<td>LTE-Advanced (4G+)</td>
<td>OFDM (DL) SC-FDMA (UL)</td>
<td>256QAM (8 digits per symbol)</td>
<td>800/1800/2600 MHz</td>
<td>10 ms</td>
<td>100 Mbps - UL, 400 Mbps - DL</td>
</tr>
</tbody>
</table>
### A. SUMMARY TABLES OF TARGETS FOR QoS PARAMETERS

#### i. Targets for PSTN Parameters

<table>
<thead>
<tr>
<th>No.</th>
<th>Service Function</th>
<th>QoS Parameter Name</th>
<th>Target</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Service Provisioning</td>
<td>Order of Completion Time</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Time (in days) elapsed after successful application before installation of Service</td>
<td>5</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Percentage of installations completed by the date agreed with the customer;</td>
<td>95</td>
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<td></td>
<td></td>
<td>Time elapsed after application for Service alteration or reconnection(days)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Service Support</td>
<td>Response Time for call centre services</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mean time to answer (Sec)</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percentage of calls answered electronically within 5 seconds</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percentage of calls answered by attendant (voice to voice) within 30 seconds</td>
<td>85</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percentage of calls answered by attendant (voice to voice) within 60 seconds</td>
<td>95</td>
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<tr>
<td></td>
<td></td>
<td>Availability</td>
<td>24/7</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Time taken to be attended to by customer care agent after answer (Sec)</td>
<td>30</td>
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<tr>
<td>3</td>
<td>Service Support</td>
<td>Complaint Resolution Time</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td>Percentage of complaints resolved within 1 week</td>
<td>100</td>
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<td>4</td>
<td>Repair</td>
<td>Fault Repair Time</td>
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<td></td>
<td>Time taken to repair 80% of faults(days)</td>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>Time taken to repair 90% of faults(days)</td>
<td>3</td>
<td></td>
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<td></td>
<td></td>
<td>Time taken to repair 80% of faults(days)</td>
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<td></td>
<td>Mean time to repair a fault (days)</td>
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<td>5</td>
<td>Network Service/Management</td>
<td>Customer Reported Faults</td>
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<td>Number of faults received by the operator per reporting period</td>
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<td>6</td>
<td>Connection Establishment</td>
<td>Call setup time</td>
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<td>Mean value intra network (seconds)</td>
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<td></td>
<td>Mean value fixed to mobile (seconds)</td>
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<td>Call Setup Success Rate</td>
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<td>Percentage national calls</td>
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<td>Percentage international calls</td>
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<td>Network Effectiveness Ratio</td>
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<td>Information Transfer Listening Voice Quality</td>
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<td>Mean Opinion Score(MOS)</td>
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<td>6</td>
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<td>Billing Complaint Rate</td>
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<td>Percentage of Billing complaints per 100 bills issued</td>
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<td>Billing Frequency (Days)</td>
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<td>Billing Tariff Validation</td>
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<td>Billing</td>
<td>Percentage reporting accuracy</td>
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### ii. Targets for PLMN Parameters

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<td>Maximum waiting time for SIM activation</td>
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<td>2</td>
<td>Service Support</td>
<td>Response Time for call centre services</td>
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<td></td>
<td></td>
<td>Mean time to answer (Sec)</td>
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<td></td>
<td>Time taken to be attended to by customer care agent after answer (sec)</td>
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<td>Service Support</td>
<td>Complaint Resolution Time</td>
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<td>Percentage of complaints resolved within 1 week</td>
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<td>Call Setup time</td>
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<td>Percentage of successful national calls</td>
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<td></td>
<td>Percentage of successful international calls</td>
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<td>VoLTE session setup success ratio</td>
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<td><strong>Circuit Switch Fall Back (CSFB)</strong></td>
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<td>CSFB time (seconds)</td>
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<td>CSFB success rate (percentage)</td>
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<td>Average time to return to 4G (seconds)</td>
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<td>From active state (seconds)</td>
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<tr>
<td>From idle state (seconds)</td>
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<td>LTE Registration Success Rate (LRSR) (percentage)</td>
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<td>Call Drop Rate voice call (percentage)</td>
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<td>Call Drop Rate video call (percentage)</td>
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<td>Hand over Success Rate</td>
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<th>5 Information Transfer</th>
<th><strong>SMS Delivery Time</strong></th>
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<td>Time within which SMS is delivered end to end (seconds)</td>
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<th>Information Transfer</th>
<th><strong>Successful SMS Ratio</strong></th>
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<td>Percentage of SMS and MMS successfully delivered</td>
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<th>7 Information Transfer</th>
<th><strong>Listen Voice Quality</strong></th>
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<td>Mean Opinion Score (MOS)</td>
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<th>8 Billing</th>
<th><strong>Billing Complaint Rate</strong></th>
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<tr>
<td>Percentage of Billing complaints per 100 bills issued</td>
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<td>Billing Frequency (Days)</td>
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<td>Tariff accuracy (percentage)</td>
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<th>9 Network Service/Management</th>
<th><strong>Network Availability of Switching</strong></th>
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<td>Time MSC Network is available to the consumer per reporting period</td>
<td>99.999%</td>
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<table>
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<th><strong>Network Availability of Radio Access</strong></th>
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<tr>
<td>Time Radio subsystem/Access network is available to the consumer per reporting period</td>
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<tr>
<th><strong>Network Coverage</strong></th>
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<tr>
<td>The ratio of the geographical land area where there is coverage to the total (country) land area (percentage wrt table)</td>
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<td>---</td>
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<tr>
<td><strong>Transmission network</strong></td>
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<td>transmission network availability (percentage)</td>
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<td><strong>Internet network</strong></td>
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<td>Internet network availability (percentage)</td>
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<tr>
<td>10</td>
<td>Network Service/Management</td>
</tr>
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<tr>
<td><strong>Block rate</strong></td>
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</tr>
<tr>
<td>TCH Congestion</td>
<td>2%</td>
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<tr>
<td>SDCCH Congestion</td>
<td>0.8%</td>
</tr>
<tr>
<td>2G</td>
<td>TCH Congestion (percentage)</td>
</tr>
<tr>
<td>SDCCH Congestion (percentage)</td>
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<td>SDCCH Blocking (percentage)</td>
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<td>SDCCH Drop (percentage)</td>
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<td>TCH Drop (percentage)</td>
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<td>TCH Assignment (percentage)</td>
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<td>HO Success Rate (percentage)</td>
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<tr>
<td>3G</td>
<td>RAB CSR (percentage)</td>
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<td>SHO Success Rate (percentage)</td>
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<td>CSSR (percentage)</td>
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<td>4G</td>
<td>RRC Drop (percentage)</td>
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<td>ERAB Drop (percentage)</td>
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<td>RRC availability (percentage)</td>
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<tr>
<td>HO Success Rate (percentage)</td>
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<td>CSSR (percentage)</td>
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<tr>
<td>CDR (percentage)</td>
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### iii. Targets for Data Parameters

