



**INFORMATION COMMUNICATION TECHNOLOGIES
QUALITY OF SERVICE AND QUALITY OF EXPERIENCE
GUIDELINES**

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CHAPTER 1: GENERAL PROVISIONS

Article 1: Preamble

- 1.1. The Botswana Communications Regulatory Authority (BOCRA or the Authority) was established through the Communications Regulatory Authority Act, 2012 (CRA Act) to regulate the communications sector in Botswana, comprising telecommunications, Internet and Information and Communications Technologies (ICTs), radio communications, broadcasting, and postal services.
- 1.2. The mandate of the Authority is, among others, to facilitate the provision and availability of efficient, effective, and affordable communication services throughout Botswana; promote the interests of consumers in having a choice of quality and variety of services at good value for money, and to promote effective competition through fair regulation that is conducive to business investment in telecommunications.
- 1.3. In line with the foregoing provisions of the CRA Act, BOCRA has these guidelines to facilitate Monitoring of Quality of Service offered.

Article 2: Objective of these Guidelines

2.0 The objectives of these Guidelines are to:

- a) implement a transparent quality of service framework whereby the quality of service of electronic communications shall be objectively measured, reported, and published based on definitions and measurement methodologies;

- b) create conditions for improvement in the quality of experience for customers by making known the quality of services which the service provider is required to provide, and the user should expect;
- c) objectively assess the quality of service provided by the service providers from time to time, by measuring and comparing them with established benchmarks;
- d) protect and promote the interest of consumers of communications services;
- e) promote competition amongst the service providers;
- f) make information readily and publicly available to help with informed customer choice of services and comparative performance of licensees; and
- g) improve the operation and performance of interconnected networks.

Article 3: Definition of Terms

In these Guidelines, unless the context otherwise requires-

“Act” means the Communications Regulatory Authority Act 2012.

“Authority” means the Botswana Communications Regulatory Authority established under the Communications Regulatory Authority Act, 2012 (CRA Act).

“Access Network Utilization” means the total data traffic moving between the access node and the aggregation node.

“Bandwidth” means the maximum rate of data transfer across a network or internet connection, typically measured in bits per second (bps).

“Benchmark” means a baseline that helps measure performance quality or progress.

“Billing” means the process of recording and processing the usage of telecommunications services by customers and generating invoices.

“Billing Complaint Rate” means the percentage of customer billing related complaints per the reporting period.

“Billing Accuracy” means the percentage of billing records that are correct and free from errors.

“Call Connection Success Rate” means the number of successfully connected calls to the number of calls attempts.

“Call Connection Failure” means the percentage of unsuccessful calls.

“Call Setup Time” means the duration from when a user initiates a call (or a service request) until the call is successfully established and the user is connected.

“Call Setup Success Rate” means the ratio of total number of successful calls to the total number of all call attempts made on the network during a specified period.

“Call Centre Operator Response” means the measurement of the time taken by a call centre operator to respond to a customer's call. This measurement is typically referred to as the "waiting time" or "response time." It includes the duration from when the customer initiates the call to when the operator answers it. The goal is to minimize this waiting time to ensure efficient and satisfactory customer service.

“Call Drop Rate” means the probability that a call will terminate unexpectedly without the user's action.

“Cell” means a geographical area in a mobile communication system that is served by a Base Transceiver Station.

“Cell Availability” means the percentage of time a cell is able to accept, and process calls or data requests relative to the total time period under consideration.

“Complaint Resolution Time” means the time taken for a service provider to resolve a complaint.

“Critical Events” means an occurrence that significantly impacts the operations, performance, or reliability of a telecommunications system, requiring immediate attention and corrective action to mitigate its effects on service availability and quality.

“Critical Outage” means a significant failure in a telecommunications system that results in extensive loss of service or a severe degrading of service quality.

“Critical Service Outage” means any event that disrupts the normal operation of a service, including planned and unplanned outages, degradation, and interruptions. This definition encompasses various scenarios where the service is either completely unavailable or its performance is significantly reduced, affecting the end-users' experience.

“Circuit Switching” also means circuit switched, which is a method of communication where a dedicated communication path or circuit is established and maintained for the entire of the transmission between two or more end points or nodes.

“Customer or Consumer” means a person or legal entity subscribing to services provided by a service provider.

“Downtime” means the period during which a system, service or component is unavailable or not operational.

“Electronic Communications Services” means transmission and reception of information by wire, radio waves, optical media, or other electromagnetic systems, between or among points of the user’s choice.

“eNodeB” means a Radio Base Station used in 4th Generation (4G) Long Term Evolution (LTE) networks.

“Fault” means a state where a network does not meet the service specifications and repair action is required.

“Force Majeure” means an event beyond the control of the Licensed Service Provider and not involving the Licensed Service Provider’s fault or negligence and which is unforeseeable. Such events may include, but are not restricted to, acts of wars or revolutions, fires, floods, epidemics, quarantine restrictions, and freight embargoes.

“Handover Success Rate” means the ratio of successful 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 station to

another as the subscriber passes the boundary of a cell. [*Recommendation ITU-T Q.1005*].

“Interconnection” means the physical and logical linking of telecommunications networks used by the same or a different service provider in order to allow the users of one service provider to communicate with the users of the same or another service.

“Jitter” means the delay variation among the different packets sent from the source host to the destination (measured over a given period of time);

“Latency” means the time delay experienced in a network during the transmission of data from the source to the destination.

“Licensee” means Licensed Service provider

“Licensed Service Provider” means an entity licensed by the Authority to provide electronic communications services.

“Major Events” means any occurrence that significantly affect the operations of a telecommunication system or service.

“Major Service Outage” means a significant interruption or degradation of service that impacts many users or critical business functions.

“Mean Opinion Score (MOS)” means the average score given by users or testing methods to evaluate the rate of quality of voice, data and video services on a predefined scale, typically from 1 (bad) to 5 (excellent).

“Mean Time To Repair (MTTR)” means the duration between a reported fault to service restoration.

“Mobile Telephone Service” means a telecommunication service that provides voice, data and multimedia communication capabilities to users via mobile devices over a wireless network.

“Network Effectiveness Ratio” means 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 Integrated Services Digital Network (ISDN) a terminal rejection/unavailability.

“Network Performance” means the ability of a network to provide the functions related to communication services with a certain level of quality

including various performance indicators such as latency, throughput, packet loss and jitter, which are used to measure and ensure the efficiency and reliability of network operations.

“NodeB” means a Radio Base Station used in 3rd Generation (3G) Universal Mobile Telecommunications System (UMTS) networks.

“Non-Bank-Led Mobile Money Service” means a mobile money service originating from a cellular device and terminating on a cellular device.

“Operator” means Licensed Service Provider

“Packet Loss” means the percentage of data packets transmitted from the source but fail to arrive at their destinations.

