Malaysian Communications and Multimedia Commission
Suruhanjaya Komunikasi dan Multimedia Malaysia

Public Inquiry Report

Review of the Mandatory Standards for Quality of Service (Wireless Broadband Access Service) – Determination No.2 of 2021

20 December 2023

This Public Inquiry Report was prepared in fulfilment of Sections 61 and 65 of the Communications and Multimedia Act 1998

Content

1. Summary of the Public Inquiry

1.1. Introduction

1.1.1. The Mandatory Standards for Quality of Service ("MSQoS") for Wireless Broadband Access Service encompass two main aspects; the performance of data delivery over internet protocol and the perceived quality of experience (QoE) for consumers. This review specifically delves into the performance evaluation of mobile broadband systems for 4G and 5G networks within Malaysia.

1.1.2. The Public Inquiry ("PI") concerning the revised MSQoS prioritizes network performance parameters identified by the Malaysian Communications and Multimedia Commission ("MCMC") as pivotal for enhancing end-user experience and enabling more effective monitoring of network capacity, ultimately aiming for improved service delivery.

1.1.3. Notably, the revised MSQoS establishes two sets of Key Quality Indicators ("KQI") which are the "Mandatory KQI" and the "Monitoring KQI". The Mandatory KQI monitors and enforces the parameters in the standards, while the Monitoring KQI monitors the parameters for improvement purpose. Generally, the Monitoring KQIs apply specifically to 5G network operating in the IMT frequency band 703 MHz to 743 MHz, 3.4 GHz to 3.6 GHz and 26.6 GHz to 28.1 GHz, which are currently undergoing migration from Single Wholesale Network ("SWN") to Dual Network model.

1.1.4. The proposed revisions in the MSQoS seek to guide the industry towards delivering enhanced QoS and QoE to the consumers. These revisions draw inspiration from benchmarks set by national regulatory authorities ("NRA") in various countries, aiming to fortify and streamline the QoS framework to accommodate present and future technologies. The revised MSQoS will take effect upon the revocation of the existing MSQoS.

1.2. Public Inquiry Exercise

1.2.1. In the PI issued on 3rd October 2023, the MCMC outlined the proposed QoS, QoE and network performance parameters pertaining to:

i. Revision on the interpretation part of the standards;
ii. Introduction and revision of the QoS, QoE and network performance parameters, measurement, standards, and notification; and
iii. Revision of the applicable guidelines.

1.2.2. The PI invited feedback from the public and relevant stakeholders on MCMC's proposed standards. The PI specifically sought comments for all proposed revisions and the general views of the standards.

1.2.3. At the conclusion of the PI period, which ended at 12 noon on 21st November 2023, MCMC received eight (8) submissions from the following parties:

No.	Submitting Parties
1	CelcomDigi Berhad ("CelcomDigi")
2	Maxis Broadband Sdn Bhd ("Maxis")
3	U Mobile Sdn Bhd ("U Mobile")
4	Redtone Engineering & Network Services Sdn Bhd ("Redtone")
5	Digital Nasional Berhad ("DNB")
6	Rohde & Schwarz Malaysia Sdn Bhd ("RSMY")
7	TM Technology Services Sdn Bhd ("TM Tech")
8	YTL Communications Sdn Bhd ("YTLC")

Table 1: List of respondents to the PI

1.2.4. MCMC considered these eight submissions where summary of comments and suggestions are outlined in this report. The PI Report is presented within the 30-day requirement from the closing date of submissions, as stipulated under section 65 of the Communications and Multimedia Act 1998 ("CMA98").

1.2.5. MCMC proposes to issue a Commission Determination that will reflect the Commission's final views expressed in this PI Report in respect to the MSQoS for Wireless Broadband Access Service.

1.3. Structure of the PI Report

1.3.1. The remainder of this PI Report is structured to provide context for MCMC's questions for comments, as follows:

i. Section 2 provides the summary of input received on the proposed changes and the Commission's final views; and
ii. Section 3 highlights the way forward.

1.3.2. In the context of this PI, the terms "download throughput" or "upload throughput" may be used interchangeably with "download speed" or "upload speed".

2. Public Inquiry Input & Commission's View

2.1. Revision on the Interpretation Part of the Standards

QUESTION 1: THE COMMISSION SEEK VIEWS ON THE INTERPRETATION PART OF THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).

Submitting Party	Comments
CelcomDigi	Agrees with the proposal, with comment for the definition to align with ITU standards.
Maxis	Proposes for the following definition to be interpreted clearly: • "ASP" means Applications Service Provider. • "FWA" means Fixed Wireless Access. • "HTTP" means Hypertext Transfer Protocol. • "IMT" means International Mobile Telecommunications. • "NSP" means Network Service Provider. • "POI" means Point of Interconnection. • "PRB" means Physical Resource Block.
U Mobile	Agrees with the terms used which are consistent with ITU standards of interpretation.
Redtone	No comment provided.
TM Tech	Proposes to include the following definition: • National POI to include any location within the Klang Valley and not limited to MYIX. • Description of test location. • Term "force majeure" to be properly defined and clarified whether referring to an "event beyond control" or "act of god".
DNB	Propose to remove "Klang Valley" from the test server interpretation.
YTLC	Propose to revise "end user" interpretation to "a person who subscribes to or uses a wireless broadband access service and includes customer".
RSMY	No comment provided.

Table 2: Response on interpretation part

Commission's View

- The definition used in the revised MSQoS is based on International Telecommunications Union (ITU) standards and the CMA98.

Conclusion:

- The Commission is of the view that the definition used which are based on ITU and the CMA98 will be maintained.

2.2. Revision on the QoS Standards

2.2.1. **Download Throughput**

QUESTION 2:	**THE COMMISSION SEEK VIEWS ON THE PROPOSED STANDARD ON DOWNLOAD THROUGHPUT FOR THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).**

Technology	**Proposed KQI**	**Mandatory / Monitoring**
• 4G or 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Download throughput for each location measured shall be at or not less than: i) 7.7 Mbps until 31 December 2024; and ii) 10.0 Mbps from 1 January 2025 onwards, averaged based on all test sample.	Mandatory
• 5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Download throughput for each location measured shall be at or not less than 100 Mbps, averaged based on all test sample.	Monitoring
• 4G and 5G (all allocated IMT frequency bands, for a specific area)	Download throughput for each state and federal territories for all technology (4G and 5G) shall be at or not less than 50 Mbps, averaged based on all test sample measured for each quarter.	Mandatory

Table 3: Proposal for download throughput KQI

Submitting Party	**Comments**
CelcomDigi	• Disagrees with the proposal and proposed that the average download throughput for each location shall be at or no less than 5 Mbps applied within coverage area from 2024 onwards, and to remove the average 10 Mbps download throughput from 1 January 2025 onwards. • Propose to defer the download throughput per state and federal territories, and 5G download speed monitoring until 5G dual network has matured. • The reference to the Germany consultation report is applicable within mixed technology of 4G and 5G. Thailand regulated download speed of 2.5 Mbps for 4G and 5 Mbps for 5G network while no QoS requirement for Singapore.

	• The proposed download speed of 5 Mbps is sufficient for 1080p videos on mobile device screen as there is no perceptible difference between 1080p and 4K resolution. • In addition, 5 Mbps download speed is also sufficient for good mobile gaming experience, emails, music streaming, web browsing and video streaming. • A minimum of 100 MHz bandwidth is recommended for robust 5G performance. The 700 MHz band with 40 MHz bandwidth may not meet the requirement. At present, 700 MHz serves as an anchor band for the 5G non-standalone (NSA).
Maxis	• Disagrees with the proposal and proposed the download throughput for 4G service to be set at least 5 Mbps by static test at a location declared in the coverage map. • Proposes to defer the download throughput per state and federal territories for all technology until the 5G penetration reaches the target set by the dual networks, e.g., 80% population coverage. • Download speed of 5 Mbps is sufficient to support full HD video streaming and other common OTT applications. Furthermore, video codec will continue to improve, resulting in lower throughput requirements for the same video quality. • In Germany, more spectrum was allocated to the service providers and without technology restriction. Therefore, higher standards are set. • Malaysian leading MNOs have significantly less spectrum compared with those in other countries, thus poses a challenge to cater for future data growth. • Malaysia just started the 5G service in 2022-2023. Therefore, it is still premature to start measuring and enforcing for 5G service. The countries benchmark by MCMC started 5G service earlier, for example Germany and Thailand started 5G rollout since 2019.
U Mobile	• Disagrees with the proposal and proposed to maintain existing 2.5 Mbps download throughput standard for 4G. • Propose to defer download throughput for all technologies per state and federal territories and the 5G monitoring until the 5G dual network reaches full maturity of deployment. • Mobile operator in Germany has reached 75% to 80% coverage population and utilized 700 MHz, 2100 MHz and 3600 MHz spectrum for 5G. • The requirement for 5G monitoring applies only to 5G SWN as the spectrum owner is the only one that has visibility on their radio network and backhaul planning. • It is unreasonable to include 5G measurement as mandatory for download throughput for each state and federal territories since 5G is set as monitoring indicator.

