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ETHIOPIAN
COMMUNICATIONS AUTHORITY

TELECOMMUNICATIONS QUALITY OF SERVICE DIRECTIVE NO. 794/2021

JULY 2021

ADDIS ABABA

TELECOMMUNICATIONS QUALITY OF SERVICE DIRECTIVE

WHEREAS it is necessary to specify technical standards for the provision of Telecommunications Services in order to ensure that Communications Services confirm to specified standards of quality;

UNDERSTANDING the need to devise a Quality of Service framework that allows the quality of service delivered by Telecommunications Operations to be measured, reported and published based on defined parameters and measurement methodologies;

COGNIZANT of the need to provide consumers of Telecommunications Services the Quality of Service obligations that Telecommunications Operators are required to meet;

RECOGNIZING the importance of setting minimum parameters to allow for improved operations and performance of interconnected networks;

NOW, THEREFORE, the Authority hereby issues this Telecommunications Quality of Service Directive in accordance with Ethiopian Communication Service Proclamation No.1148/2019, Articles 6(2), 6(5), and 54(2).

PART ONE
GENERAL

1. Short Title

This Directive may be cited as "Telecommunications Quality of Service Directive No. 794/2021".

2. Definitions

. In this Directive, unless the context otherwise requires:

1) "**Authority**" means the Ethiopian Communications Authority established under the Communications Service Proclamation No. 1148/2019.

2) "**Average**" or "**Mean**" is the result of dividing the sum of the numerical values in a set by the number of values in the set.

3) "**Base Transceiver Station (BTS)**" or "**NodeB**" or "**eNodeB**" means the radio base station (RBS) or, simply, the Base Station (BS) or a telecommunications node that provides wireless communications between mobile phones and the mobile network used in 2G, or 3G, or Long Term Evolution (LTE) networks, respectively.

4) "**Call Attempt**" means an attempt to achieve a connection to one or more devices attached to a telecommunication network.

5) "**Compensation"** means a portfolio of remedies by a Telecommunications Operator to the Customer for shortcomings in the level of the Quality of Service delivered, e.g., delays in provision, repair or not achieving the promised level of quality of service, in form of monetary or non-monetary means.

6) "**Customer**" means any person who receives Telecommunications Services and pays the corresponding fees for a certain period of time by virtue of an agreement that he enters into or accepts the terms set forth by a Telecommunications Operator.

7) "**Contravention**" means any failure to comply with the target values prescribed and/or requirements identified in this Directive.

8) "**Fault**" means the inability of an item to perform a required function, excluding that inability due to preventive maintenance, lack of external resources or planned actions.

9) "**Force Majeure**" means fire, strikes, or other labor actions or dispute, acts of Nature, or any circumstances not foreseeable and beyond the reasonable control of a Telecommunications Operator.

10) "**Internet Service**" means a service that is provided substantially for data communications to or from Network Termination Points that have IP addresses.

11) "**Item**" means any part, device, subsystem, functional unit, equipment or system that can be individually considered.

12) "**Key Performance Indicators (KPI)**" means Key Performance Indicators of Telecommunications Services that can be monitored, measured, and reported.

13) "**Measurement**" means a numerical value that is obtained by using a Measurement Method.

14) "**Measurement Method**" means the method of measuring a parameter that is prescribed in this Directive.

15) "**Network Termination Point**" means a point at which a customer has physical access through customer equipment to a network of a Telecommunications Operator.

16) "**Parameter**" means a quantifiable characteristic of a service with specified scope and boundaries.

17) "**Peak Hour**" means the hour in a day where the traffic for a licensed service is highest on the network.

18) "**Proclamation**" means the Ethiopian Communications Service Proclamation No.1148/2019.

19) "**Quality of Service Standards**" means Parameters defining the applicable quality of service standards for specific services including the methods of taking measurements that measure service performance against prescribed parameters, and any applicable targets for the prescribed parameters identified in this Directive.

20) "**Reporting Area**" means a geographic area for which Measurements are taken and recorded.

21) "**Reporting Period**" means the period of time over which Measurements are taken and recorded.

22) "**Rural**" means localities not classified as Urban.

23) "**Sanction"** means a fine or compensation requirement imposed on Telecommunications Operators for defaulting in their Quality of Service obligation.

24) "**Service**" means application, content, network or facilities service or any combination of these services, that is provided substantially for communications between Network Termination Points.

25) "**Service Level Agreement (SLA)**" means a formal agreement between a Telecommunications Operator and a Customer that is reached after a negotiating activity,

with the scope of assessing service characteristics, responsibilities and priorities of each part. An SLA may include statements about performance, tariffing and billing, service delivery, compensation and escalation procedures in cases of disagreement.

26) **"Service Retainability"** means the service quality characteristic that describes termination of services (in accordance with or against the will of the user).

27) "**Target**" means a numerical value that must be reached by a Published Measurement of the relevant service prescribed in this Directive.

28) "**Urban**" means any locality having a population size of two thousand (2000) or more inhabitants, of which fifty percent (50%) of its labor force is primarily engaged in non-agricultural activities. Moreover, all administrative capitals (Region, Zone and Woreda), and localities in which municipalities are established are considered as urban areas, irrespective of population size.

