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PART II

Statutory Notifications (S.R.O.)

PAKISTAN TELECOMMUNICATION AUTHORITY

NOTIFICATION

Islamabad, the 20th June, 2022

S.R.O 1694 (I)/2022.— In exercise of the powers conferred under clause (o) of sub-section (2) of section 5 of the Pakistan Telecommunication (Re-organization) Act, 1996 the Pakistan Telecommunication Authority is pleased to make the following regulations:

PART -1
PRELIMINARY

1. **Short Title and Commencement.—**(1) These Regulations shall be called the "Fixed Broadband Quality of Service (QoS) Regulations, 2022".

(2) These Regulations shall come into force from the date of gazette notification.

2. **Scope and Applicability.—**(1) These Regulations shall apply to all Broadband Service Providers (BSPs) in order to define the Key Performance Indicators (KPIs) for Broadband services. These KPIs shall act as quantifiable benchmarks for determining Quality of Service (QoS) for Fixed Broadband Service.

(3957)

Price: Rs. 20.00

[8432 (2022)/Ex.Gaz.]

3.   **Definitions.**—(1). In these Regulations, unless there is anything repugnant in the subject or context otherwise requires:

(a)   **"Act"** means Pakistan Telecommunication (Re-organization) Act, 1996;

(b)   **"Authority"** means Pakistan Telecommunication Authority established under Section 3 of the Act;

(c)   **"AAA"** means the Authentication, Authorization, and Accounting server which provides authentication, authorization, and accounting services for access to computer resources.

(d)   **"Access Nodes"** means the service processing and provisioning nodes such as DSLAMs, MSAG/MSAN, OLTs and ONUs installed in the access network which connects subscribers to a particular or immediate service provider and, through the carrier network, to other networks such as the Internet.

(e)   **"Bandwidth"** means, in terms of computer networks, the data transfer rate i.e. the amount of data that can be carried from one point to another in a given time period. Bandwidth is expressed in bits (of data) per second (bps);

(f)   **"Broadband Service Provider"(BSP)** for the purposes of these regulations means Fixed Local Loop (FLL), Wireless Local Loop (WLL) and Class Data Value Added Service licensee;

(g)   **"Core Nodes"** means the nodes installed in the core network (or backbone) in order to connect different parts of access network. These nodes includes but not limited to BRAS, Metro switches, high-end routers, internet exchanges, DNS, DHCP and Billing Servers. Core network also provides the gateway to other networks.

(h)   **"Fixed Broadband" (FBB)** means 'always on' services with a Download Data Throughput equal to or greater than **4Mbps** and Upload Data Throughput equal to or greater than **2Mbps** or as defined by the Authority from time to time, through

broadband technologies (e.g. xDSL, Copper Line, Cable Modem-DOCSIS 3.x, Optical Carrier / Fiber to the end user, Satellite, Terrestrial Fixed Wireless, Broadband over Power lines (BPL), GPON, DTH, etc.) excluding the legacy fixed wireless technologies.;

(i) **"Network Termination Point (NTP)"** means any point of termination on a telecommunication system at which the terminal equipment may be connected;

(j) **"Net Neutrality"** means the rules and guidelines issued by the Authority to licensees and Digital/ Internet Service Providers (ISPs)/Broadband Service Providers for treating all Internet communications equally, and not discriminating or charging the use of internet differently based on user content, website, platform, application, type of equipment, source address, destination address or method of communication.

(k) **"Rules"** means all rules issued by the Federal Government under Section 57 of the Act;

(l) **"Regulations"** means all the regulations issued by the Authority from time to time.

(m) **"Voice over Internet Protocol (VoIP)"** means a method and group of technologies for the delivery of voice communications and multimedia sessions over Internet Protocol (IP) networks, such as internet.

(n) **"National Measurement of Broadband (NMB) Program"** means a national drive carried out for testing, checking and study of broadband services;

(o) **"Volunteer"** means to the extent of these regulations, a participant/subscriber of a Broadband Service Provider being tested, who volunteers to participate in the National Measurement of Broadband Program.

(2) Words and expressions used but not defined in these regulations shall have the same meaning assigned to them in the Act, Rules, and Regulations.