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<th>No.</th>
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<th>QoS Parameter Name</th>
<th>Target</th>
<th>Actual</th>
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<tr>
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<td>DSL Wired</td>
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<td>Fixed wireless</td>
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<td>Percentage of installations completed by the date agreed with the customer;</td>
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<td>Time elapsed after application for Service alteration involving Software only</td>
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<td></td>
<td></td>
<td>Time elapsed after application for Service alteration involving Hardware</td>
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<td></td>
</tr>
<tr>
<td>2</td>
<td>Service Support</td>
<td>Complaint Resolution Time</td>
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<td>Percentage of complaints resolved within 1 week</td>
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<td>3</td>
<td>Repair</td>
<td>Fault Repair time</td>
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<td>Time taken to repair 80% of faults(days)</td>
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<td>Time taken to repair 90% of faults(days)</td>
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<td>Time taken to repair 100% of faults(days)</td>
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<td>Mean Time to Repair (hours)</td>
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<td>Data Packet Latency local (milliseconds)</td>
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<td><strong>Jitter</strong></td>
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<td></td>
<td>Data Packet Jitter international (milliseconds)</td>
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<tr>
<td></td>
<td></td>
<td>Data Packet Jitter local (milliseconds)</td>
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<td>Connection Establishment</td>
<td><strong>Successful internet Log-ins</strong></td>
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<td>Data Transmission</td>
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<td>Ratio of Data Packet Loss</td>
<td>&lt;0.1</td>
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</tbody>
</table>
Percentage of successful log-ins to access the internet when both the access network and the Internet Access Point (IAP) network are available in full working order. 98

6. **Connection Establishment/Release**

**Dropped Internet Sessions**
The proportion of successfully established internet sessions that end before they would be ended normally by users. 5%

**Internet Session Setup Time**
Time in seconds from the time a session is successfully established to the time the service access starts (seconds) 5

7. **Information Transfer**

**Data Transmission Speed Achieved**
Data transmission rate achieved for downloading and uploading specified test files between service provider's network and customer premises equipment (as percentage of advertised speed) 90

8. **Billing**

**Billing Complaint Rate**
Percentage of Billing complaints per 100 bills issued <0.1

**Tariff accuracy validation (percentage)** 100

9. **Network Service/Management**

**Network Availability**
Network availability in a reporting period 98

### iv. Targets for Transmission Parameters

<table>
<thead>
<tr>
<th>No.</th>
<th>Service Function</th>
<th>QoS Parameter</th>
<th>Target</th>
<th>Actual</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Service Provisioning</td>
<td>Order Completion Time</td>
<td>Time elapsed after application before installation of Service (days)</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Service Support</td>
<td>Complaint Resolution Time</td>
<td>Percentage of complaints resolved per given time period (per week)</td>
<td>99</td>
</tr>
<tr>
<td>3</td>
<td>Repair</td>
<td>Fault Repair Time</td>
<td>Mean time to repair (hours)</td>
<td>3</td>
</tr>
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<td></td>
<td>Mean time to repair (hours)</td>
<td>8</td>
<td></td>
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</tr>
<tr>
<td>4</td>
<td>Meet Service Level Agreement repair related requirements (percentage)</td>
<td>99</td>
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<tr>
<td>4</td>
<td>Information Transfer</td>
<td>Availability of the Transmission Network</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Time transmission network is available to the consumer per reporting period (percentage)</td>
<td>99.999</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Information Transfer</td>
<td>Transmission delay</td>
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<tr>
<td></td>
<td>Time (milliseconds) elapsed for a sent packet to be received including equipment processing time and propagation delays</td>
<td>&lt; 50</td>
<td></td>
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</tr>
<tr>
<td>6</td>
<td>Network Service/Management</td>
<td>Network Availability</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Network availability in a given quarter</td>
<td>99.999%</td>
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</tbody>
</table>