29) "**Working Days**" means business working days only and shall not include Saturday, Sunday and any day that has been declared to be a public holiday by the Federal Democratic Republic of Ethiopia.

3. Objective

The objectives of this Directive are to:

1) Create conditions for Customer satisfaction by making known the quality of service obligations that Telecommunications Operators are required to meet.

2) Measure the Quality of Service provided by Telecommunications Operators from time to time in line with the service parameters stated in this Directive in order to assess the levels of performance.

3) Improve the operation and performance of interconnected networks; and,

4) Implement a Quality of Service framework that allows the Quality of Service delivered by Telecommunications Operators to be measured, reported and published based on defined parameters and measurement methodologies as provided in this Directive and its Annexes.

4. Scope of Application

This Directive shall apply to all Telecommunications Operators offering Wholesale and Retail Telecommunications Services.

5. Obligations of Telecommunications Operators

Telecommunications Operators shall:

1) Ensure performance of Communications Services that meet Quality of Service parameters as set forth by this Directive and its Annexes; and,

2) Perform measurements on quality of services from time to time, keep records of the results of the measurements, and report the same to the Authority.

PART TWO
MEASUREMENT, REPORTING, AND RECORD KEEPING

6. Measurement Methods

1) Telecommunications Operators shall establish measurement methods consistent with this Directive.

2) The measurement of quality of service parameters shall be based on the measurement methods stated in Appendix I of this Directive.

3) The parameters referred to in Sub-Article (2) of this Directive may be reviewed and amended, from time to time, by the Authority subject to consultation with Telecommunications Operators and in accordance with international best practice.

4) Telecommunications Operators shall allow the Authority to access its trouble ticketing system for Customer service provisioning and complaints during audit processes.

5) Test calls measurement shall be made using drive-tests or other test units as determined by the Authority.

7. Reporting

Telecommunications Operators shall:

1) Submit a Quality of Service report on the Quality of Service benchmarks for all the parameters in the format to be prescribed by the Authority on a quarterly basis, ending March 31, June 30, September 30, and December 31, but not later than thirty (30) working days from the end of the Quarter. The Authority may review, from time to time, the frequency and the format of such report;

2) Specify in the report the manner in which the sampling was done with sufficient detail to enable the Authority to verify the accuracy of the report; and,

3) Be required to provide the network coverage and overall network performance on a Quarterly basis to the Authority based on data from their network operations and maintenance facilities; and,

8. Record Keeping

1) Telecommunications Operators shall maintain:

   a) Documented processes of data collection for each Quality of Service parameter contained in the Directive and submit to the Authority as required;

   b) Complete and accurate records of their compliance of each Quality of Service parameter specified in such a manner and in such a format, as may be prescribed by the Authority from time to time; and,

   c) Quality of Service data, including all measurements and related records, for a minimum of twelve (12) months after the end of the Reporting Period or as may be directed by the Authority.

2) The Authority may, subject to consultation with Telecommunications Operators, specify uniform record keeping procedures and formats including guidelines on measurement methodology for various Quality of Service Standards;

3) The Authority may, if it considers it expedient to do so, at any time, direct any of its employees to inspect the records or to get such records audited.

PART THREE
AUDITING AND PUBLICATIONS

9. Auditing

1) The Authority shall conduct audits on measurement and reporting of the Quality of Service Parameters outlined in Appendix I of this Directive.

2) The Authority shall:

   a) Undertake Quality of Service audits from time to time to verify the Quality of Service experienced by Customers and compare the results from audit exercises against license obligations and Quality of Service Standards;

   b) Audit some or all of the Quality of Service data;

   c) Vary the frequency of the audits, reporting areas and reporting periods that require auditing if required so by force majeure or following a minimum of ten (10) Working Days warning by the Authority prior to the auditing activities; and,

   d) Use an independent suitably qualified third party to perform audits on behalf of the Authority as needed.

3) In order to verify the Quality of Service experienced by customers and to compare the results (from audit exercises) against license obligations the Authority shall use any of the following methods:

   a) Drive test;

   b) Consumer survey; and,

   c) Data submitted on a quarterly basis by the Telecommunications Operators.

10. Publication

The Authority shall publish Quality of Service Standards, including results of the audit and assessments of the Quality of Service undertaken by the Authority, coverage map and service availability, on the Authority's print media or website, on a Quarterly and annual basis in order to ensure consumers are provided with information that will enable them to make informed decisions.

PART FOUR
COMPLIANCE, INVESTIGATION, AND INSPECTION

11. Compliance

1) In order to comply with this Directive, Telecommunications Operators shall:

   a) Establish measurement methods consistent with this Directive;

   b) Provide measurement results for all services and the network coverage to the Authority;

   c) Meet targets as set forth in this Directive;

   d) Produce and submit the data reasonably required by the Authority as when required;

e) Provide relevant information to Customers to make informed decisions about their services; and,

f) Provide Customers equal access to the same quality of service in accordance with the tariffs and Quality of Service standards; and inform affected Customers of any significant outage that affect service provision and technologies (2G, 3G, 4G, …) as they are deployed depending on the locations.