PART - II
TESTING METHODOLOGY

4.   Quality Of Service Testing Methodology.—The following factors shall be considered while testing the KPIs for Fixed Broadband Services, where applicable:

(a)   All BSPs are responsible to ensure end-to-end quality of service to the customers. The BSPs shall accordingly ensure to meet or exceed the KPIs detailed in the license and these Regulations at all times.

(b)   All network related parameters be applicable at the NTP. For wireless application, the last mile air interface shall be considered as the NTP;

(c)   Use of realistic, real time traffic instead of using test lines for measurements;

(d)   Testing shall be conducted either by the Authority through its own officers or employees or through an agency appointed by it;

(e)   Within one week of the Authority's request, BSPs shall provide connectivity to the concerned PTA office(s) for inspection purposes at their identified locations without prioritizing the lines in order to ensure realistic testing;

(f)   All tests to be carried out at a designated place defined by the Authority, without mobility, except for the wireless networks based on WLL or similar technologies;

(g)   Testing may be performed any time during the week keeping in view the different scenarios of peak/off peak hours;

(h)   All the BSPs shall provide complete service coverage maps with clear distribution of the type of services being provided, on their websites for the information of general public. Test areas shall be identified by the Authority after obtaining coverage information; and

(i)   The "core principles" of net neutrality must be followed by all licensed BSPs across the country. The BSP shall not be involved in blocking of applications, websites or any other content on the Internet by slowing or "throttling" Internet speeds. Network providers shall transport all services on equal basis regardless of their types. An important development in the telecommunication core and access network in NGN, a packet-based network in which service-related functions are independent of transport-related technologies. Traffic management mechanisms (to the extent of congestion management) shall be used by ISPs to optimize the flow of traffic within their networks. Special measures shall also be taken to overcome the Congestion which may be met in IP networks when traffic increases to a level at which routers run out of buffer space and are forced to start dropping some IP packets, which typically occurs, randomly. For the same purpose, advanced traffic management techniques shall be used by BSPs for detecting and overcoming the discriminatory or anti-competitive acts, avoiding the congestion and deliver the desired Quality of Service (QoS).

PART - III
BROADBAND QUALITY OF SERVICE STANDARDS
[TECHNICAL]

5.   **Technical Quality of Service Standards.**—(1) All BSPs shall adopt the performance parameters as prescribed below:

Provided further that the Authority may modify, delete or add key performance indicators and/or their rating tables on the basis of the extent of coverage, new deployments and the Quality of Service factors detailed in these Regulations.

(2)   All monitoring by the Authority shall be checked against the following Key Performance Indicators (KPIs)/parameters:

Parameters/KPIs to be checked at User End		Parameters/KPIs to be checked at Network End	
Quality of Service Parameters		*Network performance Parameters*	
Indicator	*Benchmark*	*Indicator*	*Benchmark*
Service Up Time Success Rate	≥ 98%	Network Availability (1) Access Nodes (2) Core Nodes	(1) ≥ 99% (2) ≥ 99.9%
Data Throughput (1) Download Data Throughput (2) Upload Data Throughput	(1) **≥ 80%** of advertised speed of broadband service plan/package (2) **≥ 50%** of advertised speed of broadband service plan/ package for all technologies other than xDSL for which upload throughput shall be **≥ 25%** of advertised speed/ package	**Data Throughput** (1) Download Data throughput[1] (2) Upload Data throughput	(1) DL ≥ xx Mbps[2] (2) UL ≥ xx Mbps
Network Latency/Round Trip Time *(RTT)* (1) Local Network Latency (2) International Segment-Terrestrial (3) International Segment-Satellite	(1) ≤ 40 msec (2) ≤ 110 msec (3) ≤550 msec	**Network Latency/ Round Trip Time** *(RTT)* (1) Local Network Latency (2) International Segment-Terrestrial (3) International Segment- Satellite	(1) ≤ 40 msec/ month. (2) ≤ 110 msec/month. (3) ≤550 msec/month
Packet Loss	≤ 1%	**Bandwidth Utilization**	< 80%
Jitter	≤ 15msec	**Jitter**	≤ 15msec
VoIP (1) Call Setup Time (2) Mean Opinion Score(MOS)	(1) < 7.5 sec (2) > 3	**VoIP** (1) Call Connection Time (2) Mean Opinion Score(MOS)	(1) < 7.5 sec (2) > 3
Web Page Loading Time	≤ 4 sec	**All Non-Technical KPIs**	Part-IV of the Regulations

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1 Officer of the Authority to decide the node/port or customer for provision of required parameters.
2 The actual average throughput for downlink and uplink of the users should be recorded and reported to the Authority.