“Packet Switching” means also packet switched, which is a method of data transmission where data is broken down into packets before being sent over a network.

“Planned Outage” means a scheduled interruption of service for maintenance, upgrades, or other necessary work on the network infrastructure.

“Peak Hour” means the busiest hour of the day for a specific cell, during which the highest volume of traffic is observed.

“Provision of Service” means the time taken to provide telecommunications services to end users or where it is required.

“Quality of Service” means a collective effect of service performance that determines the degree of satisfaction of a user when using a telecommunication service.

“Quality of Experience” means consumer perception or experience of the quality of the service offered.

“Rural Area” means a geographical area located outside towns and cities, characterized by low population density and limited access to certain services and infrastructure including telecommunications and these include other parts of country other than urban and sub-urban areas.

“Service Availability” means the percentage of time that the network is operational and accessible to the users.

“Sanction” means a fine, levy or compensation imposed on the Licensed Service Provider for defaulting in its QoS obligations.

“SMS Delivery Success Rate” means percentage of sent messages that are delivered to the intended recipients.

“Service Level Agreement (SLA)” means a formal contract between a service provider and a customer that outlines the expected level of service, performance metrics, and responsibilities of both parties. An SLA typically includes details such as: Service Description, Performance Metrics, Responsibilities, Penalties and Remedies, and Monitoring and Reporting.

“Service” means a provision of a function or set of functions offered to users by a network or a system.

“Service Provider” means an entity engaged in the provision of electronic communications services.

“Subscriber” means an individual or entity that has an agreement with a service provider for the provision of telecommunications services.

“Sub-Urban Areas” mean areas that typically have a mix of residential and commercial developments and are characterized by lower population density compared to urban areas, and these include villages with more than 10,000 inhabitants.

“Throughput” means a measure of the rate at which data is successfully transmitted from one point to another within a specific period.

“Unplanned Outage” means unaccepted interruptions in the operations of communication services or systems which can result in the loss of service availability and functionality.

“Unsolicited Messages or Services” means communications or messages that are sent without prior consent or request from the recipients, often for commercial purposes.

“Urban Area” means a geographical area characterized by high population density, significant infrastructure development and a concentration of economic and social and activities, and these includes cities, towns and administration areas.

“Voice Access Service Delay” means the time duration between an initial bid by the user for a voice service and the instant the user has access to the voice service.

“Website” means Botswana Communications Regulatory Authority website (<https://www.bocra.org.bw>)

Article 4: Abbreviations

The following abbreviations shall apply

“BSC” means Base Station Controller.

“BTS” means Base Transceiver Station.

“FTP” means File Transfer Protocol.

“ITU” means the International Telecommunication Union.

“KPI” means Key Performance Indicator.

“MSC” means Mobile Switching Centre.

“NMS” means Network Management System of the service provider.

“NOC” means Network Operation Centre.

“RAN” means Radio Access Network.

“RNC” means Radio Network Controller.

“SLA” means Service Level Agreement.

Article 5: Scope of Application

5.1 These Guidelines shall apply to providers of licensed communications service providers in Botswana, including-

- a) mobile telephony network operators;
- b) broadband internet service providers including satellite services;
- c) infrastructure service providers; and

- d) non-bank-led digital financial service providers.

CHAPTER 2: DUTIES AND OBLIGATIONS OF LICENSED SERVICE PROVIDERS

Article 6: Duties and Obligations of Service Providers

6.1 A licensed communications service provider shall-

- a) establish and maintain information or data to assist customers with queries relating to the services offered, installation and access requirements, processes, and customer support facilities;
- b) provide customers with equal access to services within the licensed area at the same quality of service and at the same tariff;
- c) notify all its customers of the terms and conditions of the SLAs of its licensed services and thereafter provide services based on the agreement;
- d) submit to the Authority copies of its SLAs containing the minimum quality of service standards which customers are entitled to, and the remedies and compensation available when the quality of service is below such standards;
- e) notify the customer of any modification to an existing SLA; and
- f) submit to the Authority relevant information on quality of service as and when requested.

Article 7: Obligations of Licensees

7.1 Subject to the provisions of the act, each licensee shall-

- a) deliver services at a performance level that meets or exceeds levels of performance as set out in these Guidelines; and

- b) provide information on such performance levels to the Authority to ensure that customers are allowed to make informed decisions on the choices of services.

Article 8: Performance Measurement and Compliance

- 8.1 The Licensed Service Provider shall establish performance measurement systems consistent with these Guidelines.

Article 9: Provision of Services to Paying Customers

- 9.1 The Licensed Service Provider shall provide services to a person who applies and can pay the appropriate charges for the licensed services.

Article 10: Provision of Uninterrupted Services to Customers

- 10.1 While providing services under Article 9 above, except where provided for in the terms and conditions of service, the licensed service provider shall not-

- a) intentionally interrupt or hinder the operation of its services in the normal course of business; or
- b) interrupt the provision of telephony services.

Unless it notifies the Authority in writing of the interruption in advance, and then informs its affected customers.

- 10.2 The Licensed Service Provider shall notify its customers of any planned and unplanned service interruptions either through Short Message Service (SMS), email, phone calls, mobile app, updates on their official website, social media announcements, or postal mail.

CHAPTER 3: MEASUREMENT, REPORTING AND RECORD-KEEPING

Article 11: Use of Measurement

Parameters

11.1 The quality-of-service standards shall be in accordance with-

- c) measurements required for the features of services that are significant to the operations of service providers.
- d) measurement methods and reporting format to enable the Authority to compare the parameters of the quality-of-service reports of the licensee fairly; and
- e) applicable targets or key performance indicators (KPIs) and other characteristics of the identified quality of service standards, appropriate to Botswana.

11.2 A parameter shall be used to report measurement of services that are outlined in the schedules of these Guidelines.

Article 12: Reporting Periods

12.1 Unless stated in these Guidelines, the reporting period, which is the period within which measurements are taken and recorded, shall be one (1) month starting from the first day of every applicable calendar month to the last day of the month or as the Authority may determine and communicate to licensees from time to time.

12.2 The Authority shall use any of the following methods to carry out measurements, data collection and acquisition-

- a) The Authority's NMS or the Authority's NOC;

- b) Drive tests;
- c) Consumer perception survey;
- d) Mobile station probe tests;
- e) Fixed probes installed at premises of service providers;
- f) Data collection from operators NOC; and
- g) Any other method as may be determined by the Authority.

12.3 The Authority shall rely on near real-time data acquired from feeds provided by the operators' NOCs or NMS.

12.4 For mobile networks, the KPI measurements shall be carried out at any of the network nodes, including: BTS, Cell, BSC, MSC, eNodeB, nodeB, and RNC levels, and interconnection points.