2) For the purposes of monitoring compliance of the Quality of Service parameters the Authority shall be guided by the measurement methods stated in Appendix 1 of this Directive.

12. Service Level Agreements

1) There shall be a well-outlined Service Level Agreement (SLA) between Telecommunications Operators and the Customer to ensure end to-end-Quality of Service for those subscribers and services requiring such SLA.

2) The Service Level Agreement shall state, among other matters, the:

a) Level of performance: The minimum level of performance offered to the Customer, not the average level to be achieved for all Customers;

b) The Compensation payment: if the minimum level is not achieved with the amount at least proportional to the degree of failure or as agreed in the Service Level Agreement; and,

c) The mechanism for claiming Compensation: this should be done automatically without requiring the Customer to make a claim.

d) The Escalation procedure that provides for time limits on when an unresolved problem has to be escalated to the next level.

13. Investigation

The Authority shall investigate at any time the Quality of Service measurement, reporting and recording procedures of a Telecommunications Operator.

14. Inspection

Pursuant to Article 31 of the Proclamation, the Authority or any person authorized in writing by the Authority may at any time during working hours, enter upon the premise of a Telecommunications Operator for purposes of ascertaining the compliance with this Directive.

PART FIVE
SERVICE DEGRADATION, SERVICE OUTAGES, AND PUBLIC EMERGENCIES

15. Planned Service Outages

Telecommunications Operators shall:

1) Issue the public advanced notice of planned major outage of services, at national, regional and/or city levels, by publishing the news on their website, social media pages, and electronic media with wide coverage at least forty-eight (48) hours prior to the planned outage;

2) Send a notice to Customers by Short Messaging Service (SMS) if the planned major outage exceeds a period of 24 hours, applicable to those Customers who have opted in for such messages; and,

4) Provide the information for such major service outages by electronic mail to the Authority at least forty-eight (48) hours before the planned outages of service.

16. Unplanned Service Degradation and Service Outages

In the event of any unplanned service degradation and service outages, a Telecommunications Operator shall:

1) Notify the Authority by email as soon as it becomes aware that the outage will last more than two (2) hours, or after two (2) hours of actual outage.

2) Notify its Customers of any major service degradation or service outages which extend beyond four (4) hours in an area corresponding to regions and cities through one or more of the following means of communication:

   a) SMS;

   b) Social media (including, but not limited to, Facebook, Twitter); and,

   c) Electronic communication media.

3) Provide the following information to its customers to the best of its knowledge:

   a) Affected Service;

   b) Period of disruption;

   c) Reason(s) of disruption;

   d) Areas of disruption;

   e) Possible effect(s) on consumers; and,

   f) Estimated time for service restoration.

4) Within five (5) working days of resolution of the issue, provide to the Authority a formal report detailing the circumstances attributing to the service degradation or service outages, and the action taken to remedy the situation.

17. Public Emergencies

1) In the event of public emergencies, a Telecommunications Operator shall be required to provide public emergency services to the Government giving priority to the support activities required to overcome the emergency.

2) The Authority shall inform Telecommunications Operators of the emergency services that may be needed as soon as the emergency is known to it.

3) Telecommunications Operators shall submit to the Authority annually its plan for the procedures and operations which Telecommunications Operators shall follow in the event of any such emergency and shall update the said plan upon request by the Authority.

4) In the event that the emergency or crisis is related to matters concerning national security, Telecommunications Operators shall co-ordinate with the relevant authority indicated by the Authority and shall implement the emergency plan as far as reasonably practicable in

accordance with the instructions as may be given by the Authority.

PART SIX
COMPLIANCE AND ENFORCEMENT

18. Compliance

The Authority shall monitor a Telecommunications Operator's compliance with the provisions of the Proclamation and this Directive.

19. Procedures for Rectifying Contraventions of Quality of Service Requirement

1) In case of a contravention of a Quality of Service requirement, the Authority shall send a formal notice to the Telecommunications Operator to rectify the problem within twenty (20) working days.

2) In the event that a joint team of the Authority and the Telecommunications Operator determines that the contravention cannot be resolved within twenty (20) working days, the Telecommunications Operator shall be required to submit an action plan to address and resolve the contravention.

3) Any such plan submitted in Sub-Article (2) of this Article, shall be subject to review and approval by the Authority.

4) The Authority shall apply the appropriate sanctions on a Telecommunications Operator for failure to rectify a contravention in accordance with the action plan approved pursuant to Sub-Article (3) of this Article.

20. Compensations

1) For any contraventions of a QoS requirement including for service outages customers shall not be required to pay for the services not received.

2) Affected Customers shall be compensated by Telecommunications Operators in terms of tangible service benefits to the Customer including but not limited to additional airtime or data allowance, except in the case of excused performance due to an event of force majeure.

21. Enforcement

1) Where the Authority, consistent with the provisions of this Directive, the Proclamation, and other instruments that the Authority may issue, determines that a Telecommunications Operator has violated the provisions of this Directive, it shall impose remedies pursuant to Article 52 of the Proclamation that shall include fines or restitution.

