On approval of the Methodology of measuring technical parameters of the communication services quality

Unofficial translation

Order of the Minister of Information and Communications of the Republic of Kazakhstan dated August 29, 2017 No. 327. Registered in the Ministry of Justice of the Republic of Kazakhstan on November 9, 2017 No. 15980.

Unofficial translation

In accordance with subparagraph 6-8) of paragraph 1 of Article 8 of the Law of the Republic of Kazakhstan dated July 5, 2004 “On Communications” **I hereby ORDER:**

1. To approve the attached Methodology of measuring technical parameters of the communication services quality.

2. To declare invalid order No. 68 of the acting Minister of Investments and Development of the Republic of Kazakhstan dated January 26, 2016 “On approval of the Methodology of measuring technical parameters of the communication services quality” (registered in the Register of State Registration of Regulatory Legal Acts under No. 13259, published in the legal information system "Adilet" April 19, 2016).

3. In accordance with the procedure established by the Law, the Committee of State Control over communication, informatization and mass media of the Ministry of Information and Communications of the Republic of Kazakhstan (A. Kozhikhov) shall:

1) provide the state registration of this order with the Ministry of Justice of the Republic of Kazakhstan;

2) within ten calendar days from the date of the state registration of this order, direct a copy of it in paper and electronic forms in the Kazakh and Russian languages to the Republican State Enterprise with the Right of Economic Management “Republican Center of Legal Information” for official publication and inclusion in the Reference Control Bank of Regulatory Legal Acts of the Republic of Kazakhstan;

3) place this order on the official Internet resource of the Ministry of Information and Communications of the Republic of Kazakhstan.

4. Control over the execution of this order shall be assigned to the supervising Vice Minister of Information and Communications of the Republic of Kazakhstan.

5. This order shall be enforced upon expiry of ten calendar days after the date of its first official publication.

Minister of Information and Communications of the Republic of Kazakhstan *D. Abayev*

“AGREED”

Minister of National Economy
of the Republic of Kazakhstan
_____ T. Suleimenov
"___" _____ 2017
"AGREED"
Acting Minister
of National Economy
of the Republic of Kazakhstan
_____R. Dalenov
October 25, 2017

Approved by
Order of the Minister of
Information and Communications
of the Republic of Kazakhstan
No. 327 dated August 29, 2017

Methodology for Measuring Technical Parameters of the Quality of Communication Services

Footnote. The methodology - as reworded by Order of the Minister of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan No. 153/NK dated 28.04.2021 (shall be enacted ten calendar days after the date of its first official publication).

Chapter 1. General provisions

1. This Methodology of measuring technical parameters of the communication services quality (hereinafter referred to as the Methodology) has been developed in accordance with subparagraph 6-8) of paragraph 1 of Article 8 of the Law of the Republic of Kazakhstan "On Communications" (hereinafter referred to as the Law) and is intended for use in the procedure for measuring technical parameters the quality of communication services.

Footnote. Paragraph 1 - as amended by the order of the Minister of Digital Development, Innovation and Aerospace Industry of the Republic of Kazakhstan dated 31.01.2023 No. 35/ НҚ (shall be enforced ten calendar days after the day of its first official publication).

2. Basic terms and definitions used in this Methodology:

1) communication availability (availability to establish a connection) - the possibility of setting up the required connection between the calling and called subscribers;

2) communication availability indicator - the percentage of successful calls out of the total number of call attempts;

3) communication continuity (preservation of the established connection) - the absence of early disconnection of the established connection between two subscribers for reasons beyond their control;

4) continuity indicator - the share of calls that ended with disconnection of the installed connection at the subscriber's initiative;

5) test run is a method of measuring technical parameters of communication service quality applying a mobile measuring complex in motion along a particular route;

6) test call - a call initiated by a mobile measuring complex, wearable measuring complex or a cell phone with installed special software;

7) voice sample - a sound fragment of a certain duration in milliseconds, played at the time of the test call;

8) data processing system - a system consisting of a set of technical and software tools, providing data processing;

9) a site classifier of conducted measurements - division of the environment where measurements are made by administrative division, by type of conducted measurements, by type of organizational activity (unplanned, planned ones);

10) a portable measuring unit - a mobile vehicle-based hardware measuring unit used for measurement tasks;

11) coverage - a property of the cellular network affecting the subscriber's access to the cellular network and its services;

12) service quality indicator - a quantitative description of a service obtained by calculation from quality parameters, specifying the result of the telecommunications service provider's activity in providing telecommunications services and serving subscribers;

13) portable measuring system - a mobile or wearable set of hardware devices used to perform measurement tasks;

14) mobile phone and/or modem - a hardware device enabling the function of conducting and supporting communication sessions;

15) navigation device - a device that collects signals from satellite navigation systems to determine the device's current location on Earth;

16) early disconnection of an established connection - termination of a connection (conversation) not initiated by the caller;

17) a measurement set: a complex of hardware devices, comprising both hardware and software, applied to solve measurement tasks;

18) failed calls - calls lost due to blockages and technical faults in different parts of the network;

19) failed call rate is the ratio of the number of unsuccessful calls to the total number of test calls in the measurement period, expressed as a percentage or as an absolute value;

20) successful calls - calls ended with answering the called party's station, including no answer or the called party is busy, and/or calls ended with the operator's answer that the caller is out of the service area or his/her handset is switched off;

21) scanning receiving device - an instrument for recording signals and technical parameters of cellular radio networks;

22) speech transmission quality - a combination of transmission characteristics of a speech signal (loudness, intelligibility) received by the communication system;

23) the proportion of calls that do not meet speech quality standards is the ratio of the number of calls (established connections) that do not meet speech quality standards to the total number of test calls in the measurement period, expressed as a percentage;

24) speech intelligibility - the proportion or percentage of speech elements correctly understood by listeners out of the total number spoken;

25) timeout - a fixed time interval beyond which the virtual event is switched to the next virtual event;

26) a wearable measuring system - a small mobile set of hardware and software devices designed to perform measurements on the ground and indoors;

27) technical parameter - a quantitative characteristic of a service resulting from a measurement;

28) cellular communication service quality - a combination of indicators describing the consumer properties of a telecommunication service specifying its ability to meet the declared , established and ordered needs of a subscriber;

29) measuring the technical parameters of cellular service quality (hereinafter referred to as measurement) - establishing the value of the required parameter by experimental means using special technical means.

3. The following abbreviations shall apply herein:

2G – second generation cellular technology;

3G – third generation cellular technology;

4G – fourth generation cellular technology;

BCCN (Broadcast Common Control Channel) - broadcasting on a 2G network;

dBm – measured signal power in dB divided by 1mW;

EDGE (Enhanced Data Rates for 2G Evolution) is a high-speed data transmission system for 2G networks;

FTP – File Transmission Protocol;

GPRS (General Packet Radio Service) is a packet-based data transmission system;

GPS – Global Positioning System;

HLR – Home Location Register;

HTTP – Hyper Text Transfer Protocol;

MOS (Mean Opinion Score) - mean expert opinion of speech quality;

POLQA (Perceptual Objective Listening Quality Assessment) - the next generation speech intelligibility assessment algorithm;

RSSI - received signal strength indicator in 2G technology;

QoS – Quality of Service;

SIM - a module card used in cellular communications to identify the subscriber;

SMS – Short Message Service;

SQI – Speech Quality Index.