(2) **Measurement of Parameters/KPIs**

(a) *Service Up Time Success Rate:*—It is the measure to ascertain the broadband service up time to the end users in case of planned or unplanned start of customer's end device/equipment.

Benchmark

Service up Time Success Rate should be $\geq$ 98%

Measurement

During the testing period, if N attempts are made to connect to the internet and if the attempt failed F times then:

Service Up Time Success Rate = (1-F/N) x 100%

An attempt is declared as a failure, if internet connection is not established within time as per following classification of services:—

i.   Terrestrial FLL Services (xDSL, FTTx, DOCSISx, etc.): **60** sec

ii.   Satellite FLL Services: **120** sec

Under this KPI following parameter shall be checked:

Connect time (for instances when the modem is started afresh or rebooted)

(b) *Network Availability:*—Network Availability is the measure of the degree to which the network (Access and Core) is operable and not in a state of failure or outage at any point of time. It measures the total downtime of the network, including the ATM/IP switches, multiplexers, routers, e-mail facilities (if provided) and connection to Internet backbone over a month. All scheduled downtime for the purposes of maintenance and upgrading of the network system will be excluded from the calculation. However, all access network operators must keep their users informed of such maintenance times. Please note that reported downtime should include any downtime caused by upstream service providers.

Benchmark

Network Availability for:

> *Access Nodes should be $\geq$ 99% and for;*
> *Core Nodes should be $\geq$ 99.9%*

Measurement

Network Availability = (Total operational minutes − Total minutes of service downtime) / (Total operational minutes) x 100%

Data Throughput

(c) **Download Data Throughput (Mbps):**-The download data throughput is the data transmission rate that is achieved for downloading specified test files between a remote web site and a user's computer in order to check the actual download speed available to the subscriber.

Benchmark

The download data throughput should be ≥ 80% of the advertised speed of broadband service plan/package to the consumers[3] and this must be experienced at all the times.

Measurement

Size of test file should be at least 10GB in size or as determined by the Authority. It should be downloaded from website (using either of HTTPx or FTP protocol) of the BSP and/or PTA's website and /or from http://speedtest.tele2.net and/ or from https://speed.hetzner.de/ or any other site decided by the Authority, as long as the choice is consistent for all.

Download Data Throughput = Size of the test file (in MB) / Transmission Time[4] (in seconds) required for error free transfer of the entire data.

(d) **Upload Data Throughput (Mbps):**- The upload data throughput is defined as the data transmission rate that is achieved for uploading the specified files between a user's computers to remote web site in order to check the actual upload speed available to the subscriber.

Benchmark

Technology	Upload Data Throughput
xDSL	≥ 25% of the advertised speed of broadband service plan/package for all times.
All other technologies	≥ 50% of the advertised speed of broadband service plan/package for all times.

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[3] The service delivery to CIR customers shall be governed by their mutual agreement

[4] The transmission time is the time period starting when the access network has received the necessary information to start the transmission and ending when the last bit of the test file has been received.

Measurement

A test file should be at least 500MB in size or as determined by the Authority. The file should be uploaded to an upload server/website (using either of HTTPx or FTP protocol) on the BSP and/or PTA's website and /or on http://speedtest.tele2.net and/ or on https://www.google.com/drive and / or https://testmy.net or any other site decided by the Authority, as long as the choice is consistent for all.

Upload Data Throughput = Size of the test file (in MB) / Transmission Time (in seconds) required for error free transfer of the entire data.