2) Without prejudice to Sub-Article (1) of this Article and Sub-Article (4) of Article 19 of this Directive, the Authority's remedies and sanctions shall be guided by the Council of Ministers Regulation issued pursuant to Article 52(6) of the Proclamation that determines the types of infractions that would result in license revocation, suspension and other administrative measures and stipulate the penalties and the amount of fines to be paid.

PART SEVEN
MISCELLANEOUS

22. Procedures and Quality of Service Measurement Plan

The Authority shall, upon consultation with Telecommunications Operators develop detailed procedures and measurement methods for a QoS measurement plan, after the effective date of this Directive.

23. Amendment

The Authority may, at any time, when it deems it necessary, amend this Directive by notifying all Licensees in advance and conducting a stakeholder consultation process in line with the provisions of the Proclamation.

24. Effective Date

This Directive shall come into force on the 9th day of July 2021.

DONE AT ADDIS ABABA ON THE 9TH DAY OF JULY 2021

ENGINEER BALCHA REBA
DIRECTOR GENERAL
ETHIOPIAN COMMUNICATIONS AUTHORITY

ANNEX I

TARGETS AND KPIS

1. QUALITY OF SERVICE PARAMETERS FOR FIXED LINE SERVICES

Every Fixed Line Telecommunications Operator shall meet the following Quality of Service standards set for Fixed Line Services in respect of each specified parameter measured by test traffic in any locality and shall submit a report in the reporting period based on daily peak hour conditions.

Table 1: Quality of Service parameters for Fixed line Services (Technical)

Parameter	Definition	Formula	Target	
			Urban	Rural
Unsuccessful call ratio (USCR)	The ratio of unsuccessful calls to the total number of call attempts in a specified time period.	(Number of Unsuccessful call attempts/ total number of call attempts) X100%	≤ 2%	≤ 5%
Network Availability	The degree to which the network is operable and not in the state of failure or outage at any point in time. It measures the total uptime of the network.	Network Availability = (Total operational minutes-Total minutes of service downtime) / Total operational minutes) X100%	> 95%	> 90%
Call Set-up Time	The period starting when the address information required for setting up a call is received by the network and finishing when the called party busy tone or ringing tone or answer signal or alerting message is received by the calling party.	Time of Call Alerting - Time of receiving Dial tone	≤ 5 Sec (all national calls)	≤ 8 Sec (all national calls)
Call Drop Rate	The percentage 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.	Call Drop Rate = (Number of calls terminated unwillingly/ Total number of successfully established calls)X100%	≤ 2%	≤ 4%

2. QUALITY OF SERVICE PARAMETER FOR CELLULAR MOBILE NETWORK AND SMS SERVICES

Every Cellular Mobile Telecommunications Operator shall meet the following Quality of Service standards set for cellular mobile service in respect of each specified parameter measured by test traffic in any locality and shall submit a report in the reporting period based on daily peak hour conditions.

Table 2: Quality of Service parameter for Cellular Mobile Voice and SMS Services (2G/3G/4G/LTE)

Parameter	Definition	Formula	Target	
			Urban	Rural
Call Set-up Time	The call setup time means a time interval from the instant when the calling party makes a call to the time when the calling party receives a ring back tone or alerting massage	Time of Call Alerting - Time of receiving Dial tone	≤ 8 Sec for 95% of calls	≤ 10 Sec for 95% of calls
Call Drop Rate	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.	Call Drop Rate = (Number of calls terminated unwillingly / Total number of successfully established calls) X100%	≤ 2%	≤ 5%
Blocked Call Rate	Blocked call means a call which is not connected because there is no free channel to serve a call attempt.	Blocked Call Rate = (Number of Blocked calls/ Total Number of Call Attempts) X100%	≤ 2%	≤ 5%
Call set-up Success Rate	The percentage of attempted calls that are successfully connected to the intended recipient	Call set-up Success Rate = Total number of successfully connected calls/ total number of call attempts) X100%	≥ 98%	≥ 95%
Handover Success Rate (HOSR)	Handover success rate means the ratio of successful	Handover Success Rate = (Total number of successful	≥ 96%	≥ 94%

Parameter	Definition	Formula	Target	
			Urban	Rural
	handover calls to the total number of handover call attempts made. Handover is the process by which a mobile telephone call is transferred from one Base Transceiver Station to another as the subscriber passes the boundary of a cell.	handovers / total number of handover requests) X100%		
Mobile Service Coverage Signal Strength	The transmitter power output as received by a reference antenna at a distance from the transmitting antenna	Mobile Service Coverage Signal Strength = Field Strength measurements	≥ -90dBm for 2G (Out door, for 95% of Coverage Area)	≥ -100dBm for 2G (Out Door, for 90% of Coverage Area),
			≥ -95dBm for 3G (Out Door, for 95% of Coverage Area)	≥-105dBm for 3G (Out Door, for 90% of Coverage Area)
			≥ -100dBm for 4G (Out Door, for 95% of Coverage Area)	≥ -110dBm for 4G (Out Door, for 90% of Coverage Area)
Voice Quality (Mean Opinion Score - MOS)	MOS means a numerical value that measures user experience and the factors that influence voice quality.	MOS is expressed in a number from 1-5, 1 being the worst and 5 being the best	≥ 3.0 for 2G ≥ 3.5 for 3G & 4G	≥ 3.0 for 2G, 3G and 4G
SMS				
SMS end-to-end Delivery Time	The SMS end-to-end delivery time is the time period between sending a short message to the network and receiving the very same short message at another UE.	SMS End to End Delivery Time= Time SMS Received- Time SMS Sent	≥ 95% in 15 seconds	≥ 95% in 30 seconds
SMS Delivery Success Rate	The percentage of sent messages that are received by the intended recipients	SMS Delivery Success Rate = (Number of SMS received by intended recipients/number of SMS sent) X100	≥ 98%	≥ 95%