Redtone	• Disagrees with the proposal and recommends maintaining the baseline of 2.5 Mbps. • Proposed to defer 5G download throughput per location requirement until finalization on 5G dual network.
TM Tech	• Disagrees with the proposal and proposed to retain existing 2.5 Mbps download throughput standard. • Propose to defer download throughput for each state and federal territories for combined technology until 5G penetration more than 50%. • Substantial investment over the next 3 years will be required to achieve the proposed download throughput of 7.7 Mbps in 2024 and 10 Mbps by 2025. • The industry's current priority is to strengthen 5G coverage and availability and to increase 5G subscription. • Currently there are constraints in carrier aggregation for LTE FDD band 5, TDD band 38 and 40. Due to significant difference in the frequency ranges and not harmonized, effective aggregation is technically challenging. • LTE enabled device, including smartphone and network equipment might not support carrier aggregation between divergent LTE bands.
DNB	• Agrees with the download throughput of 50 Mbps for each state and federal territories proposal. • In the event service providers unable to achieve 50 Mbps download throughput and claim that it is due to 5G access provider, service providers should provide relevant information. • Suggests increasing the minimum sample size to ensure the target can be achieved with sufficient samples.
YTLC	• Disagrees with the proposal and proposed to retain existing download throughput of 2.5 Mbps. • The review shall be made once the 5G network has matured. Emphasis should be on encouraging users to use 5G service. • Latest 5G coverage has exceeded 70%, however the uptake is only 5.7% from the total mobile broadband subscribers. • Current MSQoS was implemented only 2 years ago and shown positive impact with the reduction of complaints by 65% in 2022 from 2021. • Spectrum imbalances should be addressed before revision of new MSQoS since it is the key factor for broadband throughput.
RSMY	• Proposes to replace average throughput with 10^{th} and 90^{th} percentile throughput, or percentile value between 50^{th} to 90^{th} or median value. • To apply weightage for test locations according to population density. • Download throughput of 100 Mbps for 5G monitoring is only applicable for 26.5 GHz to 28.1 GHz due to bandwidth limitation.

Table 4: Response to download throughput KQI

Commission's View

4G Download Throughput (per location):

- Germany standards are based on the study conducted to find the minimum internet speed threshold, required for common user applications regardless of the type of access network. The requirements set in the study include services such as emails, search engines, education online tools, online newspaper, online shopping, job searching tools, professional networking, internet banking, eGovernment services, social media and video calls. The study concludes that download speed of 7.7 Mbps is the minimum service criterion. However, Bundesnetzagentur (Germany NRA) has opted to adopt 10 Mbps as the minimum requirement for download speed.

- This coincides with the Commission's objective to improve the consumers' minimum internet access quality and close the gaps in "Consumer Satisfaction Index" which was found based on the "Broadband QoE Survey" conducted by the Commission.

- The proposed standard was also based on benchmarking other national NRA. The Federal Communication Commission (FCC) of the United States for example, has published the "Broadband Speed Guide" which states that minimum download speed for streaming HD video is between 5 – 8 Mbps and HD video teleconferencing requires 6 Mbps.

- In addition, based on the on-field measurements conducted by MCMC, in order to ensure good QoS and QoE to the end user, the download speed between 6-8 Mbps is required. This supports the study mentioned above and explains why other regulators are adopting higher download speeds for instance Germany and South Africa.

- The 4G networks are highly relied upon for voice services. As Malaysia completed the 3G shutdown, consumers are now relying on Voice over LTE (VoLTE) for voice services which are delivered via 4G network.

- The Commission is anticipating that 4G traffic will still be dominant over the next 3 to 5 years until a higher 5G adoption rate is achieved. As of Oct 2023, 5G adoption rate in Malaysia is at 10.8%. Based on the GSMA Mobile Economy 2023 Report, the 5G subscriber penetration rate in Asia Pacific will reach 71% by 2030. As such, investment in improving 4G network quality is still relevant and necessary for the next several years.

5G Download Throughput (per location):

- The 5G standards are considered under the Monitoring KQI considering the transition from SWN to dual network.

- The proposed 5G download speed is aligned with the ITU-R M.2083 recommendation and the license conditions.

Download Throughput for 4G and 5G (per area)

- The combined 4G and 5G is to ensure that consumers are able to enjoy better mobile broadband experience in a defined area.

- In addition, the combination of 4G and 5G download throughput measurement would spur the 5G deployment and ensure a smooth transition from SWN to dual network.

Others:

- The proposed measurement methodology and calculation in the PI are aligned with MCMC's objective to meet user expectation.

Conclusion:

- The Commission is of the view that the proposed download throughput KQI to be included in the MSQoS without any changes to the standards and methodology.

2.2.2. **Upload Throughput**

QUESTION 3: THE COMMISSION SEEK VIEWS ON THE PROPOSED STANDARD ON UPLOAD THROUGHPUT FOR THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS

Technology	**Proposed KQI**	**Mandatory / Monitoring**
• 4G or 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Upload throughput for each location measured shall be at or not less than: (i) 1.0 Mbps until 31 December 2024; and (ii) 1.3 Mbps from 1 January 2025 onwards, averaged based on all test sample.	Mandatory
• 5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Upload throughput for each location measured shall be at or not less than 5 Mbps averaged based on all test sample.	Monitoring

Table 5: Proposal for upload throughput KQI

Submitting Party	Comments
CelcomDigi	• Disagrees with the proposal and proposed to change the upload throughput standard from mandatory to monitoring. • Proposes to defer 5G upload throughput monitoring until 5G dual network matured. • Upload throughput requirement is a new initiative that requires real-time data and network assessment, therefore needs to establish a defined time frame during the monitoring phase. • 5G upload throughput performance is unclear due to the sole operation by DNB.
Maxis	• Disagrees with the proposal and proposed the 4G service upload throughput to be set as monitoring. • Proposes to defer related 5G upload throughput measurement until 5G dual networks achieve 80% population coverage. • There is no historical data on upload throughput measurement based on FTP testing. Hence, unable to commit to the proposed upload throughput by MCMC.
U Mobile	• Disagrees with the proposal and proposed to exclude upload throughput from the mandatory requirement. • Majority of the traffic is from the download direction, and upload issues are often related to third party server.
Redtone	• Disagrees with the proposal and proposed to defer the implementation of 4G upload as mandatory requirement. • Proposes to defer 5G upload throughput requirement.
TM Tech	• Disagrees with the proposal and proposed to place the 4G upload throughput to monitoring. • Historical data during obtained during monitoring offers valuable insights on the network performance concerning upload throughput and potential areas for improvement.
DNB	• Disagrees with the proposal and proposed MCMC to adopt RAO target of 3 Mbps for NSA and 5 Mbps for SA for 5G upload throughput. • Traffic in 5G NSA for the initial implementation is carried in the dual connectivity operation using 4G (700 MHz) and 5G (3.5 GHz) radio access. If the upload traffic is using 700 MHz, it should not be subject to the same 5 Mbps upload target for SA.
YTLC	• Disagrees with the proposal and proposes that MSQoS should not be amended yet until 5G has been fully rolled out.
RSMY	• Proposes to replace average upload throughput with 10^{th} and 90^{th} percentile upload throughput, or percentile value between 50^{th} to 90^{th} or median. • To apply weightage for test locations according to population density.

Table 6: Response to upload throughput KQI

Commission's View

4G Upload Throughput (per location)

- The Commission has allocated all mobile network operators with spectrum in the coverage band and capacity band for nationwide deployment. The operators need to increase the number of sites and utilise all the spectrum that has been allocated to ensure good upload speed for the consumers.

- The upload speed measurement would encourage operators to deploy more low-band spectrum (i.e. sub-1GHz) to cater for user device limitations (transmit power, antenna gain) for indoors and remote areas.

- It is noted that deployment of low band in densely populated area may increase the possibility of inter-cell interference, which may affect service quality. However, the operators should be able to reduce the effects with proper planning, optimisation and control, and make good use of the allocated spectrum.

5G Upload Throughput (per location)

- 5G upload speed is to be in line with the 5G license condition and separated into 5G Non-standalone (SA) for not less than 3 Mbps and 5G Standalone (SA), for not less than 5 Mbps.

Others

- The proposed measurement methodology and calculation in the PI is aligned with MCMC's objective to meet user expectation.

Conclusion

- We are of the view that 4G Upload Throughput KQI to be included in the MSQoS under Monitoring KQI with the same threshold.

- We are of the view that 5G Upload Throughput KQI is separated into 5G NSA for not less than 3 Mbps and 5G SA, for not less than 5 Mbps.

2.2.3. **Latency**

QUESTION 4: THE COMMISSION SEEK VIEWS ON THE PROPOSED STANDARD ON LATENCY FOR THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).

Technology	Proposed KQI	Mandatory / Monitoring
• 4G or 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Latency should be at or not more than 100 ms measured between end user to the test server in Klang Valley averaged based on all test sample.	Mandatory
• 5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Latency should be at or not more than 40 ms measured between end user to the test server in Klang Valley averaged based on all test sample.	Monitoring

Table 7: Proposal for Latency KQI

Submitting Party	Comments
CelcomDigi	• Agrees with the proposal for latency shall be at or no more than 100 ms to test server in Klang Valley for test samples in West Malaysia for mandatory requirement. • Proposes latency shall be at or nor more than 150 ms to test server in Klang Valley for test samples in East Malaysia for mandatory parameter. • Proposes to defer latency for 5G monitoring requirement until 5G dual network matured. • Beside radio access, backhaul also contribute to latency performance, where many of them are managed by third party or NFP. The cross-ocean connectivity increases the latency especially packet data from Sabah and Sarawak. • The architecture of 5G NSA spans from 5G radio access network to the existing or upgraded core network, facilitated by the same transport network for 4G.
Maxis	• Agrees with the proposal for 4G latency of not more than 100ms based on static test conducted outdoor within the declared coverage and indoor within areas served by in-building coverage. • Proposes to defer latency for 5G monitoring requirement until the second 5G network roll-out achieves 80% population coverage.

U Mobile	• Disagrees with the proposal and proposed to maintain existing latency of not more than 150 ms for mandatory requirement. • Proposes to defer latency for 5G monitoring requirement until 5G dual network matured. • The reference made for Germany and Thailand also imposes latency of not more than 150 ms for their standard.
Redtone	• Disagrees with the proposal and proposed to maintain 4G latency of not more than 150 ms for 90% of the time.
TM Tech	• Agrees with the proposal on latency with condition to maintain the minimum download throughput of 2.5 Mbps. • Proposes to use test server in East Malaysia for testing in Sabah and Sarawak.
DNB	• Disagrees with the proposal and proposed MCMC to assess whether 40 ms latency requirement for 5G monitoring is feasible especially for locations in Sabah, Sarawak, Southern, Eastern and Northern regions. • Proposes to include provision for removal of areas or districts with long distance from the POI and require MNO's investment for regional POI. • Proposes latency measurement to be conducted from a test server located in the region or state, and to remove Klang Valley as the location of the server in the MSQoS.
YTLC	• Disagrees with the proposal and proposes that MSQoS should not be amended yet until 5G has been fully rolled out.
RSMY	• Proposes to use interactivity testing model listed in ITU-T G.1051 and install a TWAMP service inside the test server. • Proposes to consider additional jitter or deviation parameter for latency measurement. • ICMP testing does not reflect real customer experience based on UDP traffic. • Measurement value to be based on median or 90th percentile instead of average. • To apply weightage for test locations according to population density.

Table 8: Response to Latency KQI

Commission's View

4G Latency (per location)

- The latency test methodology is designed to emulate real user traffic. The tests are directed towards Klang Valley because that is where most Content Delivery Networks (CDN) are located. Not all operators have regional core and CDNs in East Malaysia.

- The proposed standards take into consideration the Broadband QoE Survey and the gap analysis which include dissatisfaction with online gaming. Hence, there is a need to reduce network latency to close the gap.

5G Latency (per location)

- 5G network must be designed as flat network architecture to meet 5G standards.
- The latency KQI proposed has already taken into consideration the calculated fibre delay, submarine delay, network equipment, other transport, and air interface.
- The Reference Access Offer (RAO) of 5G SWN states the network latency from user device to the Point of Interconnection (POI) must be within 15 ms. With the additional fibre or subsea cable delay, from any regional POIs to the operators' core network in Klang Valley, the proposed standards should be able to be met.

Others

- The proposed measurement methodology and calculation in the PI is aligned with MCMC's objective to meet user expectation.

Conclusion

- The Commission is of the view that the Latency KQI to be included in the MSQoS without any changes to the standards and methodology.

2.2.4. **Packet loss**

QUESTION 5: THE COMMISSION SEEK VIEWS ON THE PROPOSED STANDARD ON PACKET LOSS FOR THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).

Technology	Proposed KQI	Mandatory / Monitoring
• 4G or 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Packet loss shall be at or not more than 0.5%, measured between end user to the test server in Klang Valley.	Mandatory
• 5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Packet loss shall be at or not more than 0.25%, measured between end user to the test server in Klang Valley.	Monitoring

Table 9: Proposal for Packet Loss KQI

Submitting Party	Comments
CelcomDigi	• Agrees with the proposal as the requirement remain unchanged from current standard. • Proposes to defer packet loss for 5G monitoring until dual network matured.
Maxis	• Agrees with the proposal to maintain current standard for 4G service. • Proposes to defer 5G measurement until the second 5G network roll out achieve 80% population coverage.
U Mobile	• Agrees with the proposal to maintain current standard for 4G service. • Proposes to defer 5G packet loss requirement until dual network matured.
Redtone	• Proposes to maintain current standard for 4G service of 0.5% based on test samples. • Proposes to defer 5G packet loss requirement to allows for a thorough evaluation of the measurement criteria.
TM Tech	• Proposes to maintain current standards on packet loss.
DNB	• No comment.
YTLC	• Disagrees with the proposal and proposes that MSQoS should not be amended yet until 5G has been fully rolled out.
RSMY	• Proposes to use interactivity test as in the proposal for latency test. • Proposes to include packet arriving later than the delay budget in the packet loss calculation. • Proposes to use median or 90th percentile value instead of average. • To apply weightage for test locations according to population density.

Table 10: Response to Packet Loss KQI

Commission's View

4G Packet Loss (per location)

- The packet loss standard for 4G is retained from existing standards.

5G Packet Loss (per location)

- The packet loss for 5G is aligned with the 5G license condition.

- All 5G KQI is already proposed to be under Monitoring KQI.

Conclusion

- We are of the view that packet loss KQI to be included in the MSQoS without any changes to the standards and methodology.

2.2.5. HTTP Session Time (Web browsing)

QUESTION 6: THE COMMISSION SEEK VIEWS ON THE PROPOSED STANDARD ON HTTP SESSION TIME (WEB BROWSING) FOR THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).

Technology	Proposed KQI	Mandatory / Monitoring
• 4G or 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	HTTP session time for each location measured shall be at or not more than 5 seconds averaged based on all test sample.	Mandatory
• 5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	HTTP session time for each location measured shall be at or not more than 5 seconds, averaged based on all test sample.	Monitoring

Table 11: Proposal for HTTP session time (web browsing) KQI

Submitting Party	Comments
CelcomDigi	• Disagrees with the proposal and proposed to remove HTTP session time for web browsing measurement from the mandatory and monitoring requirement. • The assessment of download and upload throughput, latency and packet loss serve as a comprehensive evaluation for QoS and QoE. • Web browsing access time is influenced by factors beyond network providers control such as content server performance, website design and user device. • Monitoring specific aspects like web browsing access time sessions might provide a limited presentation of the overall user experience.
Maxis	• Supports the proposed standard for 4G networks but proposes for the standard to be set as monitoring for 4G service and to defer the measurement for 5G service until the second 5G network roll out achieves 80% population coverage. • Maxis is not in control of the design and production of the content consumed by the end user, and these contents are not hosted on the Maxis network for efficient delivery. • Some factors impacting the measurements are end user's device, available hardware resources, network infrastructure, offered service or applications, etc.

U Mobile	• Disagrees with the proposal and proposed to exclude HTTP session time web browsing measurement from the mandatory and monitoring requirement. • Current MSQoS parameters are sufficient for checking network performance.
Redtone	• Highlighted that the actual content is beyond the operator's control, whereby the network can be optimized for a better web browsing experience, but operator have no influence over the diverse content available on the internet. • Content of the websites or applications is managed by the respective content providers, not the network operators.
TM Tech	• Supports the proposal for HTTP session time for web browsing KQI but proposes that it be placed under monitoring until the next review by MCMC. • This will allow sufficient time for MNOs to enhance their transport layers and routing to international gateways and CDN services. • Proposes for MCMC to develop its own test webpage to ensure a controlled environment for measurement.
DNB	• No comment.
YTLC	• Disagrees with the proposal and proposes that MSQoS should not be amended yet until 5G has been fully rolled out.
RSMY	• Recommended to select two global websites with size less than 500KB, two local websites with size between 1000KB to 2000KB and have more than 40 resources, and one local website with size more than 2500KB and have more than 60 resources. • Proposes to use 1M fixed size downloaded within 5 seconds to simplify the test setting. • Proposes to apply weightage for test locations according to population density.

Table 12: Response to HTTP session time (web browsing) KQI

Commission's View

4G and 5G Web-browsing (per location)

- QoE test such as web browsing is slowly being implemented by several regulators. Aside from QoS KQIs, the QoE KQIs are an important indicator to gauge common user applications and improve user experience.

- The proposed web browsing KQI is aimed at closing the consumer satisfaction gaps, identified from the Commission's Broadband QoE Survey findings.

- The web browsing test will select 5 top consumer webpages to simulate real user experience. The measurement of QoE KQI will help to identify any improvement needed at the network back-end which is not directly measured using QoS.

Conclusion

- The Commission is of the view that web browsing KQI for 4G is proposed to be included in the MSQoS under Monitoring KQI for the 1st year to further study and collect more information. This KQI will be included as Mandatory KQI starting 2025 onwards with no change to the parameters.

- We are also of the view that 5G web browsing KQI will be included in the MSQoS without any changes.

2.2.6. **Video Streaming Access Time**

QUESTION 7: THE COMMISSION SEEK VIEWS ON THE PROPOSED STANDARD ON VIDEO STREAMING ACCESS TIME FOR THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).

Technology	Proposed KQI	Mandatory / Monitoring
• 4G or 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Video streaming access time for each location measured shall be at or not more than 6 seconds averaged based on all test sample.	Mandatory
• 5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Video streaming access time for each location measured shall be at or not more than 6 seconds averaged based on all test sample.	Monitoring

Table 13: Proposal for Video Streaming Access Time KQI

Submitting Party	Comments
CelcomDigi	• Proposes to remove the video streaming access time KQI from the mandatory and monitoring requirement. • Video streaming access time is influenced by various factors, including content delivery mechanisms, buffering strategies, and the efficiency of the video platform. • Monitoring download throughput provides a holistic view of the network's efficiency in handling data transfer, including video streaming.
Maxis	• Maxis supports the proposal for video streaming access time KQI for 4G service but proposes for the standard to be set as monitoring for 4G service and to defer the measurement for 5G service until the second 5G network roll out achieves 80% population coverage. • The location of the content server and popularity of the

	video streamed may impact the access time along with the end user's device memory and processing capability.
U Mobile	• Disagrees with the proposal and proposed to exclude video streaming access time measurement from the mandatory and monitoring requirement. • Current MSQoS parameters are sufficient for checking network performance.
Redtone	• Highlighted that network operators are already measuring and addressing QoS parameters. • Content availability during video streaming is not within network operator's direct control and is managed by individual content providers.
TM Tech	• Disagrees with the proposal to make this KQI mandatory and proposes to place this KQI under monitoring with an agnostic video source approach. • The test shall take into account the diverse range of consumer devices with various 4K streaming capabilities.
DNB	• No comment.
YTLC	• Disagrees with the proposal and proposes that MSQoS should not be amended yet until 5G has been fully rolled out.
RSMY	• Proposes to include video MOS KQI to address the poor playback quality, which includes resolution, freezing and jerkiness. Video MOS less than 3 is considered bad and the typical value observed is above 3.6. • Video streaming, including video on demand requires periodic buffering, while live streaming requires a constant throughput to support smooth playing. • Proposes to use at least one live streaming clip to evaluate the network performance. • Proposes to use median instead of average value and to apply weightage for test locations according to population density.

Table 14: Response to proposal for Video Streaming Access Time KQI

Commission's View

4G and 5G Video Streaming (per location)

- Video streaming is one of the KQI that needs to be measured to improve user experience. This QoE KQI will help to identify any improvement needed at the network back-end which is not directly measured using QoS.

- The QoE measurement will enable the Commission to gauge user experience. The end goal is to increase consumers' satisfaction and closing the gaps that have been identified from the Commission's Broadband QoE Survey.

- The targeted video streaming resolution is full HD at 1080p, which is common video resolution on mobile devices and video streaming platforms.

- On-field measurements conducted by the Commission indicated around 7Mbps is enough to start streaming 1080p video in less than 6s. However, there are locations tested with good download speed, but poor video access time. Therefore, more time is needed to collect data and study the requirements.

Conclusion

- The Commission is of the view that video streaming KQI for 4G is proposed to be included in the MSQoS under Monitoring KQI for the 1st year for further study and collect more data. This KQI will be included as Mandatory KQI starting 2025 onwards with no change to the parameters.

- The Commission is also of the view that 5G video streaming KQI will be included in the MSQoS without any changes.

2.2.7. **Service Accessibility**

QUESTION 8: THE COMMISSION SEEK VIEWS ON THE PROPOSED STANDARD ON SERVICE ACCESSIBILITY FOR THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).

Technology	Proposed KQI	Mandatory / Monitoring
• 4G or 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	The service accessibility ratio for all download, upload, web browsing and video streaming measurement shall be at or not less than 90% for each location.	Mandatory
• 5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	The service accessibility ratio for all download, upload, web browsing and video streaming measurement shall be at or not less than 90% for each location.	Monitoring

Table 15: Proposal for Service Accessibility KQI

Submitting Party	Comments
CelcomDigi	• Proposes to remove service accessibility KQI from the mandatory and monitoring requirement. • The assessment for download and upload, latency and packet serve as a comprehensive evaluation of both QoS and QoE. • Access time measurements for video streaming and web browsing involve more subjective elements and dependencies on external factors. • Throughput measurements offers more comprehensive

	assessment and more applicable to assessing network performance.
Maxis	• Proposes to remove the service accessibility KQI for mandatory and monitoring requirement as other performance measurements of QoS and QoE are the direct contributing factors for service accessibility.
U Mobile	• Proposes to exclude service accessibility KQI from the proposed MSQoS for both mandatory and monitoring requirement.
Redtone	• Proposes to defer service accessibility testing as it duplicates existing testing process, such as download.
TM Tech	• Proposes to place service accessibility KQI under monitoring as this approach will facilitate accurate benchmarking and providing valuable insights until the next review by MCMC. • The combination of four different types of KQI into a single ratio obscures performance issues specific to individual services.
DNB	• No comment.
YTLC	• Disagrees with the proposal and proposes that MSQoS should not be amended yet until 5G has been fully rolled out.
RSMY	• Proposes session successful ratio for service accessibility, which means the success ratio of complete testing sessions from start to finish. • Proposes to apply weightage for test locations according to population density.

Table 16: Response to proposal for Service Accessibility KQI

Commission's View

4G and 5G Service Accessibility (per location)

- Service accessibility measures the successful attempts of all the measurements conducted. The purpose of having this standard is to ensure that any location tested that is unable to establish connection and initiate measurement data (due to poor coverage, quality or capacity), improvement and actions for these locations will be able to be executed.

- This will differentiate between operators who have good, poor or no access to the service at any particular location.

Conclusion

- The Commission is of the view that service accessibility KQI for 4G is proposed to be included in the MSQoS under Monitoring KQI for the 1st year to further study and collect more data. This KQI will be included as Mandatory KQI starting 2025 onwards with no change to the parameters.

- The Commission is also of the view that 5G service accessibility KQI will be included in MSQoS without any changes.

2.2.8. **Network Utilisation**

QUESTION 9: THE COMMISSION SEEK VIEWS ON THE PROPOSED STANDARD ON NETWORK UTILISATION FOR THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).

Technology	Proposed KQI	Mandatory / Monitoring
• 4G or 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Percentage of PRB utilisation per serving sector for each eNodeB and gNodeB shall be at or not more than 80.0% of every month and shall be rectified within 14 days.	Mandatory
	Percentage of each transport node utilisation shall be at or not more than 80.0% for every month and shall be rectified within 14 days.	
	Percentage of each core network utilisation shall be at or not more than 80.0% for every month and shall be rectified within 14 days.	
• 5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Percentage of PRB utilisation per serving sector for each gNodeB shall be at or not more than 80.0% of every month and shall be rectified within 14 days.	Monitoring
	Percentage of each transport node utilisation shall be at or not more than 80.0% for every month and shall be rectified within 14 days.	
	Percentage of each POI utilisation shall be at or not more than 80.0% for every month for each state and national and shall be rectified within 14 days.	
	Percentage of each core network utilisation shall be at or not more than 80.0% for every month and shall be rectified within 14 days.	

Table 17: Proposal for Network Utilisation KQI

Submitting Party	Comments
CelcomDigi	• Proposed to remove PRB utilisation, transport node utilisation and core network utilisation from Mandatory KQI and remove PRB utilisation, transport node utilisation, POI uitilisation and core network utilisation from monitoring KQI.

	• High PRB utilisation does not necessarily equate to low throughput for users, while certain spikes in PRB utilisation may not accurately represent the actual user experience. PRB utilisation needs to be considered within the broader context of network conditions, user demands, the effectiveness of Radio Resource Management (RRM) strategies. eNBs are presently equipped with Automatic Congestion Handling to alleviate congestion, therefore enhancing network performance and user experience. • Transport network employ mix of technologies, including fiber optics, microwave links and satellite communication. Establishing a fixed standards for transport utilisation may not consider the dynamic nature of network loads and variations in protocols, potentially leading to requirements that do not align with the operational realities of transport networks. • Core network was designed to meet highest utilisation or availability including geo-redundancy. Core network conditions can vary dynamically, and monitoring may not provide any real time insights into the actual user experience. Simplifying monitoring by focusing on user-facing metrics reduces the complexity of the monitoring process and straightforward evaluation of network performance.
Maxis	• Proposed to remove PRB utilisation, transport (backhaul) utilisation and core network utilisation. • Maxis also proposed that 5G POI utilisation/availability standard to be set as monitoring and 5G related service standards to be reviewed only when both 5G networks have reached 80% populations coverage and the establishment of 5G Dual Network is clearer. • Transport aggregation and core networks are designed with reserve capacity and alternate routes to balance traffic and re-route in the event of failure. • Networks carry aggregated fixed and mobile traffic with shaping and scheduling mechanisms to manage bursty traffic. • High PRB utilisation may not necessarily represent low user throughput. The high utilisation could be due to temporary traffic spikes or temporary concurrent access at special events, hence, does not necessarily mean congestion, and such conditions may not require an upgrade which leads to unnecessary expenditure.
U Mobile	• Disagreed KQI for 4G and 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz) with the use of Busy Hour for PRB Utilisation and transport node utilisation calculation and

	benchmarking. • Proposed to keep current MSQoS 2021 standard for PRB Utilisation and transport node utilisation. • U Mobile also proposed to exclude core network utilisation since the network element seldom faces congestion issue. MNOs will report directly to MCMC if there is any issue in line with the Customer Service process. • To defer KQI for 5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz) for PRB utilisation, transport node utilisation, POI utilisation and core network utilisation.
Redtone	• Proposed to retain current MSQoS 2021 standard for PRB Utilisation and transport node utilisation while core network utilisation to be removed. • Redtone disagreed with duration of rectification for PRB utilisation, transport node utilisation and POI utilisation. Redtone propose average time is 8 weeks or more for duration of rectification.
TM Tech	• Proposed to maintain the current network utilisation standard of monthly average percentage of PRB utilisation per base station and backhaul utilisation for a duration of 3 months, which shall not be more than 80% and shall be rectified within reasonable timeline. • TM Tech also proposed to remove core network utilisation. **Physical Resource Block ("PRB") Utilisation** a. Operational Efficiency - PRB utilisation per sector will require additional resources to manage and analyse data. This may not be operationally efficient, especially when other network optimisation and maintenance tasks need to be prioritised. b. Challenging Timelines - To fulfil the per sector utilisation KQI, the rectification timeline will exceed the proposed duration. This extension is necessary as it includes studying and benchmarking the network, evaluating the cost of network improvement, exploring alternative solutions, and obtaining approvals through the governance process for the improvement plan. c. Data Management Challenges - Handling data from every sector across more than 5000 sites generates a massive volume of information. Storing, processing, and analysing this data requires sophisticated data management systems and tools. Managing such large datasets can be resource-intensive and may strain TM's existing data management infrastructure.

	• **Transport Utilisation** a. Operational Efficiency - The revision of this Transport utilisation KQI standard from per base station to each transport node utilisation will require more resources to manage and analyse data. This may not be efficient operationally, especially when other network optimisation and maintenance tasks need to be prioritised. b. Challenging Timelines - To fulfil each transport node utilisation KQI, the rectification timeline will exceed the proposed duration between 3 to 6 months for the microwave links. This extension is necessary as it includes studying and benchmarking the network, evaluating the cost of network improvement, exploring alternative solutions, and obtaining approval through the governance process for the improvement plan. c. Data Management Challenges - Handling data from every transport node across more than 5000 sites generates a massive volume of information. Storing, processing, and analysing this data require sophisticated data management systems and tools. Managing such large datasets can be resource-intensive and may strain TM's existing data management infrastructure. • **Core Network Utilisation** a. Focus on PRB & Transport Utilisation KQI - The KQI for PRB and backhaul utilisation are sufficient to address the network utilisation requirement. Core utilisation improvement will be implemented when necessary, ensuring minimum download throughput, latency and packet loss KQI are consistently met. Operational Efficiency - More resources are required to manage and analyse data for each core network elements in EPC. This may not be operationally efficient, especially when other network optimisation and maintenance tasks need to be prioritised.
DNB	• Disagreed with the proposal and proposed to grant extension of time for 5G technology for case-to-case basis. • PRB utilisation may require deploying new site to resolve congestion issue therefore require more time. • For transport utilisation, DNB leverage on other Access Provider for the fibre network therefore any rectification subject to SLA between DNB and access provider • POI utilisation DNB also leveraging POI from other Access Provider and the Access Seekers are responsible for their own POI.
YTLC	• Proposed to retain existing standard. MSQoS should be amended once 5G has been fully rolled out.
RSMY	• No comment

Table 18: Response to the proposal for Network Utilisation KQI

Commission's View

4G and 5G Network Utilisation

- Network utilisation is important to gauge the network performance and identify congestion in any part of the network including the Radio Access Network (RAN), transport network, POI and core network.