(e) *Network Latency/Round Trip Time (RTT), (msec):-* Latency or Round Trip Time (RTT) is the measure of duration of round trip for a data packet between specific source and destination. It is used to measure the delay on a network at a given time. The greater the latency within a network, the longer it takes packets to reach their destination.

Benchmark

Network Latency in Segment	Threshold
Local Network Latency	= 40 msec
International segment – Terrestrial	= 110 msec
International Segment - Satellite	= 550 msec

Measurement

The RTT test shall be conducted using "*ping*" based on a minimum standard packet size of *32 bytes*, and should be measured up to the edge node of the network, connected to the Internet cloud or any other server decided by the Authority.

(f)   Packet Loss Ratio:-This indicator measures the percentage of the data packets transmitted from the source and fails to arrive at their destinations. The most common causes of packet loss are high latency or encountered congestion along the network route. A small amount of packet loss is expected, and indeed packet loss is commonly used by some Internet protocols to infer Internet congestion and to adjust the sending rate to mitigate for the congestion.

Benchmark

Packet Loss Ratio should be $\leq 1\%$

Measurement

Packet Loss Ratio= *(Total Number of Packet Loss* x *100%)* / *Total Number of packets Sent.*

(g)   Bandwidth Utilization.—It is the ratio of peak utilization of bandwidth to the total bandwidth available.

Benchmark:

The bandwidth utilization should be $\leq$ **80%**

Measurement

BSPs are required to run "Daily" MRTG (Multi Router Traffic Grapher) Graphs at 5 minute average during peak hours. The highest bandwidth utilization is the peak utilization level for each month. BASPs are required to run "Monthly" MRTG Graphs to obtain average bandwidth utilization for each month for their network. BSPs should closely monitor their links and the loading level shall not exceed.

Bandwidth Utilization = (peak utilization level of the network / total bandwidth available) x 100%

(h)   Jitter: – A jitter is a variation in latency. High amounts of jitter cause packets to be delivered out of sequence. In a specific time window, jitter refers to the variation between the maximum delay and minimum delay.

Benchmark

The Jitter should be $\leq$ **15 msec**

Measurement

The Jitter shall be calculated using 'ping'. The minimum samples shall be 100. If RTT avg is the average RTT, derived out of 100 samples, and RTT 1, RTT 2....RTT 100 are the RTT for individual packets then jitter shall be calculated as follows:

Jitter (msec) = $\sum$ (RTTavg-RTTk)/100 (magnitude shall be used without '+/-' signs)

(i)   Voice over Internet Protocol (VoIP): -

i.   Call Setup Time

The time between sending of complete call initiation information by the caller (A-Party) and in return receipt of call setup notification.

Benchmark

Call Setup Time should be < **7.5** sec.

Measurement

The time duration should be measured between Timestamp of SIP "invite" to Timestamp of SIP "200K (Invite)" message.

ii.   VoIP Mean Opinion Score (MOS)

The degree of speech quality that a listener perceives at the terminal with a talker at the other end.

Benchmark

The speech Quality i.e. **Mean Opinion Score (MOS)** should be > **3.**

(j)   Web Page Loading Time:—Time required for loading a website is known as Webpage Loading Time.

Benchmark

The Webpage Loading time should be ≤ **4 seconds.**

Measurement

The KPI shall be measured by loading a standard reference page and recording the amount of time that this page takes to load.

PART –IV

BROADBAND QUALITY OF SERVICE STANDARDS [NON-TECHNICAL]

6.   **Non-Technical Quality of Service Standards.**—All BSPs shall adopt the non-technical performance standards as follows:

(1)   **Customer Service:**

   (a)   **Unplanned Outage.**—The BSPs unplanned outage process shall comply with the License conditions and Regulations. Reasons for outage shall be recorded by the BSP. The BSP shall keep logs with proper command line information, and report to the Authority;

   (b)   **Planned Outage.**—The BSPs shall ensure compliance to the License conditions and Regulations when planning an outage.

   (c)   **Automated Ticketing System for Recording Complaints.**— The availability of computerized customer complaint database shall be ensured by the BSP. The system should be capable of generating automated tickets to the complainants. If the automated system is not available in accordance with these regulations, the BSP must record the reasons under intimation to the Authority; and

   (d)   **Response to Assistance Requested.**—The BSPs shall provide assistance to consumers in accordance with the license conditions and Regulations.