4. The object of measurement shall include the technical quality parameters of the cellular network, cellular voice service and Internet access via mobile communication networks in the communication networks of the Republic of Kazakhstan.

5. The technical specifications for cellular voice service and Internet access via mobile phone networks in communication networks shall be measured for the following types of connections:

to receive/transmit voice information when setting up a call;

to receive/transmit data when setting up control sessions.

The technical quality parameters of the cellular network shall be measured simultaneously with the evaluation of the quality of communication services by means of a scanning receiving device.

Chapter 2. Measurement performance conditions

6. Measurement shall be performed during the operation of the cellular network without overloading, failures, under the climatic conditions indicated in the operational documents for cellular equipment and measuring instruments applied, outside periods of abnormal network load caused by migration or atypical service usage profile (holidays, mass events, technogenic accidents).

7. Measurements shall be made applying electronic and/or hard copy maps of the terrain.

8. A navigation device included in the measuring equipment or integrated into the mobile phone shall be used to determine the geographical coordinates of the measuring points.

9. The following conditions shall be assumed for measuring the technical parameters of the quality of cellular service:

the cellular network equipment is in a state of readiness;

equipment at the other end of the route in the caller-to-caller chain is ready to answer the call.

10. The measuring units and auxiliary equipment shall be prepared for operation as specified in the technical documentation.

11. The measurement route shall be planned taking into account the availability of cellular communication network coverage in the proposed measurement area. Measurement routes shall be compiled based on the route description in accordance with Appendix 1 of this Methodology.

Footnote. Paragraph 11 - as amended by the Order of the Minister of Digital Development , Innovation and Aerospace Industry of the Republic of Kazakhstan No. 35/ҚН dated 31.01.2023 (shall be enforced ten calendar days after the day of its first official publication).

12. When performing measurements, the following shall be observed:

1) the requirements of hygienic standards for physical factors affecting a person, approved by order of the Minister of Health of the Republic of Kazakhstan dated February 16, 2022, No . ҚР ДСМ-15 (registered in the State Register of Normative Legal Acts under No. 26831);

2) safety requirements established in the operating instructions for the measuring instruments used.

Footnote. Paragraph 12 - as amended by the Order of the Minister of Digital Development , Innovation and Aerospace Industry of the Republic of Kazakhstan dated 08.06.2023 No. 167 /НҚ (shall be enforced ten calendar days after the day of its first official publication).

Chapter 3. Procedure for measuring the technical parameters of the quality of cellular services

Paragraph 1. Method for measuring technical parameters of cellular service quality

13. The measurements shall be performed via test calls to assess quality of communication service indicators and test sessions to assess quality of Internet access service indicators via mobile telecommunication networks (hereinafter referred to as the Internet).

14. Virtual points characterising the connection status shall be recorded during each test call/ test session. The technical parameters shall be measured at these basic points.

15. Test calls shall be made alternately for outgoing and incoming calls.

16. Test calls shall be made from one mobile phone:

to another mobile phone;

to landline telephones (answering machines) connected to a fixed-line operator's network (fixed line telephone service).

Paragraph 2. Measuring tools used to measure technical parameters of cellular service quality

17. Measuring tools shall be divided into:

1) transportable measuring systems;

2) portable measuring units;

3) mobile phones and (or) modems with specialised software installed.

18. The portable measuring unit shall consist of the following parts:

1) a scanning receiving device;

2) mobile phones and/or modems;

3) external antennas (depending on configuration);

4) data processing system;

5) navigation device;

6) auxiliary equipment.

The composition and wiring diagram of the measuring unit are given in Annex 2 hereto.

19. The portable measuring system shall comprise:

1) mobile phones and/or modems;

2) controller.

If required, a scanning receiving device and/or a navigation device shall be connected to the portable measuring system.

The composition and wiring diagram of the measuring unit are given in Annex 2 hereto.

20. The mobile phone for measuring technical parameters shall be composed of:

1) a mobile device;

2) specialised software installed on the mobile device to enable measurements on the cellular network.

Paragraph 3. Sequence of measuring technical parameters of cellular service quality

21. The measurement shall be taken in the following sequence:

1) the area where the test runs are scheduled to take place is determined;

2) within the boundaries of the selected area a route map of the mobile measuring unit is determined;

3) the measuring devices are adjusted to measure the required parameters as per the operating instructions supplied therewith;

4) the required technical parameters are measured in automatic mode;

5) the measurement results are stored for further processing and calculations.

22. Following the test run, the following mobile service quality parameters shall be automatically measured for each route in graphical and tabular form:

parameters characterising the quality of cellular coverage;

parameters for evaluation of communication availability, continuity of communication;

parameters for estimating the value of the response delay time and the average time to establish a telephone connection;

parameters for evaluation of average speech intelligibility;

parameters describing Internet access service.

23. The quality of cellular coverage shall be measured using a scanning receiving device simultaneously in 2G, 3G, 4G networks (as per the standards and frequency bands used by operators in the study area). The scanning receiving device shall record the measurement result of each measured characteristic at least once per second in each network under investigation. Measurements shall be taken by means of the remote antennas. The scanning receiving device's external antennas shall be connected without the use of signal attenuating devices.

The measurement process shall include the record of radio coverage characteristics, including:

best received RSSI level of BCCH signals in 2G technology based networks;

best received pilot CPICH RSCP signals in 3G based networks;

the ratio of received energy of the pilot channel chip to the total received energy density in the Ec/Io band of 3G technology;

best received RSRP reference signal level in 4G-based networks.

24. Indicators of communication availability, continuity of communication shall be assessed based on the measurement cycles of the main technical parameters given in Annex 3 hereto. Once the connection time and the successful connection time have elapsed, the connection attempt shall be counted as failed in the measurement results. The maximum total duration of the measurement shall not exceed the duration of the end of call and the safety pause.

25. The parameters recorded by the measuring system to estimate the average connection time shall be interpreted using the available software.

26. The parameters for assessing average speech intelligibility shall be measured using the POLQA algorithm.

The measurement shall be performed in a manner where the average estimated speech quality value is calculated as the ratio of the total sum of the estimated voice quality values of the voice samples to the number of voice samples.

The parameter for assessing average speech intelligibility shall be calculated as a result of statistical processing, including estimates of the speech quality index for all transmitted speech sequences.

27. The Internet access service quality parameters shall be measured according to repetitive test cycles for different services. The test cycles of Internet access service quality parameters shall be given in Annex 4 hereto.

28. A dedicated local server shall be used during the measurements, ensuring a level playing field for the tests and eliminating the influence of the topology and performance of the hardware platform on the validity of the measurement results for each network under test. The local server shall connect to the IP traffic exchange point and ensure that the tests run properly. The local server shall be intended to measure data transmission based on HTTP and FTP protocols and to host a "reference" Web page on the Internet.