Article 13: Measurements Record-Keeping

13.1 For each reportable parameter, reporting area, and reporting period, a licensee shall perform the following measurements and record-keeping.

- a) take the measurements according to the defined measurement methods;
- b) Maintain and submit the measurements to the Authority within seven (7) working days after the end of the reporting period and ensure availability of near real-time performance data from the performance measurement or management systems of the licensee as may be specified by the Authority;
- c) submit information to the Authority on any additional sites, and or network elements to facilitate the processing and analysis of performance management files and other raw data;
- d) submit any additional information requested by the Authority including details of the times, places, network nodes, and other particulars of the measurements, within one (1) month after the end of the reporting period or as may be directed by the Authority; and

e) retain quality of service data and its measurement figures or targets for a minimum period of one (1) month for raw data and a minimum period of twelve (12) months for processed data after the end of the reporting period or as may be directed by the Authority.

13.2 The Authority shall publish periodic reports of quality-of-service measurements for all licensed service providers across all districts on the Authority's print and digital media platform.

CHAPTER 4: QUALITY OF SERVICE

Article 14: Quality of Service Network Compliance

14.1 The network licensee shall install, repair, and maintain electronic communications facilities to deliver quality of service at performance levels that meet the required parameters.

14.2 The Licensed Service Provider shall operate an electronic communications network and deliver services as stipulated in these Guidelines.

14.3 The Licensed Service Provider shall submit a monthly report to the Authority, detailing measurements of all applicable KPIs.

Article 15: Review of Quality-of-Service Parameters

15.1 The Authority may review the quality-of-service parameters as set out in the Schedules from time to time and shall notify Licensed service provider of the proposed review within thirty (30) days prior to the review.

Article 16: Quality of Service to Override

16.1 The KPIs in these Guidelines shall supersede the parameters that may be provided as terms and conditions in the licenses and SLAs of service providers.

Article 17: Parameters for Mobile Telephone Services

17.1 A mobile telephone service provider shall meet the quality-of-service benchmarks for cellular mobile service as set out in the **First Schedule**, for each specified parameter measured by test methods.

17.2 A service provider shall submit a monthly report to the Authority based 24 hours network performance per district, as outlined in the Schedules.

Article 18: Parameters for Broadband Services Including Satellite Services

18.1 A licensed internet service provider shall meet the quality-of-service benchmarks for broadband services delivered via wireless or wired connections, as set out in the **Second Schedule**, for each specified parameter measured by test in any locality.

18.2 A licensed internet service provider shall submit a monthly report to the Authority, detailing the network performance for its services.

Article 19: Parameters for Interconnection Services

19.1 A Licensed Service Provider shall meet the quality-of-service benchmarks for interconnected services as stipulated in the **Third Schedule** for each specified parameter measured for services traversing any interconnected route.

19.2 A service provider shall submit a monthly report to the Authority, detailing the daily peak hour conditions of its services.

Article 20: Parameters for Infrastructure Service Providers

- 20.1 A licensed infrastructure service provider shall meet the quality-of-service benchmarks for services provided at interconnection facilities through network nodes, and points of presence as set out in the **Fourth Schedule**, for each specified parameter measured in any locality.
- 20.2 The Authority may install equipment at interconnection points of licensed infrastructure service providers to inspect various traffic patterns.
- 20.3 A licensed infrastructure service provider shall submit a monthly report to the Authority detailing its infrastructure performance.

Article 21: Parameters for Non-Bank-Led Digital Financial Service Providers

- 21.1 A licensed non-bank-led mobile money operator shall meet the quality-of-service benchmarks for delivering financial services to customers, as set out in the **Fifth Schedule**, for each specified parameter measured.
- 21.2 A licensed digital financial service provider shall submit a monthly report to the Authority detailing its service accessibility, money transfer success rate, money success transfer time, money transfer failed transaction time, etc.

Article 22: Parameters for Billing Services and Customer Satisfaction

- 22.1 A licensed service provider shall meet the quality-of-service benchmarks for billing different services provided by its network to customers, as set out in the **Sixth Schedule**, for each specified parameter measured.

22.2 A licensed service provider shall submit a monthly report to the Authority detailing compliance with billing metrics and customer complaints.

Article 23: Performance Management Data Submission

23.1 A licensed service provider shall provide performance management data in formats consistent with International Telecommunications Union file transfer standards, including but not limited to ASN.1, CSV, TXT, or XML (3GPP TS 32.410).

23.2 A Licensed service provider shall provide BOCRA with access to quality-of-service performance data daily, with performance data for the preceding 24 hours or on near real-time basis as directed by the Authority.

23.3 When required by BOCRA, a Licensee shall prepare an Application Programming Interface (API) on their end to allow for seamless sharing of quality of service information.

Article 24: Notifications of Service Outage

24.1 In the event of a major or critical service outage at the district level or across a wider coverage area, the Licensed Service Provider shall notify the Authority in writing at least twenty-four (24) hours before a planned service outage, including its duration, or within one (1) hour after an unplanned service outage. Failure to notify the Authority within the time frames specified may attract sanctions that will be determined by the Authority in accordance with the Penalty Framework.

Article 25: Procedures for Rectifying Quality of Service Failures

25.1 In cases of quality-of-service failures, the Authority shall send a formal notice to the licensed service provider, requiring a

resolution plan within a maximum period of twenty-four (24) hours, apart from quality issues linked to third parties or force majeure.

- 25.2 If the period provided in the resolution plan is not met, the Licensed Service Provider shall inform the Authority within forty-eight (48) hours about the failure to achieve the target date, providing valid justifications.
- 25.3 The Authority may assess such failures and determine whether the terms and conditions of the proposed fault resolution plan constitute a breach.
- 25.4 If the quality-of-service failures persist beyond the period approved in the resolution plan or repetitive cases as per the terms and conditions of the resolution plan, an applicable sanction prescribed by the Authority shall apply.

Article 26: Mobile Drive Test and Fixed Internet Test Measurements

- 26.1 The Authority may periodically conduct drive tests for mobile networks and fixed internet tests using an appropriate drive test tool to measure the quality of service and quality of experience for various technologies delivered by licensed communications service providers.
- 26.2 The report of the drive and fixed tests conducted may be shared with operators initially and subsequently to address anomalies in the KPIs of quality-of-service failures.
- 26.3 The Authority may employ a consultant to conduct annual drive tests using an appropriate drive test tool to independently confirm the drive test results periodically conducted by the Authority. Licensed Service Provider shall be notified of the findings of the consultant and any infractions of the related KPI targets.
- 26.4 Where the infractions of the drive test conducted by the Authority are identified by the consultant following an annual drive test

campaign, such failures shall attract fines as set out in the Schedules.