- In the case of high utilisation, operators would find the best solution for network improvement. Different solutions would be applied to different parts of the network or issues. Some solutions may take longer than others. Therefore, 14 days may not be sufficient to rectify all congestion issues.

Conclusion

- The Commission is of the view that the network utilisation shall take the average network utilisation of 1 busy hour of each day, over 1 month period, for all network elements (PRB, transport, POI and core). The busy hour will be based on the highest network resource utilised and the highest number of connected users. The network utilisation threshold of 80% will remain unchanged.

- The Commission is also of the view that operators shall submit a concrete plan with a reasonable timeline to the Commission within 14 days, for the improvement of any network element that did not comply with the standards.

2.2.9. Network Availability

QUESTION 10: THE COMMISSION SEEK VIEWS ON THE PROPOSED STANDARD ON NETWORK AVAILABILITY FOR THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).

Technology	Proposed KQI	Mandatory / Monitoring
• 4G or 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Percentage of network availability (access and aggregation) shall be at or not less than 99.50% for each quarter. Percentage of core network availability shall be at or not less than 99.97% for each quarter.	Mandatory
• 5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 –	Percentage of network availability (access and aggregation) shall be at or not less than 99.70% for each quarter.	Monitoring

3.6 GHz and 26.5 – 28.1 GHz)	Percentage of POI availability shall be at or not less than 99.97% for each quarter.	
	Percentage of core network availability shall be at or not less than 99.97% for each quarter.	

Table 19: Proposal for Network Availability

Submitting Party	Comments
CelcomDigi	• Agreed with network availability for 4G/5G Mandatory KQI with proposal to incorporate a provision allowing for the exclusion of failures attributed to third parties. • CelcomDigi proposed to remove core network availability parameter for 4G/5G Mandatory KQI. • CelcomDigi also proposed to defer network availability for 5G monitoring KQI until 5G dual network matured in 2026, to remove POI and Core network availability for 5G monitoring KQI. • Element beyond control which impact network availability should be considered for exclusion, including: a. force majeure or actions by third parties b. faults attributable to third parties, such as power outages, natural disasters, or site access. c. ad-hoc or planned maintenance and network upgrading works. • Core networks are designed with redundancy and over-provisioning to ensure high availability. Core network availability is often a subset of overall network availability. User experiences are influenced by factors beyond core network, including last-mile connections, transport networks and external interference. Isolating core network availability may not provide an accurate representation of the entire service ecosystem. • Ongoing discussion between industry and DNB regarding POI availability, where the proposal is for West Malaysia POI architecture is 1+0 with geo redundancy, and 1+1 high-availability architecture in East Malaysia.
Maxis	• Maxis agreed to provide the access/aggregation network availability and proposed network availability to be monitored and to be set at not less than 99% on a quarterly basis. • Maxis acknowledged POI availability applies to the 5G Wholesale Network Provider and proposed 5G POI availability standard to be set as monitoring. • Maxis also proposed for 5G related service standards to be reviewed only when both 5G networks have reached 80%

	pop coverage and the establishment of 5G DN is clearer and standard for core network availability to be removed. • The measurement of the standard should have the following exclusions: a. Scheduled downtime or planned maintenance downtime b. Network outage at the sites which are not within Maxis' control such as MOCN by other MNOs, 5G by DNB. c. Health, safety and environment-related, e.g., weather condition that compromises safety of workers. d. Unavailability of power supply (i.e., power outage) provided by national supplier. e. Theft / vandalism of network components rendering a site inoperative. f. Site access-related issues caused by 3rd party including but not limited to authorities, landlords, site owners, public. g. Travel-time of sites located on islands or remote areas. h. Fiber cuts due to authority's work permit and other matters beyond Maxis' control i. Force majeure events
U Mobile	• Proposed to exclude network availability and core cetwork availability. MNOs will report directly to MCMC if there is any issue in line with the Customer Service process. • U Mobile also proposed to defer network availability, core network availability and POI availability from the proposed MSQoS.
Redtone	• Proposed to remove because the standard is duplicate with report under service downtime/unplanned service disruption & planned maintenance.
TM Tech	• Proposed to remove network availability (access and aggregation) and core network availability. • In Part C of MSQoS for Customer Service (Determination 4 of 2021), the MNOs are required to notify both MCMC and customers of the scheduled downtime (Clause 14) and unplanned service disruption (Clause 15). The notifications served as our commitment to quickly address the downtime, minimizing inconvenience for our valued customers and maintaining high standards. • Reporting disruptions and scheduled downtime to MCMC already gives a detailed view of the network's status. Service availability is closely connected to these events, making a separate KQI redundant. • Consolidating the overlapping KQI avoids unnecessary duplication of efforts and resources, allowing MNOs to focus on addressing actual service issues.

	• The availability of the Evolved Packet Core ("EPC") is paramount, serving as the foundation of mobile network infrastructure to maintain uninterrupted connectivity, dependable services, and a positive user experience. Recognizing the significant implications of EPC disruptions, TM has strategically implemented EPC redundancies as a pre-emptive measure, effectively mitigating the impact on service availability. • In the event of disruption, both MCMC and customers will be promptly notified in accordance with obligations outlined in Clause 14 and 15 of MSQoS Customer Service. Given the comprehensive nature of disruption reporting, introducing a separate KQI specifically for core network availability is deemed unnecessary. The existing reporting framework already encapsulates the essential information, ensuring an efficient, streamlined, and focused approach to maintaining network reliability and customer satisfaction. • Consolidating the overlapping KQI avoids unnecessary duplication of efforts and resources, allowing MNOs to focus on addressing actual service issues.
DNB	• Proposed the network availability for 5G to follow the 4G target which is 99.50% due to DNB leveraging existing tower infrastructure and backhaul that is being used for 4G. Therefore, if there is any incident at the sites the impact will be the same regardless of technology.
YTLC	• Proposed to retain existing standard. MSQoS should be amended once 5G has been fully rolled out.
RSMY	• No comment.

Table 20: Response to the proposal for Network Utilisation KQI

Commission's View

4G Network Availability

- The proposed service available for KQI covers the access and aggregation (RAN and transport), POI and core network.

- The network availability KQI is not the same as the notification to MCMC on network downtime as stated in MSQoS Customer Service. While the requirement to notify MCMC is important to alert the public and stakeholders, the network availability KQI is aimed at ensuring operators minimise their network downtime.

- Importantly, the internet has been gazetted as the third utility. Internet is not only used for social purposes, but it has become a source of income and an important medium for digital services, e-commerce, online business, conferences, and education.

- The exclusion of network downtime due to force majeure, 3rd party, vandalism, etc. will be included in the guideline of the standards.

5G Network Availability

- The 5G network is more critical than 4G because it is a single network with multiple operators. Hence, the network availability for access and aggregation should not be the same as 4G. The network availability set in the standard is not separated into targeted areas, but it considers the entire network.

Conclusion

- The Commission is of the view that network availability KQI to be included in the MSQoS without any changes.

2.2.10. **5G Single Wholesale Network QoS Requirements**

QUESTION 11: THE COMMISSION SEEK VIEWS ON THE PROPOSED STANDARD ON 5G SWN KEY QUALITY INDICATORS FOR THE MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).

Technology	Proposed KQI	Mandatory / Monitoring
• 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Mean latency for each service provider calculated via network statistic shall be not more than: i. 35 ms, between end user to the national POI; OR ii. 15 ms, between end user to the regional POI.	Monitoring
	Packet loss for each service provider shall be at or not more than 0.25% calculated via network statistic between the end user to regional or national POI.	
	Mean download throughput for each service provider shall be at or not less than 100 Mbps calculated via network statistic from the regional or national POI to the end user	
	Mean upload throughput for each service provider shall be at or not less than 5 Mbps calculated via network statistic from the end user to the regional or national POI.	

	Service accessibility for each service provider shall be not less than 99.0% calculated via network statistics. Network statistics calculated the ratio of successful end user registration, to the number of attempts.	