Parameter	Definition	Formula	Target	
			Urban	Rural
SMS Service Accessibility	The SMS service accessibility means the probability that the end-user can access SMS center for sending SMS.	SMS Service Accessibility = (Successful Access to SMS Center/Total number of SMS attempts) X100%	≥ 98%	≥ 95%

3. QUALITY OF SERVICE PARAMETERS FOR MOBILE AND FIXED BROADBAND INTERNET SERVICES

Every Mobile and Fixed Broadband Internet Telecommunications Operator shall meet the following Quality of Service standards set for Internet Service in respect of each specified parameter measured by test calls in any locality and shall submit a monthly report based on peak hour conditions.

Table 3: Quality of Service Parameters for Mobile and Fixed Broadband Internet Services

Parameter	Definition	Formula	Target	
			Urban	Rural
Mobile Internet Service				
Attach Failure Ratio [%]	The attach failure ratio is the probability that a subscriber cannot attach to the PS network.	Attach failure ratio [%] = (Unsuccessful attach Attempts/all attach Attempts) X100	≤ 2%	
Attach Setup Time [s]	The attach set-up time is the time period needed to attach to the PS network.	Attach set-up time [s] = $t_{attach\ complete} - t_{attach\ request}$	≥98% of successful attach attempts Should be completed within 1 second	
PDP Context Activation Failure Ratio [%]	The PDP context activation failure ratio denotes the probability that the PDP context cannot be activated. It is the proportion of unsuccessful PDP context activation attempts and the total number of PDP context activation attempts.	PDP context Activation Failure Ratio [%] = (Unsuccessful PDP context activation attempts/All PDP context activation attempts)X100%	≤ 3%	
PDP Context Activation Time [s]	The PDP context activation time is the time period needed for activating the PDP context.	PDP Context Activation Time [s]= $(t_{PDP\ context\ activation\ accept} - t_{PDP\ context\ activation\ request})$ [s]	≥98% of successful attach attempts Should be completed within 2 seconds	
PDP Context Cut-off Ratio	The PDP context cut-off ratio is the probability that a PDP context is deactivated without being initiated	PDP context cut-off Ratio [%] = (PDP	≤ 1%	

Parameter	Definition	Formula	Target	
			Urban	Rural
[%]	intentionally by the user, allowing the network to deactivate the context after user idle time.	context losses not initiated by the user/all successfully activated PDP contexts)X100%		
DNS host name resolution time [s]	The DNS host name resolution time is the time it takes to perform a host name to host address translation.	DNS Host Name Resolution Time [s]= ($t_{\text{standard query Response}} - t_{\text{standard query}}$)[s]	90% of samples < 1 second	
DNS Host Name Resolution Success Rate	DNS host name resolution Success rate is the likelihood for a host name to host address translation of a DNS resolver successfully.	DNS Host Name Resolution Success Rate = (Successful DNS Host Name Resolution requests/ Total DNS Host Name Resolution requests)X100	>99% for valid URL requests	
HTTP set-up time [s]	The HTTP set-up time is the time period needed to access the service successfully, from starting the dial-up connection to the point of time when the content is sent or received.	HTTP set-up time [s]= ($t_{\text{service access successful}} - t_{\text{service access start}}$)[s]	90% < 15 seconds (3G and 4G)	85% < 20 seconds (3G and 4G)
HTTP Session Failure Ratio	The Proportion of incomplete sessions that were started successfully	HTTP Session failure Ratio = (Number of incomplete sessions / Number of successfully started sessions) X100	<10% (2G) <5% (3G and 4G)	<15% (2G) <10% (3G and 4G)
HTTP mean data rate [Kbit/s]	HTTP mean data rate [Kbit/s] means the average data transfer rate measured throughout the entire connect time to the service after a data link has been successfully established,	HTTP Mean Data Rate = User data transferred [Kbit]/($t_{\text{data transfer complete}} - t_{\text{data transfer Start}}$)[s]	≥ 384 Kbps (3G); ≥ 2Mbps (4G)	≥ 128 Kbps (3G); ≥ 1Mbps (4G)
FTP {download |upload} set-up time [s]	FTP {download |upload} set-up time [s] is the time period needed to access the service successfully, from starting the dial-up connection to the point of time when the content is sent or received.	FTP {download | Upload} Set-up time [s]= $t_{\text{service access successful}} - t_{\text{service access start}}$[s]	< 5 Sec (4G)	< 10 Sec (4G)
FTP {download | Upload} Session Failure Ratio	The proportion of incomplete sessions that were started successfully.	FTP Drop Rate = (Number of incomplete sessions / Number of successfully started sessions) X100%	<5% (4G)	<10% (4G)