CHAPTER 5: INVESTIGATIONS

Article 27: Auditing of Quality-of-Service Data

- 27.1 The Authority may audit the QoS data acquired from the licensee under Article (12.2) of these Guidelines or the data retained by the licensees.
- 27.2 In carrying out its obligations under Article (27.1) of these Guidelines, the Authority may vary the frequency of audits, data collection, licensees' services, parameters, reporting areas, network nodes, and reporting periods that require audits.
- 27.3 The Authority may also utilize data acquired under Article (12.2) and (13.1) (b) of these Guidelines to audit licensees.

Article 28: Investigation of Measurement and Record Keeping Procedures

- 28.1 The Authority may investigate the quality-of-service measurement, reporting, and record keeping procedures of a licensee pursuant to the provisions of Article (13.1) (d) of these guidelines.
- 28.2 The Authority may carry out its duties under Article (28.1) of these Guidelines and exercise its powers as spelt out in the CRA the Act.
- 28.3 The Authority may from time-to-time conduct consumer surveys to determine consumer's Quality of Experience (QoE) and satisfaction.

- 28.4 The analysis and conclusions of such consumer surveys may be sent to the service provider for remedial actions.
- 28.5 Where the Authority is not satisfied with any remedial actions taken by the service provider within a specific timeframe, the Authority may request a meeting to discuss the report or give directives for resolution of performance failures within a specific period.
- 28.6 Where a service provider fails to remedy such concerns, the Authority may invoke the appropriate regulatory sanctions as set in the Penalty Framework.

CHAPTER 6: CONTRAVENTIONS AND ENFORCEMENTS

Article 29: Contraventions Measures

- 29.1 A licensee providing service is deemed to have contravened the provisions of these Guidelines relating to predefined parameters of service reporting area, prescribed network nodes and reporting period where the licensee:
- a) fails to perform the measurement, reporting and record keeping tasks set out in Article 13 of these Guidelines;
 - b) fails to achieve the set targets for parameters and services as set out in the Schedules, after the-
 - i) commencement date of these Guidelines; or
 - ii) date when the target was most recently specified.
 - c) fails to submit information requested within a timeframe specified by the Authority, pursuant to Article 12 of these Guidelines.;
 - d) submits or publishes false or misleading information about its quality of service; or
 - e) obstructs or prevents an investigation or near real-time collection of performance data by the Authority in respect of quality-of-service measurement, reporting and record-keeping procedures.

Article 30: Enforcement Measures

30.1 Where a licensee contravenes any of the parameters set out in these Guidelines, the Authority may take one or more of the following enforcement measures-

a) require the licensee to submit additional information about the quality of the relevant service, including implementation of a remedial plan within a timeframe approved by the Authority. The submitted information may be cross-checked against the performance data collected by the Authority under Article (12.2) and (13.1) (b) of these Guidelines.

b) invoke provisions of the CRA.

30.2 If the operator fails to achieve the set targets of key performance indicators, the Authority shall inform the operator in writing to improve the target figures.

30.3 Where the operator fails to meet the key performance indicator target for three (3) consecutive reporting months, a sanction for defaulting on the set target shall be triggered when the operator fails to remedy the quality-of-service target.

CHAPTER 7: MISCELLANEOUS PROVISIONS

Article 31. Customer Complaints Resolution

31.1 The licensee shall resolve any customer complaints within the resolution timeframe stated in the BOCRA complaints handling procedure or as directed by the Authority from time to time.

31.2 A licensee may be sanctioned by the Authority if the rate of occurrence exceeds the maximum number of three consecutive reporting months pursuant to these Guidelines, except linked to third-party fault or force majeure.

Article 32. Unsolicited Services or Messages

32.1 A licensed service provider shall not provide any subscriber with an unsolicited service or message except for promotions, advertisements, emergencies, pandemics, epidemics, and other natural disasters.

32.2 The service provider shall provide an option for the subscriber to opt out of receiving unsolicited services or messages by providing clear instructions on how to opt out at no cost to the subscriber.

32.3 A licensed service provider shall make reasonable efforts to identify and block or filter bulk, unsolicited messages from unlicensed sources.

Article 33. Review

33.1 The Authority may from time to time, review or modify these Guidelines.

33.2 In carrying out a review or modification of these Guidelines, the Authority shall request and receive advice or comments from external advisory groups, which advice shall not be binding on the Authority.

Article 34: Site Classifications

Category 1- Urban Areas	Category 2- Sub-urban Areas	Category 3- Rural Areas
Main Cities Towns Service Admin Areas	Population > 10,000 inhabitants (Excluding location in Category 1)	Population <10,000 inhabitants Sites along the highways

CHAPTER 8: SCHEDULES

First Schedule

Quality of Service Key Performance Indicators (KPI's) for Mobile Telephony Services

Every licensed Service Provider, offering mobile telephony services is required to meet the following Quality of Service benchmarks for Mobile Telephony Services in respect of each specified parameter measured by real traffic on any cellular network.

Technical Performance Measurements

No.	Key Performance Indicators (KPIs)	Definition	Measurement Formula	Measurement Tool	Targets
2G Network KPIs					
1	Traffic Channel (TCH) Congestion (measured at Cell levels)	The failure to allocate a Traffic Channel (TCH) when a user initiates a call or a data session due to the unavailability of free TCH resources in the Cell	$100 * (\text{Failed TCH Allocations} / \text{Total TCH Allocation Attempts})$	Performance Monitoring Systems Drive Test System, Test Stations	≤2.0% (95% of cells should record measurement values of real traffic)
2	Standalone Dedicated Control channel (SDCCH) Congestion (measured at Cell levels)	The percentage of SDCCH requests that fail due to the unavailability of an SDCCH at the Cell level	$100 * (\text{Failed SDCCH Allocations} / \text{Total SDCCH Allocation Attempts})$	Performance Monitoring Systems Drive Test System, Test Stations	≤2.0% (95% of cells should record measurement values of real traffic)

