REPUBLIKA E SHQIPËRISË

AUTORITETI I KOMUNIKIMEVE ELEKTRONIKE DHE POSTARE

GUIDELINE

ON VERY HIGH-CAPACITY NETWORKS (VHCN)

(Approved by Decision No. 27, dated 06.11.2026, of the AKEP Steering Council)

I. GENERAL PROVISIONS

1.1 This Guideline is issued in accordance with Articles 108 and 191 of Law No. 54/2024 "On Electronic Communications in the Republic of Albania".

1.2 This guideline defines the technical and functional criteria that electronic communications networks must meet in order to qualify as Very High Capacity Networks (VHCN) in the Republic of Albania.

1.3 This guideline aims to align and harmonize national standards with the principles, criteria, and requirements set out in the BEREC Guidelines on Very High-Capacity Networks (VHCN), BoR (25) 182.

II. TECHNICAL CRITERIA FOR VERY HIGH-CAPACITY NETWORKS (VHCN).

2.1 An electronic communications network shall be considered and classified as a Very High-Capacity Network (VHCN) when it provides a consistent level of service quality and meets the technical criteria and parameters defined in this Guideline.

2.2 For the purposes of this Guideline, Very High-Capacity Networks (VHCN) shall be categorized as follows:

a) **Fixed Very High**-Capacity **Networks**, which are assessed in accordance with the performance thresholds defined for Category 1. This category includes fixed electronic communications networks with fiber-optic infrastructure deployed up to the building (Fiber-to-the-Building – FTTB). Services provided to end-users over these networks are typically delivered through legacy copper or coaxial cable segments. Such networks are considered to meet the requirements for classification as VHCN when they satisfy Criterion 1 or Criterion 3, or both simultaneously, in accordance with the provisions set out in point 2.4 of this Guideline.

b) **Wireless Very High**-Capacity **Networks**, which are assessed in accordance with the performance thresholds defined for Category 2. This category includes wireless electronic communications networks in which fiber-optic infrastructure is deployed up to the base station. Such networks are considered to meet the requirements for classification as VHCN when they satisfy Criterion 2 or Criterion 4, or both simultaneously, in accordance with the provisions set out in point 2.4 of this Guideline.

c) Fixed networks providing FTTH (Fiber-to-the-Home) and wireless networks providing FTTS (Fiber-to-the-Site) are, by their very nature, automatically considered very high-capacity networks (VHCN).

2.3 A wireless Very High-Capacity Network may also meet the performance thresholds defined under Criterion 3. In such cases, it may be considered functionally equivalent to a fixed Very High-Capacity Network (VHCN). This provision applies, in particular, to wireless networks that provide access services with characteristics and performance levels comparable to those of fixed networks and that exert competitive pressure on them, such as Fixed Wireless Access (FWA) networks.

2.4 An electronic communications network shall be considered a Very High-Capacity Network (VHCN) when it meets the criteria defined in this Guideline and is based on technologies that enable the provision of services with performance parameters comparable to those of fiber-optic networks.

2.4.1 The use of G.fast, 212 MHz, DOCSIS 3.1 (or more advanced versions), and 5G technologies may result in the classification of a network as a Very High-Capacity Network (VHCN), provided that the network meets the performance thresholds and criteria set out in this Guideline

2.4.2 An electronic communications network shall be considered a Very High-Capacity Network (VHCN) if it meets at least one of the following criteria:

Criterion 1 – Fixed fiber-optic infrastructure [1].

Any fixed electronic communications network that provides fiber-optic deployment up to the building (Fiber-to-the-Building – FTTB).

Criterion 2 – Wireless infrastructure with fiber-optic deployment up to the base station[2]

Any wireless electronic communications network that provides fiber-optic deployment up to the base station.

Criterion 3 – Performance thresholds for fixed networks:

Any fixed electronic communications network capable of providing, during busy-hour periods, end-user services with performance parameters not lower than the following thresholds (as defined for Category 1)[3]:

a) Downlink data rate ≥ 1000 Mbps
b) Uplink data rate ≥ 200 Mbps
c) IP packet error ratio (Y.1540) ≤ 0.05%
d) IP packet loss ratio (Y.1540) ≤ 0.0025%
e) Round-trip IP packet delay (RFC 2681) ≤ 10 ms
f) IP packet delay variation (RFC 3393) ≤ 2 ms
g) IP service availability (Y.1540) ≥ 99.9% per year.