Parameter	Definition	Formula	Target	
			Urban	Rural
FTP {download | Upload} Mean Data Rate [Mbit/s]	The FTP {download | Upload} Mean data Rate [Mbit/s] is the average data transfer rate measured throughout the entire connect time (i.e., after a data link has been successfully established) to the service.)	FTP {download | Upload} Mean data Rate = (User data transferred (Kbit) / (Time data transfer complete – Time data transfer Start)	≥ 1 Mbit/s (4G)	≥ 512 Kbit/s (4G)
Fixed Broadband Internet Service				
Data Transmission Rate	The speed of data travelling from user to the network and back.	Data transmission Rate = Size of Test file /the transmission time required for a complete and error-free transmission	>80% of the advertised speed during peak time	
Access Network Utilization	Access Network Utilization is a parameter that measures the total traffic between access node to aggregation node.	Access Network Utilization = (Total traffic between access node / Aggregation of traffic at the node) X100%	Uplink utilization must not be more than 75% of the uplink bandwidth provided	
Latency	The duration of time it takes, in milliseconds (ms), for a data packet to reach the receiving endpoint after being transmitted from the sending end-point.	Latency (ping roundtrip) = $tpacket\ received - tpacket\ sent$ [ms]	<80ms for local target server and for xDSL access technology.	<50ms for local target server and for xDSL access technology .
			<25ms for local target server and for FTTH access technology	<50ms for local target server and for FTTH access technology
Packet Loss	Packet loss means the measure of the percentage of data packets transmitted from source that fail to arrive at their destinations.	(Total Number of Packet Loss/Total Number of packets Sent) X100%	<0.5% for 95% of tests of FTTH networks	
			<2% for 95% of tests of xDSL networks	

4. QUALITY OF SERVICE PARAMETERS FOR VoLTE SERVICES

Every VoLTE Telecommunications Operator shall meet the following Quality of Service standards set for VoLTE service in respect of each specified parameter measured by test calls in any locality and shall submit a monthly report based on peak hour conditions.

Table 4: Quality of Service Parameter for VoLTE Services

Parameter	Definition	Formula	Target
IMS Registration Success Rate	The ratio of the number of successful terminating session establishment to the number of attempted terminating session establishment for LTE network. It is used to evaluate accessibility performance provided.	Registration Success Rate = (Successful registration attempts/ Total number of registration attempts) X100	≥ 90% for Urban and ≥ 90% for Rural
Service Availability	End to end service availability in terms of capacity to establish calls from, and to, a VoLTE customer.	Service Availability = [(Total operational minutes - Total minutes of service downtime) / Total operational minutes] X 100	≥ 90% for Urban and ≥ 90% for Rural
Post Dialing Delay (PDD)	Time interval (in seconds) between the end of dialing by the caller and the reception back by user of the appropriate ringing tone or recorded announcement.	Post Dialing Delay (PDD) = Time of ringing tone - Time of Dialing	≤ 4 Seconds for LTE to LTE ≤ 6 seconds for LTE to legacy no more than
Circuit switch Fall Back (CSFB) Success Rate [%]	Circuit Switch Fall Back Success Rate denotes whether the CSFB procedure ends successfully in such a way that the mobile can continue with the actual call setup signaling.	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	≥98% success rate within 6 seconds fall back time
Call Drop Rate	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.	Call Drop Rate = (Total number of calls terminated unwillingly / Total number of successfully established calls) X100%	≤ 2%
Network Efficiency Ratio	Network Efficiency Ratio means the ability of the network to deliver calls to the far terminal. It expresses the relationship between the number of seizures and the sum of number of seizures resulting in either an answer message, or a user busy or a no answer ring.	Network Efficiency Ratio = (Number of seizures resulting in answer message, user busy, no answer / Total number of seizures attempt) X100%	≥ 95%

Parameter	Definition	Formula	Target
VoLTE Session Setup Failure Ratio [%]	The probability that the VoLTE terminal cannot setup a session.	VoLTE Session Setup Failure Ratio = (unsuccessful VoLTE session setup attempt/ all VoLTE session setup attempt) X100%	≤ 2%
Return to 4G Time (LTE Networks)	Return to 4G/LTE time is the average time (in seconds) it takes for a 4G/LTE call to return to form a legacy (2G/3G) network after a call has ended	$Return\ to\ 4G/LTE[s] = t_{\text{first System information block in LTE received}} - t_{\text{call disconnected}}$	≤5 seconds fall back time from active state
			≤10 seconds fall back time from idle state

5. QUALITY OF SERVICE PARAMETER FOR INTERCONNECTION

Every Telecommunications Operators shall meet the following Quality of Service standards set for any interconnected service in respect of each specified parameter measured by real calls on any interconnected route and shall submit a periodic report based on daily peak hour conditions.