3	Call Setup Success Rate (measured at Cell levels)	Measures the percentage of call attempts that are successfully connected to a target party within a given time frame	100*(Successful call setups/Total Call Setup Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≥98% (95% of cells should record measurement values of real traffic)
4	Drop Call Rate (measured at Cell level)	The percentage of calls that are terminated unexpectedly during a call session due to various reasons related to network performance.	100* (Number of dropped calls/Total call Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	<2% (95% of cells should record measurement values for real traffic)
5	Handover Success Rate	The percentage of successful handovers compared to the total handover attempts	100* (successful handover events/Total handover Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≥98% (95% of cells should record measurement values of real traffic)
6	Mean Opinion Score (MOS)	Measurement used to assess the perceived quality of voice and multimedia communications by end users	Mean Opinion Score (MOS) Refer to ITU-T P.863.2 (PESQ)	Drive Test [Perceptual Objective Listening Quality Analysis (POLQA)], Test Stations	≥3.0 for 2G ≥3.5 for 3G and VoLTE (95% of samples should record measurement values for real traffic)
7	Call Setup time	The duration from when a user initiates a call (or a service request) until the call is successfully established and the user is connected	Time of Call Answer - Time of Call Initiation	Performance Monitoring Systems Drive Test System, Test Stations	Mobile Networks: <6.5 seconds for voice calls
8	Cell Availability	The percentage of time a Cell can accept, and process calls or data requests relative to the	100* (Total Time – Down Time)/Total Time	Performance Monitoring Systems Drive Test System, Test Stations	>99% (95% of cells should record measurement values of real traffic)

		total time period under consideration.			
11	Coverage Signal Strength (Rx Level/Rx Quality)	Refers to the quality and strength of the signal received by a mobile device from a cell tower.	Field Strength Measurements	Drive Test System, Network Analysers	Outdoor RxLev>-70dBm (Good coverage for Voice) Indoor RxLev -85 dBm (Acceptable for indoor voice)
12	Voice Access Service Delay	Time duration between an initial bid by the user for a voice service and the instant the user has access to the voice service	Delay = Call Connected Time – Call Request Time	Test Station, Drive Test System	≤ 12 seconds (per ITU-T E.807 & G.1028.2)
3G Network KPIs					
1	Call Setup Success Rate [Packet Switched (PS)]	Measures the percentage of successfully established call setups compared to the total number of attempts made	100*(Successful call setups/Total Call Setup Attempts)	Drive Test Tools, Performance Monitoring Tools, Test Stations	≥98% (95% of cells should record measurement values for real traffic)
2	Call Setup Success Rate [Circuit Switched (CS)]	Measures the percentage of call attempts successfully completed compared to the total number of call attempts made in a circuit-switched network	100*(Successful call setups/Total Call Setup Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≥98% (95% of cells should record measurement values for real traffic)
3	Radio Resource Call (RRC) connection establishment success rate (PS)	Measures the percentage of successfully established RRC connections compared to the total	100*(Successful RRC Connections/Total RRC Connection Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≥98% (95% of RRC cells should record measurement values for real traffic)

		attempts to establish RRC connections			
4	Radio Resource Call (RRC) connection establishment success rate (CS)	Measures the percentage of successful RRC connections established to a mobile network compared to the total number of RRC connection attempts	100*(Successful RRC Connections/Total RRC Connection Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≥98% (95% of RRC cells should record measurement values for real traffic)
5	Radio Access Bearer (RAB) Establishment Success Rate	Measures the percentage of successful attempts to establish a radio access bearer (RAB) compared to the total number of attempts made to establish an RAB	100*(Successful RAB establishments/Total RAB establishment attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≥98% (95% of RAB cells should record measurement values for real traffic)
6	High-Speed Up Link Packet Access (HSUPA) Setup Success Ratio	Measures the success rate of establishing connections for different types of services (Streaming, Interactive, and Background) using Highspeed Uplink Packet Access (HSUPA) technology	100*(Successful HSUPA setup Attempts/Total HSUPA Setup Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≥95%
7	High-Speed Downlink Packet Access (HSDPA) Setup Success Ratio	Measures the effectiveness of establishing successful HSDPA connections for different types of services (Streaming (S), Interactive (I), and	100*(Successful HSDPA setup Attempts/Total HSDPA Setup Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≥95%

		Background (B)) using High-Speed Downlink Packet Access (HSDPA) technology			
8	Iub Congestion	Refers to the congestion occurring on the Iub interface between the Radio Network Controller (RNC) and the Node B (Base Station) in 3G mobile networks	100*(failed Iub Allocations/Total Iub Allocation Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	<2% (95% of Iub interface should record measurement values for real traffic)
9	RRC Congestion	Refers to the situation where a mobile network's RRC layer (part of the Radio Access Network, RAN) cannot allocate sufficient resources to initiate or maintain a signalling connection due to high traffic or insufficient resources	100*(Number of RRC connection failures /Total RRC connection attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≤2% (95% of RRC cells should record measurement values for real traffic)
10	Circuit Switched RAB Congestion	Refers to the failure to establish a Circuit Switched Radio Access Bearer (CS RAB) in a 3G or 4G mobile network, due to the unavailability of network resources, typically when the	100*(Failed CS RAB Connection Setup Attempts/Total CS RAB Connection Setup Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	<2% (95% of CS RAB cell should record measurement values for real traffic)

11	CS RAB Abnormal Release Rate	Refers to the percentage of circuit-switched (CS) connections that are abnormally terminated before the user or network intentionally ends the session	100*(Number of Abnormally Released CS RABs/Total Established CS RABs)	Performance Monitoring Systems Drive Test System, Test Stations	≤2% (95% of Cells should record measurement values for real traffic)
12	PS RAB Abnormal Release Rate	Measures the percentage of abnormal terminations of packet-switched sessions, such as data sessions	100* (Number of Abnormal RAB Releases/Total number of established PS RABs)	Performance Monitoring Systems Drive Test System, Test Stations	≤2% (95% of cells should record measurement values for real traffic)
13	Soft Handover Success Rate	Defined as the percentage of successful handovers during a soft handover process, where a mobile device is simultaneously connected to multiple Base Stations, allowing seamless transition from one Cell to another without dropping the call	100*(Number Successful Soft Handovers Releases/Total number of Soft Handover Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≥98% (95% of cells should record measurement values for real traffic)
14	Inter Radio Access Technology (RAT) Handover Success Rate for CS Domain	Refers to the percentage of successful handovers between different Radio Access Technologies (RATs) in the Circuit Switched (CS) domain	100*(Successful Inter RAT Handover/Total Inter RAT Handover Attempts)	Performance Monitoring Systems Drive Test System, Test Stations	≥98% (95% of cells should record measurement values stated above for real traffic)
15	Cell Availability	The percentage of time that a specific cell (or group of Cells) is operational and capable of providing service to users	100*(Total Time cell is available/Total Measurement period)	Performance Monitoring Systems Drive Test System, Test Stations	>99% (95% of cells should record measurement values for real traffic)

16	Average Downlink Throughput per User	Measures the average data rate experienced by users in the downlink direction (from the network to the user device)	(Total Downlink Data Volume/Total Number of Active Users)	Drive Test System, FTP service	≥5.00 mbps
17	CS Call setup time (CST) for on-net calls	Refers to the time taken to establish a Circuit Switched (CS) voice call from the moment a user initiates the call until the call is successfully connected	Call Setup Time (CST) =T-T0 Where: T is the time when the called party answers the call (the call is connected) T0 is the time when the calling party initiates the call	Performance Monitoring Systems Drive Test System, Test Stations	≤6.5 seconds
18	CS Call setup time (CST) for off-net calls	Refers to the duration from when the caller initiates a call until the call is successfully established and the receiver answers.	CST=Time when Call is Answered-Time when Call is Initiated	Performance Monitoring Systems Drive Test System, Test Stations	≤6.5 seconds
19	Mean Opinion Score (MOS)	Measurement used to assess the perceived quality of voice and multimedia communications by endusers	Mean Opinion Score (MOS) Refer to ITU-T P.863.2 (PESQ)	Drive Test [Perceptual Objective Listening Quality Analysis (POLQA)] Network Monitoring Tools	≥3.0 for 3G (95% of Samples should record measurement values for real traffic)
20	SMS Delivery Success Rate	Percentage of sent messages that are delivered to the intended recipients	100*(Number of SMS received by the intended recipient/Number of SMS sent)	Performance Monitoring Systems Drive Test System, Test Stations	>97% (Excluding absent subscribers)

21	SMS/MMS Delivery time	Duration between the SMS/MMS sent time and SMS/MMS receiving by the intended recipient	Time SMS/MMS Received – Time SMS/MMS Sent	Performance Monitoring Systems Drive Test System, Test Stations	<5 seconds in (95% of the time)
22	Latency	Refers to the time delay experienced in the transmission of data between the source and destination, specifically during the process of sending and receiving data packets.	Time to send packet + Time to receive acknowledgment	Performance Monitoring Systems Drive Test System, Active Probes	<85ms National < 300ms international
23	Data Access Success Rate	Refers to the rate at which data can be accessed or transmitted over the network.	100 * (Number of data service connections made/ Total number of data service connections requested)	Performance Monitoring Systems Drive Test System, Test Stations	≥98% (95% of cells should record measurement values for real traffic)
24	Data Service Access Time	Refers to the time it takes for a device to establish a connection and start transmitting data over the network	Data Access Time=Connecti on Setup Time+Initial Data Transfer Time	Performance Monitoring Systems Drive Test System, Test Stations	<5 seconds (In 95% of the time)
25	CS call drop rate	Refers to call that are disconnected unintentionally while the caller is still engaged in conversation	100* (Number of call drops/total number of call attempts)	Performance Management Tools, Drive Test Tools	<2% (95% of cells should record measurement values for real traffic)
26	PS call drop rate	Refers to the percentage of packet switch sessions that are terminated unexpectedly	100*(Number of drop sessions/Total number of sessions attempts)	Performance Monitoring Systems Drive Test System, Test Stations	<2% (95% of cells should record measurement values for real traffic)

26	Coverage Signal Strength	Refers to the quality and strength of the signal received by a mobile device from a cell tower.	Field Strength Measurements	Drive Test Tools, Network Analysers	Outdoor ≥ -85 dBm (Good coverage for voice and basic data) Indoor ≥ -95 dBm (Acceptable for indoor voice/data)
27	Voice Access Service Delay	Time duration between an initial bid by the user for a voice service and the instant the user has access to the voice service	Delay = Call Connected Time – Call Request Time	Test Station, Drive Test System	≤ 12 seconds (per ITU-T G.1028.2)
4G Network KPIs					
1	Cell Availability	The proportion of time that a cell is operational and capable of handling calls and data sessions	100*(Total Time Cell is Available/Total Time)	Performance Monitoring Systems Drive Test System, Test Stations	$\geq 99\%$ (95% of cells should record measurement values for real traffic)
2	Circuit Switch Fall Back (CSFB) Call Set-up Time (CST)	A technique used in 4G LTE networks to handle voice calls by temporarily falling back to the circuit-switched domain, such as 2G or 3G, when a voice call is initiated	CST=Time from Call Initiation to Call Established	Performance Monitoring Systems Drive Test System,	≤ 6.5 seconds
3	CSFB Preparation Success Rate	Refers to the percentage of successful preparations for circuit-switched (CS) calls that are initiated when a user is in a 4G LTE network, but the call needs to fall back to a	100*(Successful CSFB Preparations/Total CSFB Preparation)	Performance Monitoring Systems Drive Test System,	$\geq 98\%$ (95% of cells should record measurement values for real traffic)

		2G/3G network for connection			
4	Extended Radio Access Bearer (ERAB) Set up Success Rate	Measures the success of establishing a Radio Access Bearer in 4G LTE networks	100*(Number of successful ERAB setup/Total Number of ERAB setup Attempts)	Performance Monitoring Systems Drive Test System, Test Stations Network Probes	≥98% (95% of cells should record measurement values for real traffic)
5	Radio Resource Call (RRC) Set up Success Rate	Refers to the percentage of successful Radio Resource Control connections established between a user's device (UE) and the network's base station (eNodeB) out of the total RRC connection attempts	100*(Successful RRC Setup Attempts/Total RRC Setup Attempts)	Performance Monitoring Systems Drive Test System, Test Stations Network Probes	≥98% (95% of cells should record measurement values for real traffic)
6	ERAB Drop Rate	The ratio of the number of ERABs that are dropped to the total number of ERABs established over a specific period.	100*(Dropped ERABs/Total Established ERABs)	Performance Monitoring Systems Drive Test System, Test Stations Network Probes	≤2% (95% of cells should record measurement values for real traffic)
7	Evolved- UMTS Terrestrial Radio Access Network (E-UTRAN) Downlink Throughput (Mbps) per user	Refers to the data transmission rate achieved by a user device when receiving data from the network, measured in megabits per second (Mbps)	100*(Total Data Successfully Received/Total Time)	Performance Monitoring Systems Drive Test System, Test Stations FTP service	≥30 Mbps (For category 1) ≥25 Mbps (For category 2) ≥20 Mbps (For category 3)

8	E – UTRAN Uplink Throughput (Mbps) per user	Refers to the data transmission rate that a user can achieve while sending data from their device (user equipment) to the network	100*(Total Uplink Data Volume/Total Uplink Time)	Performance Monitoring Systems Drive Test System, Test Stations FTP service	≥10 Mbps (For all categories)
9	Latency	Refers to the time delay experienced in the transmission of data between the source and destination, specifically during the process of sending and receiving data packets	Time to send packet + Time to receive acknowledgment	Performance Monitoring Systems Drive Test System, Active Probes	<50ms National < 200ms international
10	Mean Opinion Score (MOS)	Measurement used to assess the perceived quality of voice and multimedia communications by endusers	Mean Opinion Score (MOS) Refer to ITU-T P.863.2 (PESQ)	Drive Test [Perceptual Objective Listening Quality Analysis (POLQA)] Network Monitoring Tools	≥3.5 for 4G (95% of Samples should record measurement values for real traffic)
11	Single Radio Voice Call continuity (SRVCC)	A feature in 4G (LTE) networks that ensures seamless voice call continuity when a user transitions from a 4G LTE network to a 2G/3G network	100*(Successful SRVCCs/Total S RVCC Attempts)	Performance Monitoring Systems Drive Test System, Active Probes	≥98% (95% of cells should record measurement values for real traffic)
12	Data Success Access Rate	Refers to the rate at which data can be accessed or transmitted over the network.	100 * (Number of data service connections made/ Total number of data service connections requested)	Performance Monitoring Systems Drive Test System, Test Stations	≥98% (95% of cells should record measurement values for real traffic)