Criterion 4 – Performance thresholds for wireless networks

Any wireless electronic communications network capable of providing, during busy-hour periods, end-user services with performance parameters not lower than the following thresholds (as defined for Category 2):

a) Downlink data rate ≥ 350 Mbps
b) Uplink data rate ≥ 50 Mbps

[1] A network that qualifies as a Very High-Capacity Network under Criterion 1 does not necessarily meet Criterion 3.
[2] A network that qualifies as a Very High-Capacity Network under Criterion 2 does not necessarily meet Criterion 4.
[3] For Criteria 3 and 4, in order to qualify as a Very High-Capacity Network, it is sufficient that a network (without requiring further investment) is capable of providing a service that meets Performance Threshold 1 in the case of a fixed connection, or Performance Threshold 2 in the case of a wireless connection. Accordingly, it is not necessary for the network to actually provide such a service, nor is it required that all services offered by the network meet Performance Threshold 1 or Performance Threshold 2.

c) IP packet error ratio (Y.1540) ≤ 0.01%
d) IP packet loss ratio (Y.1540) ≤ 0.01%
e) Round-trip IP packet delay (RFC 2681) ≤ 18 ms
f) IP packet delay variation (RFC 3393) ≤ 5 ms
g) IP service availability (Y.1540) ≥ 99.9% per year.

2.5 Electronic communications undertakings whose networks are classified as Very High-Capacity Networks (VHCN) under Criteria 3 or 4 shall be required to carry out network performance testing and measurements in order to verify compliance with the applicable performance thresholds, as appropriate.

2.6 Performance parameters for Categories 1 and 2 shall be measured from the user's terminal equipment to the first interconnection point of the undertaking's network with another public electronic communications network (peering point). For round-trip performance parameters, the measurement shall cover the entire communication path, from the user's terminal equipment to the interconnection point and back to the same terminal equipment.

2.7 The data transmission speed for the performance thresholds of Category 1 shall be defined at the IP packet payload level, excluding protocol overhead information.

2.8 The data transmission speed for the performance thresholds of Category 2 shall be defined at the transport layer payload level, excluding communication protocol overhead.

2.9 Data transmission speed thresholds for Category 1 performance shall be measured at the Network Termination Point (NTP) at the end-user/subscriber premises, such as, where applicable, the access interface via copper or coaxial cable.

2.10 Where the distance between the end-user terminal equipment and the first interconnection point of the undertaking's network with another public electronic communications network (peering point) significantly exceeds typical transmission distances, for example several hundred kilometers, the maximum permissible IP packet round-trip delay threshold may be increased by 1 (one) millisecond for every additional 100 (one hundred) kilometers of distance.

2.11 The performance thresholds for Category 2 shall apply only to outdoor locations and shall be assessed based on average values measured within the relevant coverage area.

2.12 Events of an exceptional nature and force majeure circumstances beyond the reasonable control of the network operator shall be excluded from the calculation of IP service availability, including cases of force majeure.

2.13 The performance thresholds for Categories 1 and 2 refer to the Quality of Service (QoS) achievable for the end-user, based on the highest-performing technology available in the network, in accordance with the provisions set out in point 2.4.2 of this Guideline.

III. QUALITY OF SERVICE (QoS)

3.1 As the Quality of Service (QoS) may vary among end-users due to access line characteristics, electromagnetic interference, network noise, and other technical factors, the performance thresholds for Categories 1 and 2 shall be determined on the basis of the

average Quality of Service typically experienced by end-users under normal network operating conditions.

3.2 In the assessment and calculation of average Quality of Service indicators, temporary effects caused by atmospheric or meteorological conditions, which may affect the performance of the wireless connection between the end-user's terminal equipment and the electronic communications network, shall not be taken into account.

3.3 The performance thresholds for Categories 1 and 2 shall be determined on the basis of the key Quality of Service (QoS) parameters, including data transmission bandwidth (download/upload), service availability and reliability, error-related parameters and packet loss, as well as latency and latency variation (jitter) parameters.

3.4 Quality of Service (QoS) parameters defined for the performance thresholds of Categories 1 and 2:

a) shall apply to any electronic communications network that is classified, or is intended to be classified, as a Very High-Capacity Network (VHCN), regardless of whether it is operational or in the planning and development phase;
b) shall be based on IP protocol transmission parameters, with the exception of data transmission speed parameters for download and upload services;
c) shall be assessed on an end-to-end basis and shall apply to the entire network segment involved in the provision of the service;
d) shall be based on Round-Trip IP Packet Delay parameters, in accordance with RFC 2681, and IP Packet Delay Variation parameters, in accordance with RFC 3393;
e) shall be based on the IP Packet Error Ratio and the IP Packet Loss Ratio, in accordance with ITU-T Recommendation Y.1540;
f) shall be based on IP Service Availability, in accordance with ITU-T Recommendation Y.1540, measured over a one-year reference period.

3.5 Electronic communications undertakings subject to categorization in accordance with the provisions of Section II, point 2.2, shall be required to complete and submit to AKEP, respectively:

3.5.1. Undertakings falling within the scope of point 2.2, subpoints (a) and (b), shall complete the questionnaires set out in Annex 1 to these Guidelines, for the purpose of identifying and recording very high-capacity networks (VHCN).

3.5.2. Undertakings falling within the scope of point 2.2, subpoint (c), shall submit a self-declaration on the status and coverage of FTTH and FTTS networks.

The information required under points 3.5.1 and 3.5.2 shall be submitted to AKEP once a year, by 31 January of the year following the reporting year.

3.6 In the application and assessment of Criteria 1 to 4 set out in this Guideline, AKEP shall take into account the following:

According to Criterion 1:

a) Any electronic communications network providing fixed-line access shall be considered to meet Criterion 1 and qualify as a Very High-Capacity Network (VHCN) where fiber-optic infrastructure is deployed at least up to the building (Fiber-to-the-Building – FTTB). In such cases, no additional criteria are required to be met for classification under

Criterion 1.

b) Where fiber-optic infrastructure is deployed up to the building (FTTB), it is recommended that the technologies used within the in-building network segment are capable of supporting performance levels comparable to the technical potential of FTTx infrastructure.

c) Fixed networks in which fiber-optic infrastructure is deployed only up to a distribution node, and not up to the end-user's building, shall not be considered as meeting Criterion 1. However, such networks may be classified as Very High-Capacity Networks (VHCN) if they meet Criterion 3 as defined in this Guideline.

According to Criterion 2:

a) Any electronic communications network providing wireless access in which fiber-optic infrastructure is deployed up to the base station shall be considered to meet Criterion 2 and qualify as a Very High-Capacity Network (VHCN). In such cases, no additional criteria are required to be met for classification under Criterion 2.

b) Criterion 2 applies to wireless electronic communications networks. In this context, public mobile electronic communications networks in which fiber-optic infrastructure is deployed up to the base station shall be considered to meet this criterion. Furthermore, Criterion 2 may also be considered fulfilled by public local wireless networks (Public WLAN/Wi-Fi) where fiber-optic infrastructure is deployed up to the access point (AP).

c) Where fiber-optic infrastructure is deployed up to the base station or access point, it is recommended that the wireless access technologies used are capable of supporting performance levels corresponding to the technical potential of the fiber-optic infrastructure.

According to Criterion 3:

a) Any fixed electronic communications network capable of providing, even during peak traffic periods, the minimum levels of Quality of Service defined in the Category 1 performance thresholds shall be considered to meet Criterion 3 and shall qualify as a Very High-Capacity Network (VHCN).

b) The coverage area of a fixed-line access network shall be divided into homogeneous and technically identifiable sub-areas, such as multi-dwelling buildings, clusters of individual households, or areas served by the same access node. For each sub-area, compliance with the Category 1 performance thresholds shall be assessed. Where a sub-area meets these thresholds, the network segment serving that sub-area shall be considered to qualify as a Very High-Capacity Network (VHCN).

c) A sub-area shall be considered to meet Performance Threshold 1 where, during normal peak traffic periods, end-users in that area experience the minimum levels of Quality of Service defined in these thresholds, measured at the Network Termination Point (NTP) at the end-user premises. This assessment shall not take into account performance limitations or degradations arising from the user's terminal equipment, such as modems, routers, or other local network devices.

d) Criterion 3 shall apply in a technologically neutral manner and shall be applicable to any electronic communications network providing fixed access to end-users, regardless of the technology used.

e) A wireless network classified as a Very High-Capacity Network (VHCN) under Criterion 2 or Criterion 4, or both, may also be considered to meet Criterion 3 if it demonstrates

compliance with the performance thresholds defined for this criterion. In such cases, the wireless network may be considered functionally equivalent to a fixed Very High-Capacity Network.

According to Criterion 4:

a) Any electronic communications network providing wireless access and capable of delivering, during normal peak traffic periods, the minimum levels of Quality of Service (QoS) defined in the Category 2 performance thresholds shall be considered to meet Criterion 4 and shall qualify as a Very High-Capacity Network (VHCN).

b) For the purpose of classification as a Very High-Capacity Network (VHCN), it is sufficient that the network, without requiring additional infrastructure investment, is technically capable of providing a service that meets the Category 2 performance thresholds. Accordingly, it is not required that all services provided by the network meet these thresholds. However, in order to verify the existence of such capability, the undertaking shall conduct testing and measurements through a test service demonstrating compliance with the Category 2 performance thresholds.

c) The coverage area of a wireless access network shall be divided into homogeneous and technically identifiable sub-areas, such as, inter alia, the coverage areas of a base station or a group of base stations. For each sub-area, compliance with the Category 2 performance thresholds shall be assessed. Where a sub-area meets these thresholds, the network segment providing coverage to that sub-area shall be considered to qualify as a Very High-Capacity Network (VHCN).

d) A sub-area shall be considered to meet Performance Threshold 2 where, during normal peak traffic periods, end-users in outdoor environments experience, on average, the minimum levels of Quality of Service defined in these thresholds.

e) Criterion 4 shall apply in a technologically neutral manner and shall be applicable to any electronic communications network providing wireless access to end-users, including, inter alia, public mobile electronic communications networks, public local wireless networks (Public WLAN/Wi-Fi), and satellite networks.

IV FINAL PROVISIONS

4.1 AKEP shall review and, where necessary, update the technical criteria set out in this Guideline at least once every two years, taking into account the latest BEREC guidelines, technological developments, and the evolution of the electronic communications market.

4.2 This Guideline shall enter into force upon approval by the Steering Board of AKEP and shall be published on the official website: www.akep.al

ANNEX 1

Questionnaire for fixed network operators with fiber to the building (FTTB) and in-building copper twisted pair

Name of the company: Address: Contact (email):

1. What is the **achievable end-user QoS** (see Box 1 below) in your fixed network based on fiber to the **multi-dwelling building** and the deployment of the **most advanced access technology** (e.g. G.fast 212 MHz, or MGfast) on the in-building **twisted pair** with regard to the parameters a) to h) below (see next page)

   Please answer this question for two **scenarios** under the following **conditions**:

Scenario 1 (current situation)	**Scenario 2 (pilot deployment/field trial)**
(i) (i) Under usual peak-time[5] conditions;[4]	
(ii) For the service with the highest data rate (down+up) as currently provided in your network (based on fiber to the multi-dwelling building and the most advanced access technology on the in-building twisted pair)	(ii) For the service with the highest data rate (down+up) based on the most advanced access technology (e.g. G.fast 212 MHz , or MGfast) deployed in a pilot deployment or a field trial in your network (provided to the end-users which are currently subscribed to the service with the highest data rate from scenario 1)[5] This implies that the complete VDSL spectrum is used for G.fast, 212 MHz or MGfast.
(iii) The other services are provided with the same end-user QoS as it is currently the case.	
(iv) Limitations of the end-user QoS caused by the CPE[6] should not be taken into account.	

   Please provide **estimated values**[7] of the **achievable end-user QoS in peak-time** and since it depends on the circumstances of the individual end-users (e.g. loop length, copper quality) provide **typical values** (e.g. mean, range, no 'up to' values). Please provide such values for the following **QoS parameters** (see also Box 2 below):

[4] The peak-time is the time of the day with a typical duration of one hour where the network load usually has its maximum.

[5] Please assume that the end-users which use the service with the highest data rate currently provided in your network (scenario 1) now get the service with the highest data rate of the pilot deployment or field trial scenario 2) instead.

[6] Customer premises equipment

[7] Assessments based on your experience with G.fast 212 MHz or more advanced access technologies, e.g. data obtained from measurements, simulations or calculations. A line length of up to 100 m may be assumed for copper-pair networks using G.fast technology. These values serve as indicative references for network configurations and not as mandatory limits for the required distance. The operator shall provide actual data for the network being reported and document the methodology used to calculate the average distance, ensuring that the result reflects the actual network configuration.

QoS parameter	Scenario 1 Current situation	Scenario 2 Pilot deployment/ Field trial
a) Aggregated data rate[8] (Mbps)?		
b) Downlink data rate[9] (Mbps)?		
c) Uplink data rate (Mbps)?		
d) IP packet error ratio (Y.1540) (%)?		
e) IP packet loss ratio (Y.1540) (%)?		
f) Round-trip IP packet delay (RFC 2681) (ms)?		
g) IP packet delay variation (RFC 3393) (ms)?		
h) IP service availability (Y.1540) (% per year)?		

Box 1: Note to the "achievable end-user QoS"[10]:

The "**achievable data rate**" is the data rate which an end-user would typically measure with an internet speed test during peak-time6 in case of conditions (i) to (iv) listed above. The "achievable data rate" is not the average data rate of the real end-user traffic in the network during peak-time, 6 which depends on how end-users use their service.

Box 2: Note to the QoS parameters:

- The QoS parameters should be provided for the path from the **end-user** to the first point in the network where the traffic of the end-user services is **handed** over to other public networks (e.g. nearest peering point)[11] and in case of round-trip parameters back to the end-user.
- In case of the one-way parameters d), e), g) and h) the values should be as much as possible representative for both downlink and uplink. If this is not possible, then please provide the values separately for downlink and uplink.
- In case values cannot be provided for a certain QoS parameter, please provide values for a **comparable QoS parameter** and information on that parameter in particular the standard on which it is based on.

2. Parameters underlying your answers to question (2):

   a) On which access technology are your answers to question (2) based:

	Scenario 1	Scenario 2
(i) MGfast TDD (Yes/No)?		
(ii) G.fast 212 MHz (Yes/No)?		
(iii) Other access technology (Yes/No)? If Yes, which access technology?		

[8] Please provide, where possible, the transport layer protocol payload data rate or specify the OSI layer to which it refers and whether it refers to the payload or the gross bit rate.
[9] Please provide, where possible, the transport layer protocol payload data rate or specify the OSI layer to which the data rate refers and whether it refers to the payload or the gross bit rate.
[10] Please note that conditions (i)–(iv) listed above must be met cumulatively.
[11] If this is not possible, the values of the QoS parameters between the end-user and a centralized system may also be provided. In this case, please provide information about this centralized system.

b) On which frequency spectrum usage are your answers to question (2) based:

	Scenario 1	Scenario 2
What is the upper edge of the frequency spectrum used (e.g. 212 MHz, 424 MHz)?		
What is the lower edge of the frequency spectrum used (e.g. 2.2 MHz, 20 MHz)?		0 MHz (2.2 MHz)

c) On how many twisted pairs per service provided to the end-user (e.g. 1 pair, 2 bonded pairs) are your answers to question (2) based? Please report separately for Scenario 1 and Scenario 2 if the answer differs between them. On what typical (e.g. average) copper loop length are your answers to question (2) based (please report separately for Scenario 1 and Scenario 2 if the answer differs)?

d) On what typical (e.g. average) copper loop length are your answers to question (2) based? Please report separately for Scenario 1 and Scenario 2 if the answer differs between them.

e) What is the typical (e.g. average) copper loop attenuation value, expressed in decibels (dB), on which the values reported in question (2) are based? If the values differ between Scenario 1 and Scenario 2, please report them separately for each scenario[12].

f) What is the average distance between the end-user and the first interconnection point of the operator's network with other public electronic communications networks (peering point), where the end-user's service traffic is transferred to these networks?

g) On what IP packet size are your answers to questions (2)f) and (2)g) based:

(i) Round-Trip IP Packet Delay, according to RFC 2681?

(ii) IP Packet Delay Variation, according to RFC 3393?

h) On which other relevant parameters are your answers to question (2) based?

3. On which other relevant parameters are your answers to question (2) based?
4. What is the highest advertised data rate currently offered to end-users based on copper twisted pair access:
   a) In downstream direction?
   b) In upstream direction?
5. What is the status of the deployment of the technology according to question (3)a):
   a) Field trials (Yes/No)?
   b) Pilot deployment(s) (Yes/No)?
   c) Regular operation (Yes/No)?
6. Since when the technology according to question (3)a) has been deployed in your network?

[12] If you have provided QoS parameter values between the end-user and a centralized system (see footnote 6), please provide here information on the average distance between the end-user and the centralized syst

7. How many end-users are currently provided with services based on the technology according to question (3)a)?

   a) =< 1000 ?
   b) > 1,000 – 10,000 ?
   c) > 10,000 – 100,000 ?
   d) > 100,000 ?

Questionnaire for operators of a hybrid fiber coax (HFC) network with fiber rolled out up to the building

Name of the company: Address: Contact (email):

1. What is the **achievable end-user QoS**[13] (see Box 1 below) in your hybrid fiber coax (**HFC**) network with fiber to the **multi-dwelling building** and the deployment of the **most advanced access technology** (e.g. DOCSIS 3.1[14] or alternative MoCA Access technologies) in-building coax network with regard to the parameters a) to g) below (see next page)?

   Please answer this question for two **scenarios** under the following **conditions**:

Scenario 1 (current situation)	**Scenario 2 (pilot deployment/field trial)**
(ii) (i) Under usual peak-time[15] conditions;	
(ii) For the service with the highest data rate (down up) as currently provided in your HFC network (based on fiber to the multi-dwelling building and the most advanced access technology on the in-building coax network)	(ii) For the service with the highest data rate (down+up) based on the most advanced access technology (e.g. DOCSIS 3.1[1] or alternative MoCA Access technologies in a pilot deployment or a field trial in your HFC network (provided to the end-users which are currently subscribed to the service with the highest data rate from scenario 1).[16]
(iii) The other services are provided with the same end-user QoS as it is currently the case.	
(iv) Limitations of the end-user QoS caused by the CPE[17] should not be taken into account.	

   Please provide **estimated[18] values** of the **achievable end-user QoS in peak-time**[6] and since it depends on the circumstances of the individual end-users (e.g. length of the coax cable, coax quality) provide **typical values** (e.g. mean, range, no 'up to' values). Please provide such values for the following **QoS parameters** (see also Box 2 below):

[13] QoS parameters may be measured for 10 and 30 end-users per optical access node. These values serve as indicative references for network configurations and not as mandatory limits for the required distance. The operator shall provide representative data for the network being reported and document the methodology used to calculate the average distance, ensuring that the result reflects the actual network configuration.
[14] Or a combination of DOCSIS 3.1 and DOCSIS 3.0.
[15] Peak hour is the time of day, typically lasting one hour, during which network traffic usually reaches its maximum.
[16] Please assume that end-users currently using the service with the highest data rate available on your network (Scenario 1) now receive the service with the highest data rate of the pilot deployment or field trial scenario (Scenario 2) instead.
[17] Customer Premises Equipment (CPE).
[18] Assessments based on your experience with the most advanced DOCSIS technology, e.g. data obtained from measurements, simulations or calculations

QoS parameter	Scenario 1 Current situation	Scenario 2 Pilot deployment/ Field trial
a) Downlink data rate[19] (Mbps)?		
b) Uplink data rate[9] (Mbps)?		
c) IP packet error ratio (Y.1540) (%)?		
d) IP packet loss ratio (Y.1540) (%)?		
e) Round-trip IP packet delay (RFC 2681) (ms)?		
f) IP packet delay variation (RFC 3393) (ms)?		
g) IP service availability (Y.1540) (% per year)?		

Box 1: Note to the "achievable end-user QOS [20]
The "achievable data rate" is the data rate which an end-user would typically measure with an internet speed test during peak-time in case of conditions (i) to (iv) listed above. The "achievable data rate" is not the total capacity (data rate) of the DOCSIS technology and it is also not the average data rate of the real end -user traffic in the network during peak-time which depend on how end-users use their service

Box 2: Note to the QoS parameters:

- The QoS parameters should be provided for the path from the **end-user** to the first point in the network where the traffic of the end-user services is **handed over** to other public networks (e.g. nearest peering point)[21] and in case of round-trip parameters back to the end-user.

- In case of the one-way parameters c), d), f) and g) the values should be as much as possible representative for both downlink and uplink. If this is not possible, then please provide the values separately for downlink and uplink.

- In case values cannot be provided for a certain QoS parameter, please provide values for a **comparable QoS parameter** and information on that parameter in particular the standard on which it is based on.

2. Parameters underlying your answers to question (2):

   a) On which access technology are your answers to question (2) based (please report separately for downlink and uplink, if the answer differs):

[19] Please provide, where possible, the transport layer protocol payload data rate or specify the OSI layer to which the data rate refers and whether it refers to the payload or the gross bit rate.
[20] Please note that conditions (i)–(iv) listed above must be met cumulatively.
[21] If this is not possible, the values of the QoS parameters between the end-user and a centralized system may also be provided. In this case, please provide information about this centralized system.

	Scenario 1	Scenario 2
(iv) DOCSIS 4.0 (Yes/No)?		
(v) DOCSIS 3.1 (Yes/No)?		
(vi) A combination of DOCSIS technologies (e.g. DOCSIS 3.1 and 3.0) (Yes/No)? If Yes, which DOCSIS technologies?		
(vii) Other access technology (Yes/No)? If Yes, which access technology?		

b) How large is the total DOCSIS spectrum usage (in MHz) on which your answers to question (2) are based (please see footnote 13):[22]

	Scenario 1	Scenario 2
In downstream direction?		
In upstream direction?		

c) On which QAM[23] modulation (e.g. 256 QAM, 4096 QAM) are your answers to question (2) based (if your answers to questions (2) are based on a combination of DOCSIS technologies, e.g. DOCSIS 3.1 and DOCSIS 3.0, please provide the QAM modulation for each DOCSIS technology separately):

	Scenario 1	Scenario 2
In downstream direction?		
In upstream direction?		

d) On how many end-users per multi-dwelling building (on average) to whom a service is provided are your answers to question (2) based?

e) On how many end-users in the multi-dwelling building (on average) who share the same coax resources are your answers to question (2) based?

f) On what typical (e.g. mean) length of the coax cable (between optical access node[24] and end-user) are your answers to question (2) based?

g) What is the average distance between end-user and the first point in the network where the traffic of the end-user services is handed over to other public networks (see note to the QoS parameters above)?[25]

[22] The total DOCSIS spectrum usage (in MHz) on which your answers to question (2) are based is the number of channels used for DOCSIS technology (in the downstream/upstream direction) multiplied by the DOCSIS channel bandwidth (in the downstream/upstream direction). For example, if DOCSIS technology uses two channels with a bandwidth of 192 MHz in the downstream direction, the total downstream DOCSIS spectrum is 394 MHz (= 2 × 192 MHz). If your answers to question (2) are based on a combination of DOCSIS technologies (e.g. DOCSIS 3.1 and DOCSIS 3.0), the total DOCSIS spectrum usage (in MHz) is the sum of the total spectrum usage (downstream/upstream) for each DOCSIS technology.

[23] Quadrature Amplitude Modulation (QAM).

[24] The optical access node is the node where the fiber-based network terminates and the coaxial-based access network begins (viewed in the downstream direction).

[25] If you have provided QoS parameter values between the end-user and a centralized system (see footnote 5), please provide here information on the average distance between the end-user and the centralized system.

h) On what IP packet size are your answers to questions (2)e) and (2)f) based:
   (iii) Round-trip IP packet delay (RFC 2681)?
   (iv) IP packet delay variation (RFC 3393)?

i) On which other relevant parameters are your answers to question (2) based?

3. What is the highest advertised data rate currently offered to end-users based on coax access:
   a) In downstream direction?
   b) In upstream direction?
4. What is the status of the deployment of the technology according to question (3)a):
   a) Field trials (Yes/No)?
   b) Pilot deployment(s) (Yes/No)?
   c) Regular operation (Yes/No)?
5. Since when the technology according to question (3)a) has been deployed in your network?
6. How many end-users are currently provided with services based on the technology according to question (3)a)?
   a) =< 1000 ?
   b) > 1,000 – 10,000 ?
   c) > 10,000 – 100,000 ?
   d) > 100,000 ?