29. Transport bandwidth shall not limit data transfer speeds.

Paragraph 4. Bias characteristics and accuracy control of the measuring results of technical parameters of cellular service quality

30. The number of test calls/test sessions to ensure adequate accuracy shall be based on the class of locations to be measured.

31. A classifier of measurement sites may be found in Annex 5 hereto.

32. When conducting measurements in D0, D1, D2 classes, norms ensuring technical compatibility of telecommunication networks and facilities, indicators of quality of communication services, approved by Order No. 410 of the Minister of Information and Communications of the Republic of Kazakhstan dated November 22, 2017 (recorded in the Register of State Registration of Regulatory Legal Acts under No. 16064), billing unit sizes, approved by Order No. 43 of the Chairman of the Kazakhstan Agency for Informatization and Communications dated February 2, 2009 (recorded in the Register of State Registration of

Regulatory Legal Acts under No. 5573), shall be taken as expected for the respective indicator to be calculated. The number of test calls/test sessions shall be sufficient to obtain an estimate of each parameter with a relative error not exceeding 15 % at a confidence level of 95 %.

33. The minimum number of control calls/control sessions required at a confidence level of a = 95% and a relative error of 15% may be found in Annex 6 hereto.

34. For classes D3, C1C, O1C the calculation of the number of necessary test calls/test sessions shall be made using the algorithm of tolerance limits, with the establishment of guaranteed compliance/non-compliance limits. A description of the tolerance limits algorithm may be found in Annex 7 hereto.

For voice quality and average data rate measurements, the number of test calls (test sessions) shall be assumed to be equal to the actual value, but not less than 98 test calls to assess voice quality, including voice quality, and 58 sessions to assess data rate.

35. Verification of applied measuring instruments shall be performed in accredited verification laboratories following the methods of verification of measuring instruments recorded in the register of the National Uniform Measurement Assurance System (NUMAS RK) under the Rules for Verification of Measuring Instruments, Establishing the Frequency of Verification of Measuring Instruments and the form of verification certificate of measuring instruments, approved by Order No. 934 of the Minister for Investments and Development of the Republic of Kazakhstan from December 27, 2010 (recorded in the Register of State Registration of Regulatory Legal Acts under No. 18094).

Paragraph 5. Processing the measurement results of technical parameters of cellular service quality and calculation algorithms

36. The indicators characterising the quality of cellular communication service shall be calculated after processing the technical parameters obtained by measuring. Technical parameters of cellular service quality are given in Annex 8 hereto.

37. The rate of failed calls out of the total number of calls to a cellular (fixed telephony) network subscriber (communication availability rate) shall be expressed as the ratio of the number of failed attempted voice connections to the total number of test voice connections and shall be calculated based on the following formula:

Value =

$$\frac{Q}{N} * 100\%,$$

where:

Q – the number of failed attempts to establish a voice connection;

N – the total number of attempts to establish a test voice connection.

38. The percentage of calls terminated prematurely by an established connection not initiated by the subscriber (continuity indicator) shall be expressed as the ratio of the number of connections terminated not initiated by the subscriber to the total number of successful calls and shall be calculated as follows:

Value =

$$\frac{R}{N} * 100\%,$$

where:

R – the number of connections terminated not initiated by the mobile phone;

N – total number of successful calls.

39. The average connection time in the cellular network terminating to the cellular network in the same region shall be calculated as the ratio of the sum of the connection time parameters to the number of connections where the parameter was recorded and shall be based on the following formula:

Value =

$$\frac{E}{N} * 100\%,$$

where:

E – sum of connection time parameters;

N – total number of test voice connections.

40. The percentage of calls not satisfying speech quality standards shall be expressed as the ratio of the number of test voice samples received with poor intelligibility to the total number of test voice samples and shall be based on the following formula:

Value=

$$\frac{N<2,8}{N} * 100\%,$$

where:

N<2,8 – number of test voice samples with poor speech intelligibility accepted (MOS POLQA < 2,8);

N – total number of test voice samples.

41. The indicator of the success rate of web page loading sessions is HTTP. The calculation shall be based on the total number of times the Attach procedure has been attempted. The Attach procedure shall be included in each loop of the web page load test session. The indicator shall be calculated using the following formula:

Value =

$$\frac{P}{N} * 100\%,$$

where:

P – the number of successful attempts to load the WEB page;

N – the total number of sessions downloading the web page.

42. Indicator of the success rate of data downloading sessions from the HTTP server. The calculation of the indicator shall be based on the total number of times the Attach procedure has been attemptedh. The Attach procedure shall be included in each loop of the data load test session, calculated using the following formula:

Value =

$$\frac{D}{N} * 100\%,$$

where:

D – the number of successful data download sessions from the HTTP server;

N – the total number of sessions downloaded from the HTTP server.

43. Indicator of the success rate of data downloading sessions from the FTP server. The calculation of the indicator shall depend on the total number of times the Attach procedure has been attempted. The Attach procedure shall be included in every loop of the data loading test session and shall be based on the following formula:

Value =

$$\frac{H}{N} * 100\%,$$

where:

H – the number of successful sessions to download data from the FTP server;

N – the total number of sessions downloaded from the FTP server.

44. The proportion of average FTP server download speeds is less than the technology-specific threshold on a “downstream” basis:

Value =

$$\frac{R}{N} * 100\%,$$

where:

R – number of sessions where the average download speed from the FTP server is less than the threshold;

N – total number of sessions downloaded from the FTP server.

45. Any of the sessions outlined (voice or data) shall not be counted if they have not been completed on time or have not been started due to a lack of funds on the SIM card balance of the devices in the test suite.

Paragraph 6. Presentation of measurement results

46. Upon the results of the measurement, a report on the results of measurements of the technical parameters of the quality of cellular communication services shall be drawn up in the form according to Annex 9 hereto.

Chapter 4. Requirements for measuring the technical quality of Internet access services via fixed telecommunication networks Paragraph 1. Requirements for quality measurements via fixed telecommunication networks

47. Measuring shall be done during operation of fixed telecommunication networks without overloads, failures, in climatic conditions specified in the operating documents for fixed telecommunication network equipment and measuring instruments applied.

48. Measuring shall not be carried out during periods of abnormal load on the network (public holidays, mass events, man-made incidents).

49. The technical data transmission quality measurements shall be made under the condition that the port to be measured is loaded to no more than 80% of its capacity.

50. During the instrumental test on test laptops, anti-virus and other programmes that increase the CPU load or network data transmission must be deactivated.

51. When instrumental monitoring is performed, all network devices (including client routers) must be physically disconnected from the subscriber's local network, except for measuring instruments.

52. Test files shall consist of incompressible data.

53. The minimum size of the test file must exceed twice the theoretical maximum baud rate of the connection being measured.

54. With a view to ensuring the objectivity of the measurement process, the service provider shall provide access to a test server with a connected communications link, located on its data transmission network.