Table 21: Proposal for 5G SWN network performance KQI

Submitting Party	Comments
CelcomDigi	• Proposed to defer 5G SWN network statistic reporting for 5G monitoring KQI until 5G dual network matured in 2026.
Maxis	• Proposed the 5G related measurement to be deferred until the 5G second network rolls out and both 5G networks achieve 80% population coverage.
U Mobile	• Proposed this standard should be exclusively reported by the 5G wholesale network providers.
Redtone	• Proposed to defer the 5G QoS standards until both of 5G networks in 5G Dual Network model concluded. Further review when both 5G networks arrive at 80% population coverage.
TM Tech	• No view on this standard.
DNB	• Proposed to adopt the RAO upload throughput target of 3Mbps for NSA and 5 Mbps for SA. • Latency to be measured from the server located in the region or state instead of only Klang Valley.
YTLC	• Proposed to retain existing standard. MSQoS should be amended once 5G has been fully rolled out.
RSMY	• No comment.

Table 22: Response to the proposal for 5G SWN network performance KQI

Commission's View

5G SWN QoS Requirements

- The SWN Reference Access Offer (RAO) stated the upload speed to be not less than 3 Mbps for 5G NSA and not less than 5 Mbps for 5G SA. It is noted that there are no specific 5G apps that use high uplink bandwidth, and it would be a big challenge to achieve the intended target because it is dependent on consumer usage.

- The SWN operator will be responsible for providing all network data to the Commission.

- The Commission has taken into consideration the shift to 5G dual network model. Hence, the 5G network is proposed to be under Monitoring KQI. This will enable the Commission to gauge the performance of 1st 5G network and ensure that deployment of the 2nd 5G network is on par or better.

Conclusion

- The Commission is of the view that the 5G SWN QoS requirements based on network statistic reporting, to be implemented in the MSQoS with the change to separate upload speed of 5G NSA for not less than 3 Mbps and 5G NSA for not less 5 Mbps.

- This network statistic reporting will apply to 5G SWN operator during the transition period to dual network, and to any of the entities providing 5G dual network during and after the transition.

2.3 Revision of the Applicable Guidelines

QUESTION 12:	**THE COMMISSION SEEK VIEWS ON THE PROPOSED GUIDELINES FOR THE COMMISSION DETERMINATION ON MANDATORY STANDARD FOR QUALITY OF SERVICE (WIRELESS BROADBAND ACCESS SERVICE).**

2.3.1 Interpretation

Submitting Party	Comments
CelcomDigi	No comment.
Maxis	No comment.
U Mobile	No comment.
Redtone	No comment.
TM Tech	TM Tech proposed for the definition of test server to be refined by specifying its location. There should be uniform specifications for both test terminal and test server that addressed aspects of client and hardware for the measurement server.
DNB	No comment.
YTLC	No comment.
RSMY	No comment.

Table 23: Responses to the Interpretation of the guidelines

2.3.2 Part A: Objective and scope

Submitting Party	Comments
CelcomDigi	No comment.
Maxis	Maxis is of the view that it is premature to set the standard for 5G services and should only be set once the 5G rollout is complete and 5G service adoption is matured.
U Mobile	U Mobile proposed to defer the guideline until 5G Dual Network achieves full maturity and deployment.

Redtone	No comment.
TM Tech	No comment.
DNB	No comment.
YTLC	No comment.
RSMY	No Comment.

Table 24: Responses to the objective and scope of the guidelines

2.3.3 Part B: Key Quality Indicators (KQI) Assessment

Submitting Party	Comments
CelcomDigi	No comment.
Maxis	Maxis took note of the requirement.
U Mobile	The 5G network statistic data reporting should exclusively reported by 5G SWN since they are the entities with all the necessary information.
Redtone	No comment.
TM Tech	No comment.
DNB	No comment.
YTLC	No comment.
RSMY	No comment.

Table 25: Responses to the KQI assessment of the guidelines

2.3.4 Part C: Measurement Methodology for Quality of Service and Quality of Experience

Submitting Party	Comments
Maxis	• Indoor location should only be measured when it has dedicated IBC solution, building that are accessible to the public, signal strength of more than -90dBm and within Maxis control to design, operate and maintain. Indoor measurement should only use static test methodology. • Outdoor locations measurement shall exclude all USP/MC RAN sharing sites and third party operated sites. The signal strength should be more than -90dBm and within Maxis control to design, operate and maintain. • Outdoor testing should only be conducted within the service provider's declared coverage areas and using static test methodology. Drive test should be excluded from the outdoor measurement since site serving highways or trunk road are only meant for connectivity not for capacity. • Maxis proposed the test tool and testing methodology should support latest capabilities including multi-thread and higher order MIMO. • 4G measurement equipment should be logged to 4G technology during the measurement. • Maxis proposed the usage of standard script for the testing that has been agreed upon by MCMC and the drive tools vendor. MCMC also should notify the service provider 1 year

	ahead if there are any changes in the drive test tool vendor. • The number of locations should be maintained at 120 as per current MSQoS. MCMC should consider adopting crowdsource methodology for better sampling and wider analysis. • Network unavailability should only be considered during total site outage since during partial network failure, the end user is still able to access the network service. • Maxis proposed for para 36 to be reconsider as "The Commission may at its discretion, on reasonable grounds including consideration of technical capability and cost, acquire a more granular set of data or data within specific period, on network utilisation and availability." • Maxis is of the view that for 5G access network statistic data reporting should be deferred until the dual 5G network reaches 80%. • Maxis proposed for para 41 to be reconsider as "The Commission may at its discretion, on reasonable grounds including consideration of technical capability and cost, acquire a more granular set of data or raw data." • Maxis is of the view that service provider should not be held responsible for network elements to which the service provider do not have control over. • MCMC should exempt any non-compliance for areas that service provider has not declared in the coverage area map since it would need 100% coverage even at non-populated areas.
CelcomDigi	• Disagreed with the sample size and proposed to increase the sample size to 10 and to use multiple thread as it provides more accurate simulation and reduce overall testing time. • CelcomDigi is of the view that the test logfiles to only be stored for 3 months instead of 24 months due to concern on storage management and further upgrade /optimization may already take place within 24 months. • Proposed to do static tests as it provides more accurate measurement and allows for detailed analysis and for improvement. • To gauge the indoor coverage performance, measurements are conducted at public common access area with IBC coverage. • Indoor measurement at residential area should be exempted due to internal design layout, material and obstruction that affects signal penetration. • There should also be exclusion for building of residential apartment/condominium above 3rd floor as antenna at the tower is tilted towards the ground. • The test area should only be conducted within the declared coverage map.

	• The test should be performed on weekdays during working hours as it provides a realistic assessment of network performance because it aligns with the times when the network is likely to experience the highest usage. • The number of test locations should be maintained at 120 locations as increasing the test location will impact the cost, resource, and delivery time. • The measurement for utilisation parameters should be removed. Monitoring one busy hour of each day averaging over one month does not represent actual high utilisation.
U Mobile	• U Mobile proposed that the background data should not be present during the QoE measurement. • The test should be conducted in stationary conditions since mobility test involves unavoidable mobility signaling between service cells that can affect the KQI results. • MCMC should maintain the current measurement location methodology, since a certain signal level is necessary to provide service. • The enforcement for each specific location should be removed. • There should be an exclusion of location such as locations that fall outside mobile operator's published coverage map, cell edge, overspill areas, in-building and MOCN locations. • U Mobile also proposed for multi-thread measurement and and observe the actual performance results of the mobile network. • U Mobile disagreed with para 33 that stated any non-compliance in the network utilisation should be rectified within 14 days since an event that causes temporary spike in traffic which will normalize in the following months. • U Mobile disagreed with para 36 that stated the Commission may acquire more granular set of data due to the data extraction process that requires extended timeframe and coordination across multiple network elements.
Redtone	No comment.
TM Tech	• TM Tech propose that the test measurement should be done outdoor and only by static test and walk test only. The measurement should exclude indoor measurement. • If indoor measurement to be carried out it should be limited to where IBC infrastructure is already available. • TM Tech is of the view that there should be a different KQI for the drive test since it has a different environment and involves handing over of connections between eNodeB. • The site location selection must be carried out at the location that is ascertained to have wireless broadband service coverage. • The service coverage should be identified based on service coverage information as advertised in the service provider's

	website or from consumer or individual service's complaint that has been lodged to MCMC. • TM Tech propose that the test location site remain at 480 sites per year as the increase of site locations to 1000 per year will result in unnecessary regulatory overhead. • TM Tech deem that network statistic KQI should be removed as MNOs implement robust support system to ensure minimal network interruption. The network elements are monitored daily and will be rectified proactively and reactively. • TM Tech suggested that non-compliance actions should not be taken for audit locations that are undergoing scheduled downtime or experiencing unplanned service disruption. • TM Tech propose for para 46 "..on condition that the event is reported in time." to "..on condition that an event beyond control is reported to MCMC within reasonable time." • TM Tech finds that there is not any proposal specifications for the measurement devices in the PI. This is an important aspect in measuring the KQI as uniform measurement device allow comparison of results to be made.
DNB	• DNB proposed for the sample size to be increased based on calculation of Mandatory KQI of 200 locations with the minimum speed of 7.7 Mbps for 4G and 50 locations of monitoring KQI with the minimum speed of 100 Mbps, the average download throughput will be 26.16 Mbps as follows: $$\frac{(6x200x7.7Mbps) + (6x50x100Mbps)}{250x6samples} = 26.16Mbps$$ • The appropriate number of samples will ensure the end-to-end measurement to be on acceptable confidence level. • DNB also proposed for the rectification process for POI Network Utilisation in para 34 to be further extended on case-to-case basis. • DNB also proposed for para 46 to include following exclusion events aligned with the RAO and Access Agreement that includes vandalism, theft, sabotage, planned and emergency maintenance, delay to obtained access from other third party, prolonged fibre rectification or power blackout, damage to the facilities or any other similar events or cause beyond DNB's reasonable control.
YTLC	No comment.
RSMY	• RSMY recommends for the download throughput test to use HTTPS multi-thread with the file size of 1 GB and the test time should be 10 seconds. • RSMY proposed for the upload throughput test to use HTTPS multi-thread with the file size of 200 MB or 500 MB and the test time should be 10 seconds. • As for round-trip latency measurement, RSMY recommends for the test to use TWAMP. The test should apply defined

	applications profile and 6 cycles for each location. • The service accessibility test should be measured based on the successful session ratio instead of the successful attempt ratio. • RSMY proposed for the video streaming access test, the video source should include one 4K video resolution, one live streaming channel and one HD video with a duration of more than 1 minute each. The streaming duration should be set at 45 seconds for each video source to get sufficient Video MOS sample. • The download throughput per area test should be weighted according to population density for each state and federal territories within a quarter. • RSMY also recommends including social media and messaging test. • RSMY proposed the wait time to be shortened to 3s and allowing for shortened whole testing time collecting more data samples. • For monitoring KQI, the test should be done at the same time for all entities and service providers to test the resource allocation fairness.

Table 26: Responses to the measurement methodology of the guidelines

2.3.5 Part D: Requirement for Report Submission

Submitting Party	Comments
CelcomDigi	• Proposed to allow C-levels management to endorse and signoff the MSQoS quarterly report submission. • All of the submission on the reporting should be streamlined on a quarterly basis for better internal resource management.
Maxis	• Proposed allowing other Maxis Management Team members or Chief Officer that has been delegated by the Board of Directors to endorse the signoff the quarterly report. • This is to ensure the respective Chief Officer to take accountability on the network performances to comply with the MSQoS. • Maxis proposed that Network Utilisation Report to be removed from the MSQoS and Access Network Statistic Report submission to be on quarterly basis.
U Mobile	• U Mobile proposed that Report submission for Access Network Statistic Report should be aligned with the others which is quarterly.
Redtone	• Redtone proposed that all the reports should be submitted quarterly.

TM Tech	No comment.
DNB	• DNB recommends the Access Network Statistic Report to be a quarterly submission aligned with the licence conditions and MNO's obligations for QoS reports. • Reference to para 73 of the PI, 5G KQIs will be monitored for each gNodeB and Access Seekers and DNB will need to prepare the report for each of Access Seekers. • The raw data for the network statistics will be generated manually and DNB will need to prepare, extract, compile and analyze from each network element and this is time consuming monthly. • DNB suggested for the endorsement and the signoff of the report, it is sufficient to be on the relevant executive level which is C-level that includes Chief Operating Officer or Chief Technology Officer.
YTLC	No comment.
RSMY	No comment.

Table 27: Responses to the requirement for report submission of the guidelines

2.3.6 Part E: Effective Date and Commission Contact

Submitting Party	Comments
CelcomDigi	No comment.
Maxis	MNOs should be given a grace period for the readiness of any new measurement and reports.
U Mobile	No comment.
Redtone	No comment.
TM Tech	No comment.
DNB	No comment.
YTLC	YTLC is of the view that the MSQOS and Guidelines should not be amended until 5G rollout is complete.
RSMY	No comment.

Table 28: Responses to the effective date of the guidelines

2.3.7 Other comments

Submitting Party	Comments
U Mobile	• To enforce the MSQoS yearly basis to reflect the overall performance of service provider. • To abolish the enforcement of for each specific location.
DNB	• DNB suggested to include new provision that the Guideline can be updated by MCMC with consultation by the industry in updating the testing methodology in line with the latest international standard (i.e ITU, ETSI) and regulatory best practices.

	• The MSQoS also should have a reference to the definitions and measurement methodologies in accordance with the relevant international standards such as ITU and ETSI pertaining to each KQI. • This is to ensure that the best industry and international practices are followed and the results from the measurements would be comparable to other countries.
RSMY	• RSMY recommends MCMC to adopt ETSI 103 559 scoring method that will give common and standardized criteria for vendors and service providers. • RSMY also recommends MCMC to deploy remote probe at key locations to monitor the network KQI's performance from end-to-end perspective.

Table 29: Responses for other comments of the guidelines

Commission's View

MSQoS Guidelines

- The number of test locations is increased to provide better representation of 4G, and 5G network performance and to ensure more locations can be improved in the case of non-compliance to the standards.

- Tests will be conducted in populated areas to push for infra-sharing among operators and ensure all consumers are connected.

- The measurement may also be performed indoors to encourage operators to deploy IBC or small cells, since most people are using internet indoors. In addition, this is to encourage operators to make use of the sub-1GHz band which has better indoor penetration.

- Network improvement plan must be submitted with reasonable timeline for locations with no IBC or out of declared coverage. The Commission will explore the plan on a case-by-case basis.

- USP sites with MOCN or MORAN active sharing have higher QoS target. In time, more USP sites have become commercial sites. A total of 806 sites from T3 and T3E projects have been established as commercial sites.

- The report submission will be required on a quarterly basis and must be endorsed by the CEO or any designated C-level.

- The test tool used by the Commission is of the latest model and uniform for any particular location.

- Use of multi-thread can be done with the support from the operators to provide the test server in Klang Valley. The operators shall be responsible to ensure the multi-thread server capacity is always sufficient to be tested by the Commission.

Conclusion

- The Commission is of the view that the proposed Guidelines to MSQOS will be implemented with the change for the declaration of report submission endorsed by C-level of respective operators.

3. The Way Forward

- MCMC is of the view that the proposed revision of the MSQoS for Wireless Broadband Access Service will ensure enhancements to existing levels of quality of service by the service providers and further improve consumers' experience.

- In selecting a particular benchmark for the quality of service, MCMC endeavours to make certain that the benchmark is meaningful to the customer and will enable them to assess and make informed decisions on the levels of quality they are experiencing. The benchmark will be equally useful for MCMC to gauge the performance of the service providers in fulfilling its role to monitor the industry.

- MCMC has considered all the general views and proposed approaches, from respondents to improve the state of the wireless broadband services in Malaysia.

- The Commission Determination on revised MSQoS for Wireless Broadband Access Service will be published within 45 days from the conclusion of the PI and come into effect starting **1 April 2024**.