Table 5: Quality of Service Parameter for Interconnection

Parameter	Definition	Formula	Target
Interconnection Route Utilization	The percentage of provisioned interconnection route that is carrying traffic	Interconnection Route Utilization= (Total Capacity in use/Capacity Provisioned) X100%	≤ 70%
Mean Time To Repair (MTTR) Interconnection Route	The duration from a reported interconnection fault to service on Route restoration	Mean Time To Repair (MTTR) Interconnection Route=Time Service Restored-Time Fault Reported	≤ 1 hour
Point of Interconnection (PoI) Congestion	The ratio of calls failed over the POI (between two Telecommunications Operators) due to unavailability of free circuits to the total call requests for seizure of POI circuit.	POI congestion = failed call requests over the POI due to unavailability of free circuits/ (total call requests for seizure of POI circuit)x100%	< 0.5%
Time-frame for activation of a new POI	The time frame for activation of a new POI is the time duration permitted for commissioning of interconnect capacity or link after confirmation or acceptance of demand for interconnect capacity provisioning and commissioning	Counted from the date of confirmation or acceptance of demand for POI connectivity	≤ 90 days

Parameter	Definition	Formula	Target
Time-frame for POI Capacity Enhancement	the time frame given for the expansion of links for interconnection where a POI between networks already exists	Counted from the date of confirmation or acceptance of demand for capacity enhancement	≤ 60 days
Dual Seizure Ratio	The condition that occurs when, in both-way operation, two exchanges attempt to seize the same circuit at approximately the same time.	Dual seizures as percentage of handling capacity number of seizures	≤ 40%
Signaling Link Utilization	Signaling link utilization is the average traffic over a particular link expressed as a percentage of a total link capacity.	Used signaling links as percentage of total number of signaling links provided between POIs to avoid any signaling congestion.	≤ 40%
Unit of call duration measurement and recordings in CDRs (call detail records)	All POIs should have the same time stamp so that the CDR comparison/call tracing and disputes, if any, can be quickly resolved.	The unit of time measurement should either be in seconds or milliseconds in CDRs in order to avoid any inter-operator billing disputes.	seconds or milliseconds

6. QUALITY OF SERVICE PARAMETERS FOR INFRASTRUCTURE

A Telecommunications Operator is required per its License to offer infrastructure service shall meet the following quality of service standards.

Table 6: Quality of Service Parameter for Infrastructure

Parameter	Formula	Target	
		Urban	Rural
Coverage Signal Strength	Mobile Service Coverage Signal Strength = Field Strength measurements (RSSI for 2G, RSCP for 3G and RSRP for 4G)	≥ -90dBm for 2G (Out door, for 95% of Coverage Area)	≥ -100dBm for 2G (Out Door, for 90% of Coverage Area),
		≥ -95dBm for 3G (Out Door, for 95% of Coverage Area)	≥-105dBm for 3G (Out Door, for 90% of Coverage Area)
		≥ -100dBm for 4G (Out Door, for 95% of Coverage Area)	≥ -110dBm for 4G (Out Door, for 90% of Coverage Area)

Parameter	Formula	Target	
		Urban	Rural
Time to Restore Service (TTR)	Time service restored - Time reported	*85%* in 24 H and 99% in 72H for radio BTS (2G, 3G, 4G) 95% in 12H for BSC/RNC (2G, 3G) 95% in 6H for commutation (2G, 3G, 4G) 95% in 24H for local transmission (2G, 3G, 4G)	

7. NON-TECHNICAL QUALITY OF SERVICE PARAMETER FOR ALL SERVICES

Every Service Providers shall meet the following non-technical Quality of Service standards set for all services in respect of each specified parameter measured by test traffic in any locality and shall submit a report in the reporting period based on daily conditions.

Table 7: Non-Technical Quality of Service Parameter for all Services

Parameter	Measurement Method		Target	
	Description	Formula	Urban	Rural
Service Availability	Service Availability means the percentage of the time a system stays operational over a period of time.	(Total Operational hours over a reporting period – Total downtime over a reporting period) / Total operational hour over a reporting period X 100%	>95%	>90%
Supply time for initial connection	The duration from the instant of a valid service order being received by a direct Telecommunications Operator to the instant a working service is made available for use.	Time Service Operational-Time Payment of Service	≤5 working days	
Fault Repair Time	The duration from the instant a fault has been notified by the customer to the published point of contact of a Telecommunications Operator to the instant when the service element or service has been restored to normal working order.	The time taken to restore a service to working order after receiving valid fault reports.	Fixed Services : ≥ 90% in five (5) working days Mobile Services: ≥ 90% in two (2) working days	Fixed Services: ≥ 80% in five (5) working days Mobile Services: ≥ 85% in three (3) working days
Fault Report Submission Rate	The number of valid fault reports received by an operator per customer per reporting period.	Number of valid fault reports per access line per Reporting Period	<0.002% of customers in the Reporting Period	