13	Data Success Access Time	Refers to the time it takes for a device to establish a connection and start transmitting data over the network	Data Access Time=Connecti on Setup Time+Initial Data Transfer Time	Performance monitoring tool, Drive test Tools	<5 seconds (95% of the time)
14	Coverage Signal Strength	Refers to the quality and strength of the signal received by a mobile device from a cell tower.	Field Strength Measurements	Drive Test Tools, Network Analysers	Outdoor ≥ -90 dBm (RSRP) (Reliable for voice (VoLTE) and data) Indoor ≥ -100 dBm (RSRP) (Minimum for indoor usability)
5G Network KPIs					
1	Latency	The time it takes for a data packet to travel from the source to the destination and back again	Time to send packet + Time to receive acknowledgment	Drive Test Tools, Network Emulators	<20ms National < 80ms international URLLC: 1ms eMBB:4ms mMTC: <20 ms
2	Download throughput	The rate at which data is successfully transmitted from the network to the user's device over a specified period	100*(Total Data Received (in bits)/Total time (in seconds))	Performance Monitoring Systems Drive Test System, Test Stations	≥100Mbps (For category 1) ≥80Mbps (For category 2) ≥50Mbps (For category 3)
3	Upload Throughput	The rate at which data is successfully transmitted from a user equipment (UE) to the network in a 5G system	100*Total Uplink Data Transmitted (in bits)/Total duration (in seconds) *10 ⁶)	Performance Monitoring Systems Drive Test System, Test Stations	≥40 Mbps (For category 1) ≥25Mbps (For category 2) ≥10Mbps (For category 3)
4	Cell Availability	The proportion of time that a cell is operational and capable of handling calls and data sessions	100*(Total Time Cell is Available/Total Time)	Performance Monitoring Systems Drive Test System, Test Stations	≥99% (95% of cells should record measurement values for real traffic)

Second Schedule

Quality of Service Parameters for Broadband Services

Every licensed Internet Service Provider shall meet the following Quality of Service benchmarks for broadband services delivered via wireless network services and satellites, for each specified parameter measured by tests in any locality.

Technical Performance Measurements

No.	KPIs	Definition	Measurement Formula	Measurement Tool	Targets
1	Metro Latency	The total round-trip time for a data packet to be transmitted and return to the source	Average round trip time	Performance Monitoring Systems Drive Test System, Test Stations Ping test	≤10ms
2	National Terrestrial Latency	The total round-trip time for a data packet to be transmitted and return to the source	Average round trip time	Performance Monitoring Systems Drive Test System, Test Stations Ping test	≤80ms
3	International Latency	The total round-trip time for a data packet to be transmitted and return to the source	Average round trip time	Performance Monitoring Systems Drive Test System, Test Stations Ping test	≤100ms
4	Service Availability	The percentage of time that the network is operational and accessible to the users	$100 * \{(Agreed\ service\ time - downtime) / (Agreed\ Service\ time)\}$	Performance Monitoring Systems Drive Test System, Test Stations	≥99%

5	Packet Loss	The ratio between the number of packets lost in the network and the total number of transmitted packets	100* (Number of lost data packets/Total number of sent data packets)	Performance Monitoring Systems Drive Test System Test Stations Ping Test	≤1%
6	Jitter	The variation in the time delay in the transmission of packets over a network	Jitter Refer to ITU-T G.810/ITU-R BT.1363	Performance Monitoring Systems Drive Test System Test Stations Ping test	±10% of latency
5	Traffic Utilization	The measurement of how efficiently the available network resources such as bandwidth or capacity are being used to transmit data	100*(Actual Traffic/Total capacity)	Performance Monitoring Systems Drive Test System, Test Stations	≤95%
6	Download Throughput	The average volume of data (in bits) downloaded per second in a network	Total amount of data (in bits)/Time taken to download data (Secs)	Performance Monitoring Systems Drive Test System, Test Stations	≥75% of subscribed level of bandwidth for 90% of the time
7	Upload Throughput	The average volume of data (in bits) Uploaded per second in a network	Total amount of data (in bits)/Time taken to Upload data (Secs)	Performance Monitoring Systems Drive Test System, Test Stations	≥75% of subscribed level of bandwidth for 90% of the time
8	Downtime for radio Access and Core equipment	The unavailability of radio Access and Core equipment (Controller, Switches, Routers, etc..) within 24 hrs	Time reported time restoration – System time of site outage	Performance Monitoring Systems Drive Test System, Test Stations	<1hr (Core Controllers) within 24hrs <2hrs (Other equipment) for Urban areas within 24hrs <4hrs (Other equipment) for sub-urban areas within 24hrs <6hrs (Other equipment)

					for Rural areas within 24hrs
9	Mean Time to repair (MTTR)	The duration from reported fault to service restoration	Time reported time restoration – System time of site outage	Network uptime performance monitoring system	<1hr (Core Controllers) within 24hrs <2hrs (Other equipment) for Urban areas within 24hrs <4hrs (Other equipment) for sub-urban areas within 24hrs <6hrs (Other equipment) for rural areas within 24hrs
Satellite Services					
4	Service Availability	The percentage of time that the network is operational and accessible to the users	$100 * \{(\text{Agreed service time} - \text{downtime}) / (\text{Agreed Service time})\}$	Test Stations	≥99%
5	Packet Loss	The ratio between the number of packets lost in the network and the total number of transmitted packets	$100 * (\text{Number of lost data packets} / \text{Total number of sent data packets})$	Test Stations Ping Test	≤1%
6	Latency	The total round-trip time for a data packet to be transmitted and return to the source via a satellite service	Average round trip time	Test Stations Ping test	≤100ms (LEO satellites) ≤300ms (MEO & GEO satellites)

7	Jitter	The variation in the time delay in the transmission of packets over a network	Jitter Refer to ITU-T G.810/ITU-R BT.1363	Test Stations Ping test	±10% of latency
8	Traffic Utilization	The measurement of how efficiently the available network resources such as bandwidth or capacity are being used to transmit data	100*(Actual Traffic/Total capacity)	Test Stations	≤95%
9	Download Throughput	The average volume of data (in bits) downloaded per second in a network	Total amount of data (in bits)/Time taken to download data (Secs)	Test Stations	≥80% of subscribed level of bandwidth for 95% of the time
10	Upload Throughput	The average volume of data (in bits) Uploaded per second in a network	Total amount of data (in bits)/Time taken to Upload data (Secs)	Test Stations	≥80% of subscribed level of bandwidth for 95% of the time
11	Congestion	Refers to the situation where the demand for satellite resources exceeds the available capacity.	100*(Available Capacity /Offered Traffic)	Test Stations	≤2%

Third Schedule

Quality of Service Parameters for Interconnection Services

Every licensed Service Provider is required to meet the following Quality of Service benchmarks for Interconnection Services for each specified parameter measured by real traffic on any interconnection route.

Technical Performance Measurements

No.	KPIs	Definition	Measurement Formula	Measurement Tool	Targets
1	Downtime for Interconnection route	Refers to the period during which the interconnection route is not operational or fails to meet the required performance standards	$100 * (\text{MTTR} / \text{MTBF} + \text{MTTR})$	Performance Monitoring Systems Test Stations	$\leq 2\text{hr}$
2	Interconnection Route Utilization	The percentage of provisioned interconnection route that is actively carrying traffic	$100 * (\text{capacity in use} / \text{Total capacity})$	Performance Monitoring Systems Test Stations	$\leq 80\%$

3	Interconnection Route Availability	The percentage of time that an interconnection route is operational and capable of carrying traffic	100* (Total Operational/Total Time)	Performance Monitoring Systems Test Stations	≥99.99%
4	Network Effectiveness Ratio (NER)	The ability of a network to deliver a call to the called terminal (Ref ITU-T E.425)	100* (Answers Call+ Ring no answer + user busy + terminal rejected/seizures)	Performance Monitoring Systems Test Stations	≥95%
5	Time to Repair Interconnection Route	The duration from when the fault is reported until the service is fully restored	Time at which service is restored – Time at which fault is reported	Performance Monitoring Systems Test Stations	≤2hrs for Urban ≤4hrs for Sub-urban areas
6	Answer Seizure Ratio (ASR) (bidirectional)	Measures the percentage of successful answered incoming calls out of the total number of incoming call attempts	100* (Number of answered incoming calls/Total number of incoming call Attempts)	Performance Monitoring Systems Test Stations	≥35% for MNOs ≥40% for fixed line networks

Fourth Schedule

Quality of Service Parameters for Infrastructure Communication Services

Every licensed Infrastructure Communication Service Providers shall meet the following Quality of Service benchmarks for infrastructure communication services delivered via a fibre network, for each specified parameter measured by tests in any locality.

Technical Performance Measurements

No.	Parameter Name	Definition	Measurement Formula	Measurement Tool	Target
1	Infrastructure Service Availability	A measure of the percentage of time that a telecommunication service is operational and accessible to users over a specific period	$100 * \frac{\text{Total Time-Downtime}}{\text{Total time}}$	Performance Monitoring Systems Complaints	>99.99%
2	Downtime for Infrastructure service	A period during which a telecommunication service is unavailable or not functioning properly due to system failures, maintenance, or external factors	Total Time -Uptime	Performance Monitoring Systems Complaints	Urban <2 hrs/day Sub-urban areas <3 hrs/day Rural <4 hrs/day
3	Latency	The time it takes for a data packet to travel from the source to the destination and back again	Average round trip time	Test Stations Ping Test	≤50ms national ≤100ms international

4	Mean Time to Restore	The duration from reported fault to service restoration	Time reported time restoration – System time of site outage.	Performance Monitoring Systems	<2 hrs/day for Urban areas <3 hrs/day for Suburban areas <4 hrs/day for Rural areas-
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Fifth Schedule

Quality of Service (QoS) Requirements for Digital for Non-Bank-Led Financial Service Providers

A service provider offering digital financial services (such as mobile money) must adhere to the following Quality of Service benchmarks for each specified parameter, through the measurement of test traffic.

Technical Performance Measurements

No	Parameter	Definition	Formula	Measurement Tool	Target
1	Service Accessibility Rate (P2P & merchant)	The percentage of successful attempts to access the service compared to the total number of attempts.	$(\text{Number of service request response received} / \text{Total service request attempts}) * 100$	Performance Reports Test Stations	≥99%

2	Money Transfer Success Rate	The percentage of successful money transfer transactions compared to the total number of attempted transactions	(Number of Money Transfers received by intended recipients/ Number of Money Transfers sent) *100%	Performance Reports Test Stations	Equal to 100%
3	Money Transfer Success Time	The duration it takes for a money transfer transaction to be successfully completed from the initiation of the transfer to the confirmation of receipt by the recipient.	Time Mobile Money Notice received- Time Mobile Money Sent	Performance Reports Test Stations	≤10 seconds
4	Money Transfer Failed Transaction Resolution Time	The duration it takes to resolve a failed money transfer transaction from the moment the failure is detected to the moment the issue is resolved and the user is notified.	Time Mobile Money Credited - Time Mobile Money Failed transaction reported	Trouble Ticket System	≤24 hours

Sixth Schedule

Quality of Service (QoS) Requirements for Billing Services and Customer Satisfaction

A Licensed service provider shall adhere to the following benchmarks for billing services and customer satisfaction for each specified parameter.

Technical Performance Measurements

No	Parameter	Definition	Formula	Measurement Tool	Target
1	Billing Accuracy- Voice Calls	The precision with which a service provider charges users for their voice call usage	Per pulse Charging	Billing Assurance Systems, Drive Test System	100% accurate
2	Billing Accuracy- Messaging	The precision with which a service provider charges users for their messaging services	Message length of 160 characters	Billing Assurance Systems, Drive Test System	100% accurate
3	Billing Accuracy- Data usage (Internet Service)	The precision with which a service provider charges users for their data usage	Volume (per kb/Mb/Gb) charging	Billing Assurance Systems, Drive Test System	100% accurate
4	Billing Accuracy- Internet service	The precision with which a service provider charges users for their internet usage	Speed(per kbps/Mbps/Gbps) charging	Billing Assurance Systems, Drive Test System	100% accurate
5	Interactive Voice Response (IVR)	Duration of announcement of the first IVR option before a customer can make a choice	Time IVR option to operator to speak to an agent -Time IVR Started	Test Stations	<15 seconds
6	Call Centre Operator Response	Duration of waiting after the option to a Customer Care Assistant has been chosen	Time Operator Assistant Pick upTime making operator Request	Test Stations	<180 seconds
7	Customer satisfaction on overall Quality of Service	A measure of how well the telecommunication services meet the expectations and needs of the users	$100 * (\text{Number of answers as good Quality}) / (\text{Number of customers Interviewed})$	Trouble ticket system or Survey	>95%