(2)   **Service Provisioning/activation and Billing Complaints.**—The service provision/ activation time means the time taken from the date of receipt of valid application to the date when the service is activated whereas the billing complaints refers to the complaints lodged by customer regarding incorrect billing, wrong tariff/cost/charges etc. Service Provisioning and billing complaints shall be resolved by the BSPs in accordance with the License conditions and applicable Regulations.

PART-V

BROADBAND SERVICE TESTING AND REPORTING REQUIREMENTS

7.   **Quality of Service (QoS) Testing.**—(1) In addition to Authority's own conducted surveys and tests, all BSPs shall carry out quarterly testing of the Quality of Service of its Broadband service being provided in accordance with the parameters prescribed in these Regulations.

(2)   The Authority may depute its representatives to be present at the quality tests and surveys carried out by the BSPs.

(3)   Each BSPs shall maintain record of all data collected against each Quality of Service parameter/factor tested as prescribed by the Authority in these Regulations.

(4)   The Authority shall initiate and notify a **National Measurement of Broadband (NMB) Program** as determined by the Authority. For this purpose, the Authority may plan and execute a recurring program, through its officers/authorized representatives or an agency appointed by it or through an automated mechanism designed for it (dedicated App, etc.), henceforth called "**NMB Partners**". This survey shall gauge the performance of broadband service in the country with the aim to improve availability of broadband services to consumers and the program shall be built on principles of openness and transparency.

(5)   The Methodology for the **National Measurement of Broadband (NMB) Program** survey shall be as follows:

(a)   Through media outreach, PTA and NMB Partners/BSP shall select a group of consumers to volunteer. PTA, NMB Partners in consultation with BSPs, shall select the panel of the volunteers from the large pool of prospective participants according to a plan designed to generate a representative sample of desired consumer demographics, including geographical location, ISP, and speed tier. The goal is to cover the maximum number of BSPs and broadband technologies i.e. DSL, cable, fiber-to-the-home, fixed terrestrial wireless, satellite, etc:

Provided that the confidentiality of information of a volunteer shall be ensured during the testing by the respective BSP.

(b)   For measuring fixed broadband speed, a dedicated device pre-configured with custom testing software for measuring internet performance, shall be provided and placed inside the authorized/selected volunteering consumers' homes by BSPs, directly connected to the customer end router via Ethernet cable to directly access fixed internet service being delivered to the home. All the KPIs included in these Regulations shall be measured **Every Other Hour, 24x7** and after getting the results of thousands of Off-Net and On-Net tests, the results shall be calculated for different volunteer groups.

(c) The testing equipment having built in storage capacity not accessible to the user, and having the LAN interfaces of at least 1Gbps speed, Wi-Fi radios supporting 802.11a/b/g/n/ac standards, shall be capable to interact with On-Net and Off-Net testing servers, along with the capability to fetch the complete list of test servers upon first execution of the test batch and performs a simple round trip time measurement to each. The device shall select the test server with the lowest round trip time to test against from that point forward.

(d) Testing measurement servers (with adequate computing, storage and networking capabilities) having installed the test scheduler along with reporting databases, and other testing probes involved in the survey and firewalled, shall be provided by the BSPs at its own cost at premises designated by the Authority. The relevant BSP shall provide the Authority with access to such equipment in real time for the information generated by these systems.

(e) The Authority may depute its representatives to be present at the quality tests and surveys carried out by the BSPs.

(6) The QoS testing methodology shall be issued by the Authority and may be modified from time to time.

(7) Every BSP shall extend the access of their broadband network(s) to the Authority for the extraction of all the relevant KPIs/parameters.

(8) Each BSPs shall maintain record of all data collected against each Quality of Service parameter/factor tested in the manner as prescribed by the Authority in these Regulations.

8.   Reporting Requirements.—(1) The data collected during the National Broadband Measurement (NBM) program shall be submitted to the Authority within Fifteen **(15)** days of the completion of the drive, whereas the Network Performance (NP) Parameters shall be submitted on Quarterly basis or at such intervals as the Authority may direct from time to time, and in the form and format as prescribed by the Authority.

(2) The BSPs shall keep a record of the said quality tests and surveys, in such form and manner as the Authority may specify. This record shall at all times be open to inspection and audit by the designated representative of the Authority, with or without notice to the BSPs.

(3) The record of all data shall be retained and maintained in the safe custody of the BSPs for a period of three (03) years.

Monitored Services and Quality of Service Reporting Requirements

Parameters/KPIs to be checked at Network End		
Network Performance Parameters		
Indicator/KPI	**Benchmark**	**Reporting Period**
Network Availability (1) Access Network (2) Core Network	(1) $\geq$ 99% (2) $\geq$ 99.9%	Quarterly
Data Throughput (1) Download Data throughput[5] (2) Upload Data throughput	(1) DL $\geq$ xx Mbps[6] (2) UL $\geq$ xx Mbps	Quarterly
Bandwidth Utilization	$\leq$ 80%	Quarterly
Network Latency/Round Trip Time (RTT) (1) Local Network Latency (2) International Segment-Terrestrial (3) International Segment-Satellite	(1) $\leq$ 40 msec/month (2) $\leq$ 110 msec/ month. (3) $\leq$ 550 msec/month.	Quarterly
All Non-Technical KPIs:	As per license conditions and Regulations	Quarterly
(1) Call Connection, Time for VOIP (2) Mean Option Score (MOS)	(1) < 7.5 Sec (2) > 3	Quarterly Quarterly

9.   **Inspection of Quality of Service.**—(1) The Authority may conduct inspections, surveys, tests or make surprise checks through its designated representative or conduct performance audit of the quality of service offered by BSPs from time to time to ensure that services are provided in accordance with the standards prescribed in the license, these Regulations or as determined by the Authority from time to time.

(2)   In order to carry out the tests and surveys the BSPs shall provide connections (on non-discriminatory basis) to PTA within one week of request extend full co-operation and provide all required assistance to the designated representative.

(3)   The Authority may, if circumstances so require, engage a consultant to conduct the quality of service audit.

(4)   The designated representative shall prepare an inspection report of such Quality of Service inspections, which clearly spell out the shortfalls, if any, observed during the inspection. This report shall be provided to the BSPs. The BSPs shall immediately take all remedial measures to remove the shortfalls

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[5] Officer of the Authority to decide the node/port or customer for provision of required parameters
[6] The actual average throughput for downlink and uplink of the users should be recorded and reported on quarterly basis to the authority.

identified in the report and submit a compliance report within fifteen (15) days by confirming that all the specified shortfalls have been removed.

(5)   Every BSP shall extend the access of their broadband network(s) to the Authority for the extraction of all the detailed KPIs/parameters in the Regulations.

(6)   The testing methodology shall be issued by the Authority and may be modified from time to time.

10. Publication of Quality of Service Reports.— (1) The Authority may publish survey results, service test results, and ratings of the BSPs for information of the general public.

(2)   All survey results, service test results and ratings of the BSPs shall also be available for the information of the general public on the website of each BSP.

11. Provisioning of QoS Monitoring System.—(1) Each Licensee shall provide, at its own cost, state-of-the-art system(s) (equipment hardware, firmware, software) at premises designated by the Authority and ensure its upgrading, updating, security and safety in best possible, in order to measure and record traffic, billing, call detail records, IP data records, voice over IP to measure the Quality of Service (QoS) in a manner specified by the Authority.

(2)   The Licensee shall provide the Authority with access to such system, and the information generated by such system/equipment, and shall extend full co-operation and assistance to the Authority in connection with quality of service monitoring.

12. Repeal and Savings.—(1) The Broadband Quality of Service Regulations, 2014 are hereby repealed:

(2)   Provided that all orders, directives, notifications and/or actions under the Broadband Quality of Service Regulations, 2014 shall be deemed always to have been made, taken, issued lawfully and validly unless amended, withdrawn, rescinded, or annulled by a person or authority competent to do so under these regulations.

[No.79/Regs/PTA/2012/Pt-11/40.]

ERUM LATIF,
Director (Law & Regulations).