55. For measuring the key quality characteristics of the communication channel provided, the communication operator's data transmission network shall be equipped with hardware control device No. 2 with a connected communication channel to establish a connection with hardware control device No. 1 to be plugged in instead of the subscriber's terminal equipment.

56. For objective measurements, it shall be advisable to locate the server at a minimum distance from the operator's traffic exchange point.

Paragraph 2. Measuring tools for technical parameters of the quality of Internet access services via fixed telecommunication networks

57. Measuring instruments shall be classified into:

1) hardware controls;

2) software controls installed on a laptop (notebook computer);

3) portable computer (laptop).

Paragraph 3. Procedure for measuring the technical quality of Internet access services via fixed telecommunication networks

58. In case of control measurements, a web service for the indication of quality-of-service indicators of a set type shall be used, with the selection of a test server hosted on the operator's network as the control measurement server.

59. Measuring shall be accomplished applying hardware, firmware, software controls via control measuring (load tests) of at least 600 seconds duration (10 minutes).

60. A standard scheme for the measurement organisation is shown in Annex 10 hereto.

61. A report on the measuring results of the quality of Internet access services shall be drawn up as per Annex 11 hereto.

62. Measurable quality characteristics of Internet access services via fixed telecommunications networks shall relate to the following connectivity parameters:

channel capacity in the “from”/”to” direction of the subscriber, unit “Mbit/s”;

IP packet delay time, unit of measure “msec”;

IP packet delay time variation (hereinafter – “jitter”), unit “msec”;

IP packet loss, unit of measure “percentage”.

63. The channel capacity measurement in the "from"/"to" direction of the subscriber shall involve the transmission of a known number of bytes between the control hardware in both directions in a settable time interval and further calculation of the data transmission capacity based on the formula:

$$S = \frac{8 * N_{байт}}{t_{уст}},$$

bit/sec,

Where:

Nбайт [Nbyte] – the number of bytes transferred,

туст – [tset] the set time period, sec.

64. The measurement of the IP packet delay time parameter shall comprises the sending and further reception of test packages by the control hardware. A minimum of 2 control hardware (#1 and #2) shall be involved in the measuring process, whereby control hardware #1 shall insert timestamp #1 in each test package and send the sequence of test packages to control hardware #2. Hardware Control Unit 2 shall receive the test packages, insert Timestamp 2 into the packages, and send them back to Hardware Control Unit 1. Hardware Control Unit 1 shall receive a sequence of test packages with timestamps 1 and 2, and will insert timestamp 3 (to calculate the two-way delay).

65. The two-way delay time of the i-th packet shall be computed by using the formula:

dTyx2i= dTy2i- dTxi,

where:

i – the first package in the test stream.

dTyx2i - the two-way delay time of the i-th package.

dTxi – sending time of the i-th package in the test stream at control hardware output 1 (the first timestamp of the package).

dTy2i – time of reception of the i-th package in the test stream at the input of control hardware 1 (the third timestamp of the package).

66. The delay time variation parameter shall be measured via hardware controls, by monitoring the time stamps in test packages sent between the hardware controls.

67. The package loss rate parameter shall be measured via control hardware by sending a sequence of test packages from control hardware #1 to control hardware #2 and back, followed by a comparison of the number of packages sent and received to determine the two-way package loss rate.

Paragraph 4. Error characteristics of the measurement and accuracy control of the measurement results

68. The following error characteristics shall be set in the measurements:

- absolute error limits for duration of measurement session, s +-0.5
- absolute error limits for the amount of information transmitted (received), bytes

K

$\leq$

10 Mbyte - 10

K

$\geq$

10 Mbyte - 10-4 K,

where K is the amount of information in bytes

Paragraph 5. Measurement results processing and calculation algorithms

69. Once the technical parameters obtained via measurement have been processed, the indicators that characterise the quality of the Internet access service via fixed networks shall be calculated.

70. The link capacity index Кпр [Kcp] shall be obtained by the following formula:

$$К_{пр} = \frac{S}{S_{тариф}} * 100\%,$$

where

S – the average value of the data transmission capacity determined over the measurement period;

Старифф [Stariff]– the maximum data transmission capacity guaranteed to the subscriber under the tariff plan or contract.

71. The IP package delay time, t latency, shall be calculated as follows:

$$\mathrm{dTyx(average)} = \frac{\sum_{n}^{i} \mathrm{dTyx}^{(i,n)}}{N},$$

where

dTyx (average) – average bilateral test delay time;

dTyx (i,n) – bidirectional package delay time;

i – the first package in the test stream;

n – the last package in the test stream;

N – the number of packages in the test stream.

72. The lag time variation index shall be calculated by using the formula:

$$\mathrm{J\ average} = \frac{\sum_{n}^{i} \mathrm{Jk}^{(i,n)}}{N},$$

where

Javerage – is the average delay variation time in the test stream from the i-th to the j-th package;

Jk – current package delay variation time;

i – the first package in the test stream;

n – the last package in the test stream;

N – the number of packages in the test stream.

73. The IP package loss rate shall be determined by the formula:

$$FLR_T^{\langle i,j \rangle} = \left(\frac{I_T^{\langle i,j \rangle} - E_T^{\langle i,j \rangle}}{I_T^{i,j}} \right) \times 100 \text{ if } I_T^{\langle i,j \rangle} \geq 1,$$

wherer

FLRT (i,j) – is the package loss ratio in the test flow from the i-th package to the j-th one;

IT – the number of test packages sent;

ET – the number of test packages received;

T – time interval;

i – the first package in the test stream;

j – the last package in the test stream.

Annex 1
to the Methodology for Measuring
Technical Parameters of the
Quality of Communication
Services

Description of routes

Prior to the test runs, a measurement route shall be compiled in advance as described below:

1) the measurement route covers administrative and public organisations of settlements, central squares, areas of shopping and cultural centres, entrances to railway stations and airports, educational institutions and other important social facilities, tourist areas accessible for passage, and other areas with a high density of subscribers;

2) in settlements, the measurement route covers as many arterial roads, high-density streets within the administrative boundary of the city as possible, as well as ring roads;

3) beyond settlements, the measurement route comprises roads connecting settlements within the measuring area;

4) the measurement route is evenly distributed over the area to be measured;

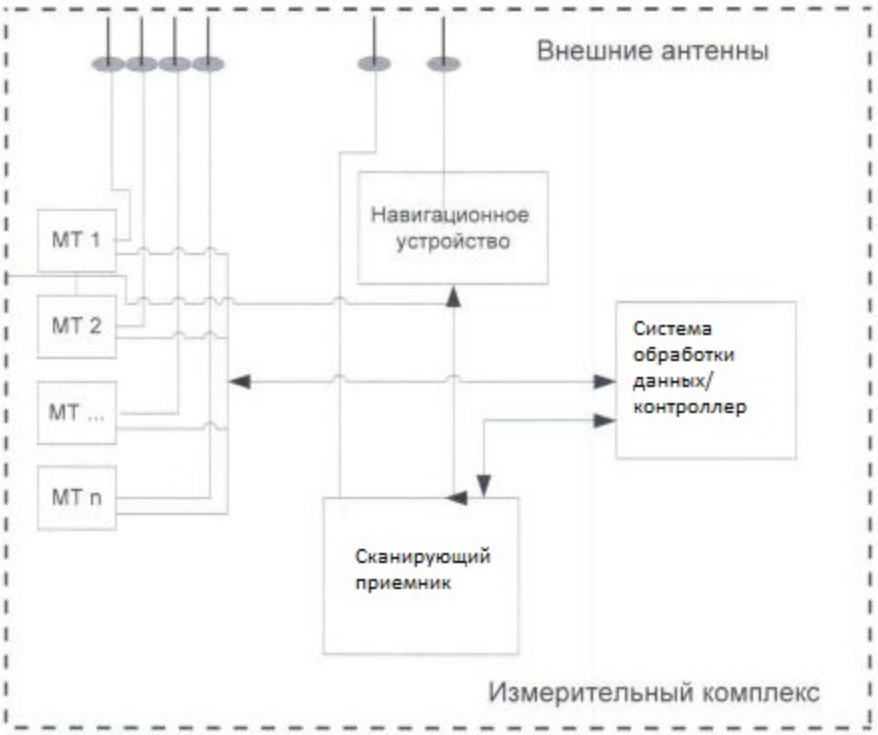
5) should the administrative boundaries of the municipality change, the quality of communication in the newly annexed areas, during the first year after the change, shall be computed as per the type of terrain characteristic of the municipality prior to annexation.

Some deviations from the predetermined route may be allowed when measuring due to road repairs, road closures, barriers, poor road surfaces.

When driving repeatedly along a test section, averaging of the measurement results must be used during software processing. In the case of measuring along the road, the averaging shall be equal to the road width.

Annex 2
to the Methodology for Measuring
Technical Parameters
of the Quality of Communication
Services

Composition and wiring diagram of the measuring system



[Внешние антенны - External antennas
[Навигационное устройство – Navigation device]
[Система обработки данных/контролер - Data processing system/controller]
[Сканирующий приемник – Scanning receiving device]
[Измерительный комплекс – Measuring system]

Annex 3
to the Methodology for Measuring
Technical Parameters
of the Quality of Communication
Services

Cycles for measuring key technical parameters Parameter measurement cycle for calculating the voice service availability indicator

Call direction	Operation	Duration, seconds
1	2	3
A call initiated by a mobile phone	Total duration of the measurement cycle (Call Window)	40
	Establishing connection (Call setup time)	20
	Duration of successful connection (Call Duration)	10
	Safety pause between cycles, minimum	10
	Total measuring time (Call Window)	40

A call received on a mobile phone	Establishing connection (Call setup time)	20
	Duration of successful connection (Call Duration)	10
	Safety pause between cycles, minimum	10

Parameter measurement cycle for calculating the service continuity indicator

Call direction	Operation	Duration, seconds
1	2	3
A call initiated by a mobile phone	Total measurement cycle time (Window duration)	90
	Establishing connection (Call setup time)	15
	Duration of successful connection (Call Duration)	65
	Safety pause, minimum	10
A call received on a mobile phone	Total measurement cycle time (Window duration)	80
	Establishing connection (Call setup time)	20
	Duration of successful connection (Call Duration)	65
	Safety pause, minimum	10

Annex 4
to the Methodology for Measuring
Technical Parameters
of the Quality of Communication
Services

Internet access service quality parameter test cycles

Operation	Timeout duration	Note
Test parameters for 3G networks		
Payload ping x5	1 second (per ping)	800 byte, ICMP Ping x5, no pause between pings; (ping X.X.X.X -n 5 -l 800 -w 1000
HTTP DL	IP Service access setup time – 30 seconds Session duration - 20 seconds	Uncompressible content. Window test - 50 seconds
HTTP WEB browsing 1	IP Service access setup time – 30 seconds to Session duration - 30 seconds	Kepler. Test window - 60 seconds
FTP DL	IP Service access setup time – 30 seconds Session duration - 20 seconds	Uncompressible content. Test window - 50 seconds
Wait	10 seconds (between cycles)	
Test parameters for 4G networks		

Payload ping x5	1 second (per ping)	800 byte, ICMP Ping x5, no pause between pings; (ping X.X.X.X -n 5 -l 800 -w 1000
HTTP DL	IP Service access setup time – 20 seconds Session duration - 10 seconds	Uncompressible content. Test window - 30 seconds
HTTP WEB browsing 1	IP Service access setup time – 20 seconds Session duration - 20 seconds	Kepler. Test window – 40 seconds
FTP DL	IP Service access setup time – 20 seconds Session duration - 10 seconds	Uncompressible content. Test window - 30 seconds
Wait	10 seconds (between cycles)	

Note: Each individual data test cycle shall comprise the Attach procedure and the PDP context setting procedure and shall end with the PDP context deactivation and Detach commands. When testing 4G networks, the PDP Context Activation command shall correspond to the EPS Bearer Setup procedure.

Deciphering abbreviations:

1. Attach – the procedure for registering the device to the network;
2. Detach – the procedure for disconnecting the device from the mains;
3. EPS Bearer Setup – the procedure for setting up the virtual connection;
4. PDP Context Activation – activation of the package transmission data service;
5. PDP – package data protocol;
6. FTP DL – procedure for downloading data using the network file transfer protocol;
7. Payload ping – payload pinging procedure;
8. HTTP DL – procedure for downloading data via hypertext transfer protocol;
9. HTTP WEB browsing 1 – Web browsing via hypertext transfer protocol;
10. Wait – waiting.

Annex 5
to the Methodology for Measuring
Technical Parameters
of the Quality of Communication
Services

Classifier of measuring locations

Classifier of measurements to be taken		
C1C	Airports, railway/bus terminals, business centres, administrative complexes, exhibition areas, venues for cultural events	Measurements taken outside buildings
D0	Cities with more than 1 million inhabitants	
D1	Cities of national importance and/or with a population of more than 300, 000 inhabitants	

D2	Urban areas (medium to large cities with populations between 50,000 and 300, 000 inhabitants)	Measurements to be taken while on the move only
D3	Rural areas and small towns of up to 50,000 inhabitants	
O1C	Measuring based on the requests received	Measuring outside of buildings

Note: Measurements for class C1C shall be made on the spot by collecting statistics, for classes D0, D1, D2, D3 on the move, for class O1C based on the requests received.

Annex 6
to the Methodology for Measuring
Technical Parameters
of the Quality of Communication
Services

Minimum number of test calls/test sessions required at a confidence level of a = 95%

No.	Normative value of the indicator	Number of test calls/sessions at a relative error of 15%*
1	0.025	6,659
2	0.03	5,521
3	0.05	3,244
4	0.08	1,963
5	0.10	1,537

* as per the formula given in International Telecommunication Union Recommendation E .804

Annex 7
to the Methodology for Measuring
Technical Parameters
of the Quality of Communication
Services

Description of the tolerant limits algorithm

The number of calls/sessions required to ensure proper accuracy shall be estimated using a formula relating the probability P (S < s) of the number of failed calls/sessions not exceeding s to a given loss rate of calls/failed sessions p and the number of attempted calls/ sessions n:

$$P(S < s) = \sum_{k=0}^{s} C_n^k p^k (1-p)^{n-k},$$

where
n – number of call/session attempts;
k – number of failed call/session attempts;
S<s – the condition of violation of the rate of failed calls/sessions;

pk– probability of failed calls;

pk (1-p)n-k – the probability that after n calls/sessions, k of them were failed;

C_n^k

– is the number of combinations of n over k;

$\sum_{k=0}^{S}$

- summation over all options that meet the condition S < s.

Applying the formula yields two calculation points:

The compliance limit shall be based on the inverse probability formula:

$$Q = 1 - P(S < s),$$

where

Q – boundary of guaranteed norm compliance;

P – confidence probability.

In such a case, the values of s and n shall fulfil the condition: if after making n calls the number of lost calls/failed sessions does not exceed s, then the rate of lost calls/failed sessions will be p with a confidence probability P.

The boundary of guaranteed violation of the norm, if a solution is sought for P (S < s), then the values of s and n found comply with the following condition: if after n calls/sessions the number of failed calls/sessions is greater than s, then the norm of the proportion of failed calls/sessions p will be violated with confidence probability P.

The boundaries for the rate of failed calls out of the total number of calls to a cellular network subscriber (p = 3.0 %) and the rate of failed sessions (p = 5.0 %) are shown in the following table:

p = 3.0 %			p = 5.0 %					
n - total number of calls/ sessions	s - number of failed calls/ sessions	Share of failed calls/ sessions, %	n - total number of calls/ sessions	s - number of failed calls/ sessions	Share of failed calls/ sessions, %	n - total number of calls/ sessions	s - number of failed calls/ sessions	Percentage of failed calls/ sessions, %
98	0	0	58	0	0	1,809	75	4.146
156	1	0.642	92	1	1.087	1,831	76	4.151
207	2	0.966	123	2	1.626	1,853	77	4.155
256	3	1.172	152	3	1.974	1,875	78	4.16
302	4	1.325	180	4	2.222	1,896	79	4.167
347	5	1.441	207	5	2.415	1,918	80	4.171
391	6	1.535	233	6	2.575	1,940	81	4.175
435	7	1.609	259	7	2.703	1,962	82	4.179
477	8	1.677	285	8	2.807	1,984	83	4.183

520	9	1.731	310	9	2.903	2,005	84	4.19
561	10	1.783	335	10	2.985	2,027	85	4.193
603	11	1.824	360	11	3.056	2,049	86	4.197
644	12	1.863	385	12	3.117	2,070	87	4.203
685	13	1.898	409	13	3.178	2,092	88	4.207
725	14	1.931	433	14	3.233	2,114	89	4.21
765	15	1.961	457	15	3.282	2,136	90	4.213
805	16	1.988	481	16	3.326	2,157	91	4.219
845	17	2.012	505	17	3.366	2,179	92	4.222
885	18	2.034	529	18	3.403	2,201	93	4.225
924	19	2.056	553	19	3.436	2,222	94	4.23
964	20	2.075	576	20	3.472	2,244	95	4.234
1,003	21	2.094	600	21	3.5	2,265	96	4.238
1,042	22	2.111	623	22	3.531	2,287	97	4.241
1,081	23	2.128	646	23	3.56	2,309	98	4.244
1,120	24	2.143	670	24	3.582	2,330	99	4.249
1,158	25	2.159	693	25	3.608	2,352	100	4.252
197	26	2.172	716	26	3.631	2,374	101	4.254
1,235	7	2.186	739	27	3.654	2,395	102	4.259
1,274	28	2.198	762	28	3.675	2,417	103	4.261
1,312	29	2.21	785	29	3.694	2,438	104	4.266
1,350	30	2.222	808	30	3.713	2,460	105	4.268
1,389	31	2.232	831	31	3.73	2,481	106	4.272
1,427	32	2.242	854	32	3.747	2,503	107	4.275
1,465	33	2.253	876	33	3.767	2,524	108	4.279
1,503	34	2.262	899	34	3.782	2,546	109	4.281
1,541	35	2.271	922	35	3.796	2,568	110	4.283
1,578	36	2.281	944	36	3.814	2,589	111	4.287
1,616	37	2.29	967	37	3.826	2,611	112	4.29
1,654	38	2.297	990	38	3.838	2,632	113	4.293
1,691	39	2.306	1,012	39	3.854	2,654	114	4.295
1,729	40	2.313	1,035	40	3.865	2,675	115	4.299
1,767	41	2.32	1,057	41	3.879	2,697	116	4.301
1,804	42	2.328	1,080	42	3.889	2,718	117	4.305
1,842	43	2.334	1,102	43	3.902	2,740	118	4.307
1,879	44	2.342	1,125	44	3.911	2,761	119	4.31
1,916	45	2.349	1,147	45	3.923	2,782	120	4.313
1,954	46	2.354	1,169	46	3.935	2,804	121	4.315
1,991	47	2.361	1,192	47	3.943	2,825	122	4.319
2,028	48	2.367	1,214	48	3.954	2,847	123	4.32
2,065	49	2.373	1,236	49	3.964	2,868	124	4.324
2,102	50	2.379	1,259	50	3.971	2,890	125	4.325

2,139	51	2.384	1,281	51	3.981	2,911	126	4.328
2,177	52	2.389	1,303	52	3.991	2,933	127	4.33
2,214	53	2.394	1,325	53	4	2,954	128	4.333
2,251	54	2.399	1,347	54	4.009	2,975	129	4.336
2,288	55	2.404	1,370	55	4.015	2,997	130	4.338
2,324	56	2.41	1,392	56	4.023	-	-	-
2,361	57	2.414	1,414	57	4.031	-	-	-
2,398	58	2.419	1,436	58	4.039	-	-	-
2,435	59	2.423	1,458	59	4.047	-	-	-
2,472	60	2.427	1,480	60	4.054	-	-	-
2,509	61	2.431	1,502	61	4.061	-	-	-
2,545	62	2.436	1,524	62	4.068	-	-	-
2,582	63	2.44	1,546	63	4.075	-	-	-
2,619	64	2.444	1,568	64	4.082	-	-	-
2,656	65	2.447	1,590	65	4.088	-	-	-
2,692	6	2.452	1,612	66	4.094	-	-	-
2,729	67	2.455	1,634	67	4.1	-	-	-
2,765	68	2.459	1,656	68	4.106	-	-	-
802	69	2.463	1,678	69	4.112	-	-	-
2,839	70	2.466	1,700	70	4.118	-	-	-
2,875	71	2.47	1,722	71	4.123	-	-	-
2,912	72	2.473	1,744	72	4.128	-	-	-
2,948	73	2.476	1,765	73	4.136	-	-	-

Note:

example of using a table:

“During measuring, 156 control calls were made, among them one call was a failure, then as per the table the percentage of failed calls is 0.642.”.

Annex 8
to the Methodology for Measuring
Technical Parameters
of the Quality of Communication
Services

Technical parameters for the quality of cellular services

Seq No.	Technical parameter	Call events	A service quality indicator interrelated with the parameter
1	2	3	4
1	Transmission of voice information		
		Starting point: Sending a RACH message for 2G – “A CHANNEL_REQUEST”;	

1.1	The number of failed attempts to establish a voice connection. The total number of established connections. Failed attempt: connection not established within 15 seconds	for 3G the first message “ RRC CONNECTION REQUEST” with request reason “Originating Conversational Call”; for 4G, in CS-Fallback procedure from “ EXTENDED SEVICE REQUEST” message with request reason "Mobile Originating CS-Fallback End point: The “ALERTING” messages have been transmitted: 1. from the B side to the commutator (UL); 2. from the commutator to the A side (DL)	Proportion of failed calls out of the total number of calls made to a cellular (fixed line) subscriber
1.2	Number of successfully established connections broken. The total number of successfully established connections. Connection interruption - termination of a connection not initiated by the subscribers	Starting point: “ALERTING”messages have been transmitted: 1. from B side to the switch (UL); 2. from the switch to the A side (DL) End point: For 2G: reception of the “ DISCONNECT” message by side A or B For 3G: “DISCONNECT” message is not simultaneously observed in the direction of the switch from one terminal and the message	Proportion of calls ended with disconnection of an established connection not initiated by the connection
1.3	Number of voice connections (voice samples) with low speech intelligibility Total number of voice connections (voice samples).	Proportion of test speech sequences for which the intelligibility rating is below the recommended level as per ITU-T Recommendations R.863, R 863.1 (MOS POLQA < 2.8).	Proportion of calls not satisfying voice quality standards
2	Response signal delay time value		
		Starting point: Sending RACH message for 2G – “A CHANNEL_REQUEST”; for 3G first message “RRC CONNECTION REQUEST” with query	Proportion of calls on the cellular network for calls terminated on the cellular (

2.1	The number of test calls not satisfying the standard Call Delay Time for all measurement sessions. The total of the total number of test calls in all measurement sessions.	reason "Originating Conversational Call"; for 4G, in CS-Fallback procedure from " EXTENDED SEVICE REQUEST" message with query reason "Mobile Originating CS-Fallback" End point: "ALERTING" messages have been transmitted: 1. from B side to the switch (UL); 2. from the switch to the A side (DL)	fixed line) network not satisfying the standard response delay time Average time to establish a telephone connection on a cellular (fixed line) network not meeting the standard value of the response delay time
3	Quality of Internet access service		
3.1	number of successful attempts to download the WEB page total number of WEB page download sessions	Starting point: Sending a request for access to an Internet resource End point: Requested content downloaded successfully	Percentage of successful WEB page download sessions - HTTP
3.2	number of successful attempts to download data from the FTP server total number of sessions to download data from the FTP server	Starting point: Sending a request to download data from an FTP server End point: Requested content downloaded successfully	proportion of successful sessions downloading data from the FTP server
3.3	number of successful attempts to download data from the HTTP server total number of sessions to download data from the HTTP server	Starting point: Sending a request to download data from an HTTP server End point: Requested content downloaded successfully	the percentage of successful sessions downloading data from the HTTP server
3.4	number of successful attempts to download data from the FTP server with an average download speed of less than 2 Mbit/s total number of upload sessions from the FTP server	Starting point: Sending a request to download data from an FTP server End point: Requested content downloaded successfully	proportion of successful sessions downloading data from the FTP server
3.5	number of successful attempts to download data from the FTP server with an average download speed of less than 1 Mbit/s	Starting point: Sending a request to download data from an FTP server End point:	

	total number of data download sessions from the FTP server in 3G technology	Requested content downloaded successfully	proportion of successful sessions downloading data from the FTP server
3.6	number of successful attempts to download data from the FTP server with an average download speed of less than 5 Mbps total number of upload sessions from the FTP server in 4G technology	Starting point: Sending a request to download data from an FTP server End point: Requested content downloaded successfully	proportion of successful sessions downloading data from the FTP server

Note: Explanation of abbreviations:

1. BCCH – the broadcast control channel required to transmit control information in the direction from the base station to the mobile phone;

2. RSSI – 2G technology received signal strength, dBm;

3. RSCP (Receive Signal Code Power) – is the level of the received useful signal at the input of the mobile terminal receiver in 3G technology, dBm;

4. Ec/Io – is the ratio of useful signal to noise in 3G technology, dB;

5. RSRP (Reference Signal Received Power)- average power value of received pilot signals at the input of the 4G mobile terminal receiver, dBm;

6. RACH (Random Access Channel) – the access channel used to request the assignment of an individual control channel in the direction from the mobile phone to the base station;

7. RRC CONNECTION REQUEST – the message sent by the mobile phone during the first stage of establishing a connection;

8. A CHANNEL_REQUEST – a message sent by a mobile phone that contains a request for a channel allocation;

9. ALERTING – message, describes the pre-reply state of the mobile phone;

10. DISCONNECTED – a message describing the disconnection of the connection;

11. EXTENDED SERVICE REQUEST – a message sent by a mobile terminal in the 4G network when attempting to make a voice connection or receiving an SMS message;

12. SMS (Short Message Service) – a technology enabling the reception and transmission of short text messages using a mobile phone;

13. SYN (synchronize) – the package sent by the customer to establish a connection;

14. UL (UpLink) – channel from the mobile phone to the base station;

15. DL (DownLink) – channel from the base station to the mobile phone;

16. HTTP – application layer transfer protocol;

17. FTP – file transfer protocol.

Annex 9
to the Methodology for Measuring
Technical Parameters
of the Quality of Communication
Services

Document form

Report on the measuring results of the technical parameters of the quality of cellular services

city _____ "__" _____20__

Grounds for the measurement:

_____

Surname, first name, patronymic (if any) and position of the staff who performed this measurement:

_____

Address, name of settlement, specifying district, region:

_____

Administrative boundary of the measurement:

_____

Time interval for measuring:

_____

_____

The identification of the measuring system (type of equipment, date of factory calibration or date of verification)

Date of calibration or date of verification):

_____

_____

1. Measurement results:

Table 1 - Quality indicators of the cellular network.

No.	Indicator		Location type*			
			1	2	3	4
1	RSSI – 2G technology signal strength indicator, dBm	Recommended threshold value	≤-75	≤-85	≤-95	≤-95
		Permissible percentage, %	5	10	10	10
		Measured value, %				

2	CPICH RSCP - level of received useful signal at the scanning receiver input in 3G technology, dBm	Recommended threshold value	≤ -80	≤-90	≤-100	≤-105
		Permissible percentage, %	10	10	10	10
		Measured value, %				
3	Ec/Io – 3G technology's signal-to-noise ratio, dB	Recommended threshold value	<15	<15	<15	<15
		Permissible percentage, %	10	10	5	15
		Measured value, %				
4	RSRP - average power value of received reference signals at the input of the scanning receiver in 4G technology, dBm	Recommended threshold value	≤ -100	≤ -105	≤ -105	-
		Permissible percentage, %	5	10	15	-
		Measured value, %				

Note: Location types according to building density:

1 - high-density city (outdoors);

2 - low-density town, outskirts (outdoors);

3 - rural area (with coverage according to licence obligations);

4 - highways (with coverage according to licence obligations).

Table 2 - Quality indicators for voice cellular services.

No.	Name of cellular service quality indicator	Indicator value
Voice service quality indicators		
1	Percentage of failed calls out of the total number of calls made to the cellular network subscriber	
2	Percentage of failed calls out of the total number of calls made to a fixed telephone network subscriber	
3	Percentage of calls disconnected on an established connection not initiated by the caller	
4	Percentage of calls not satisfying speech quality standards (MOS POLQA < 2.8)	

5	Average connection time on the cellular network terminating to the cellular network in the same region, seconds	

Table 3 - Quality of service indicators for Internet access via mobile operator networks.

No.	Service quality indicators	Indicator value
1	Percentage of successful data download sessions from HTTP server, %	
2	Percentage of successful FTP uploads, %	
3	Percentage of successful WEB page download sessions - HTTP, %	
4	Proportion of average FTP server download speed less than 2 Mbps downlink (for classes D0, D1, D2, D3 as per licence commitment)	
5	Proportion of average FTP server download speed less than 1 Mbps downlink in 3G technology (for classes C1C, O1C)	
6	Proportion of average FTP server download speed values less than 5 Mbps downlink in 4G technology (for classes C1C, O1C)	

Together with the total calculated value of each indicator, the total number of attempts for all tests is shown in the format “indicator, (%)/number of attempts”.

Note:_____

_____

_____

Revealed:_____

_____

_____

_____

Officials:

Position_____

surname, first name, patronymic (if any), signature

Position_____

—

surname, first name, patronymic (if any), signature

Annex 10
to the Methodology for Measuring
Technical Parameters
of the Quality of Communication
Services

Model scheme for measuring

[Агент Web сервис - Web service agent]

[Объект измерений – Object of measurement]

[Сеть – Network]

[Измерение параметров услуги передачи данных с помощью АСК/ПС АРМ (UPD-test) – Data transmission service measurement with hardware controls/ software controls for the automated workplace (UPD-test)]

[Измерение параметров услуги передачи данных с помощью web сервиса (HTTP) – Measuring data service parameters using a web service (HTTP)]

ПС – software utilities;

ПС АРМ – software controls for the automated workplace;

АСК – hardware controls;

Annex 11
to the Methodology for Measuring
Technical Parameters
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Services

Internet access service quality measurement report

date

Grounds for measurements:_____

_____

_

Surname, first name, patronymic (if any) and position of the officials who performed this measurement:

_____

__

_____

__

Address, name of locality, specifying district, region: _____

_____

__

Time interval for measuring: _____

_____

__

Identification data of the measuring tools (type of equipment, period of verification, serial numbers):

_____

__

_____

__

_____

__

Information on the tariff plan (guaranteed speeds, etc.)_____

___

_____

__

_____

__

Information on the external ip-address of the survey object: _____

_

_____

__

1. Measuring results for the quality of Internet access services via the operator's fixed telecommunication networks:

Connection type		Communication bandwidth, Mbit/s	IP package delay time, ms,	Variation of IP package delay, ms	IP package losses, %

When data is transmitted over Fibre Channel links between the measurement object and the test server/control hardware located on the operator's data transmission network	measured value				
	threshold value, max.	according to the tariff plan	15	10	0,2
When transmitting data over composite Fibre+Twisted Pair, RPS+ Twisted Pair links between the measurement object and the test server/control hardware located on the operator's data network	measured value				
	threshold value, max.	according to the tariff plan	150	50	0,3
When transmitting data over composite links with a single satellite link between the measurement object and the test server/control hardware located on the operator's data network	measured value				
	threshold value, max.	according to the tariff plan	400	50	0,5

Revealed:_____

_ _____

_ _____

__ _____

__ _____

__

Official:

Position_____

_

surname, first name, patronymic (if any), signature

Position_____

_

surname, first name, patronymic (if any), signature

Table 1 –Indicators of cellular communication quality

№	Indicator	Recommended threshold value/ Value%			
		/Type of location*			
1.	RxLevel-indicator of useful signal in 2G technology, dBm	≥-75 5	≥-85 10	≥-95 10	≥ -95 10
2.	C/1- ratio of received signal level at the input of mobile station receiver and the level of unwanted (interfering) signal in 2G technology, dB	<9 15	<9 15	<9 15	<9 15
3.	C P I C H RSCP-level of received useful signal at the input of mobile station receiver in 3G technology, dBm	≥ -85 10	≥ -95 10	≥ -100 10	≥ -100 10
4.	Ec/No –ratio of received energy of pilot channel chip to total received energy density in 3D technology band, dB	< -15	< -15	< -15	< -15
5.	RSRP-average power value of received reference signals at the input of mobile station	≥ -100 5	≥ -120 10		not normalized

	receiver in 4G technology, dBm			not normalized	
6.	RSRQ-quality of received pilot signals at the input of mobile station receiver in 4 G , d B technology	≥ - 15 15	≥ -20 15	not normalized	not normalized
7.	SINR- ratio of received signal level at the input of mobile station receiver and level of unwanted (interfering) signal	<5 15	<5 10	not normalized	not normalized

Note: Types of locality depending on building density:

1 – city with high building density;

2 – city with low building density, suburbs;

3 – rural area (with coverage according to the license obligations);

4 – highways (with coverage according to the license obligations).

Table 2- Indicators of voice cellular services quality _____.

№	Indicator of services quality	Standard		
		GSM	UMTS/WCDMA	LTE/LTE Advanced
1	Share of unsuccessful calls of the total number of calls at connections setup with a cellular network subscriber,%			
2	Share of unsuccessful calls of the total number of calls at connections setup with a subscriber of a fixed telephone network,%			
3	Share of calls that ended in disconnecting of established connection not at the initiative of the subscriber,%			
4	Share of calls that do not meet voice quality standards,%			
	Share of calls in the cellular network at			

5	the calls terminating in the cellular network and not meeting the standard of response signal delay time value (<15 s),%			
6	Average time of connection setup in cellular network ending in a cellular network in the same region, with			

Table 3 – Indicators of Internet access services quality through mobile communication networks of the operator

№	Indicator of service quality	Standard		
		GSM	UMTS/WCDMA	LTE/LTE Advanced
1	Share of successful data downloading sessions from HTTP server,%			
2	Share of successful data downloading sessions from FTP server, %			
3	Share of successful WEB pages downloading sessions from HTTP server, %			

Note: _____

_____

_____

_____

It was established: _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Qualified persons:

Position _____

__

full name, signature

Position _____

__

full name, signature