Parameter	Measurement Method		Target	
	Description	Formula	Urban	Rural
Call Centre Operator Response	Duration of waiting after the option to a Customer Care Assistant has been chosen.	$t_{\text{Operator Assistant Pick up}} - t_{\text{Making Operator Request}}$	≥80% in < 30 seconds	≥80% in < 30 seconds
Interactive Voice Response (IVR)	Duration of announcement of the entire IVR options before a customer can make choice	$t_{\text{IVR Option to Operator to speak to an agent}} - t_{\text{IVR started}}$	≤ 60 Seconds (to an agent) ≤ 30 seconds (to first selection)	≤ 60 Seconds (to an agent) ≤ 30 seconds (to first selection)
Complaint Resolution Time	Complaint Resolution Time is the time taken for a Telecommunications Operator to resolve a complaint.	Number of valid complaint resolved / Total number of complaints received) X100	99% of complaints resolved within 1 week	99% of complaints resolved within 1 week
Customer Service Point Delay	The duration for queuing at a Customer Service Point before queries or complaints can be rendered.	$t_{\text{customer service assistance}} - t_{\text{of issued queue number}}$	>95%	
Billing Accuracy-	Billing Accuracy means Same duration in seconds used for a call should be used for charging.	Time Service Used - Time Service Charged) X100%	Not more than 0.1%	Not more than 0.1%
Billing Complaint Rate	The proportion of bills resulting in a customer complaining about the correctness of a given bill.	Total number of billing complaint received at the end of the reporting period/ Total number of active customer base at the end of the period)X100%	≤1%	≤1%

8. QUALITY OF SERVICE FOR CUSTOMER SATISFACTION ATTRIBUTES

A Telecommunications Operator in respect of the following Quality of Service benchmarks shall be subject to periodic assessment by the Authority through customer satisfaction surveys, which may be conducted by the Authority either through its own employees or through any Agency appointed by the Authority.

Table 8: Quality of Service for Customer Satisfaction Attributes

Parameter	Target
% of customers satisfied with the service availability	>85%
% of customers satisfied with the service accessibility	>85%
% of customers satisfied with the service retainability	>85%
% of customers satisfied with billing performance.	>85%
% of customers satisfied with the customer support services.	>85%

ANNEX II

LIST OF ABBREVIATIONS

Table 9: List of Abbreviations

2G	2ND Generation
3G	3RD Generation
4G	4TH Generation
CDR	Call Detail Record
CSCF	Call Session Control Function
CSFB	Circuit Switch Fall Back
CSR	Call Setup Rate
CSSR	Call Setup Success Rate
DNS	Domain Name Server
DSL	Digital Subscriber Line
ERAB	E-UTRAN Radio Access Network
E-UTRAN	Evolved UMTS Terrestrial Radio Access Network
HTTP	HyperText Transfer Protocol
IMS	IP Multimedia Subsystem
LTE	Long term evolution
MOS	Mean Opinion Score
MTTR	Mean Time To Repair
PDP	Packet Data Protocol
POI	Point of Interconnection
PS	Packet Switch
QoS	Quality of Service
RAB	Radio Access Bearer
RRC	Radio Resource Control
RSCP	Received Signal Code Power
RSRP	Reference Signal Received Power
RSSI	Received Signal Strength Indicator
SDCCH	Stand-alone Dedicated Control Channel
SHO	Soft Hand Over
SLA	Service Level Agreement
SMS	Short Messaging System

TCH	Traffic Channel
UE	User Equipment
UMTS	Universal Mobile Telecommunications Service
VoLTE	Voice Over Long Term Evolution

ANNEX III

QUALITY OF SERVICE REPORTING FORM

Table 10: Quality of Service Reporting Form

No	QoS Parameters	Target Value	Measurement Results (M=Month, Av=Average, Q=Quarter				
			M1	M2	M3	Avg. Q	Remark
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

ANNEX IV

NETWORK MAINTENANCE AND OUTAGE REPORT FORM

Table 11: Network Maintenance and Outage Report Form

NETWORK MAINTENANCE AND OUTAGE REPORT CONTACT INFORMATION
Name of Reporting Entity:
Primary Contact Person:
Email:
Phone Number:
MAINTENANCE/OUTAGE INFORMATION
Type of outage: ➢ Emergency Services outage ➢ Critical ➢ Major ➢ Planned Maintenance
Timing of the Outage
Date of Outage:
Time Outage Began:
Time Outage Resolved:
Outage Duration:
If not resolved, expected time service(s) to be resolved:
Timing of Planned Maintenance
Date of Maintenance:
Time Maintenance to Begin:
Time Maintenance to End:
Maintenance Duration:
Description of Maintenance/Outage
Service(s) affected:
Area(s) affected:
Network Element(s) affected:
Percent of traffic affected:

Percent of consumers affected:
Ability for consumers to access emergency service(s) during the activity: ☐ Yes ☐ No
Does the outage involve a security issue?: ☐ Yes ☐ No
If resolved, proposed corrective measures to be implemented (for critical and major outages):
Certification
I certify that I am authorized by the Reporting Entity, that I have examined this Report and that I affirm that the information contained herein is true, complete, and accurate to the best of my knowledge.
Signature:
Name:
Date: