



**Suruhanjaya Komunikasi dan Multimedia Malaysia**

Malaysian Communications and Multimedia Commission

**PROPOSAL ON REVIEW OF THE MANDATORY  
STANDARDS FOR QUALITY OF SERVICE (WIRELESS  
BROADBAND ACCESS SERVICE)  
(DETERMINATION NO. 2 OF 2021)**

**3 OCTOBER 2023**

This Public Inquiry Paper is prepared in fulfilment of Sections 58 and 61 of the  
Communications and Multimedia Act 1998.

## TABLE OF CONTENTS

PREFACE.....	1
GLOSSARY.....	2
PREAMBLE.....	3
PUBLIC INQUIRY PROCESS.....	5
THE MANDATORY STANDARDS FOR QUALITY OF SERVICE .....	6
PART A: THE INTERPRETATION PART OF THE STANDARDS.....	6
PART B: THE QUALITY OF SERVICE INDICATORS, MEASUREMENTS, STANDARDS AND NOTIFICATION .....	7
PART C: APPLICABLE GUIDELINES .....	34

## PREFACE

The Commission is hereby holding a Public Inquiry on the proposal for the revision of Mandatory Standards for Quality of Service (Wireless broadband access service) and invites members of the public and interested parties to participate in this inquiry by making written submissions on any matter they consider relevant to the inquiry. Written submissions, in both hard copy and electronic form, should be provided to the Commission in full by **12 noon, 21 November 2023 (49 days)** and addressed to:

Malaysian Communications and Multimedia Commission  
MCMC Tower 1  
Jalan Impact  
Cyber 6  
63000 Cyberjaya  
Selangor Darul Ehsan

Attention : Quality Standards Development Department  
Or E-mail : qos.dept@mcmc.gov.my

In the interest of fostering informed and robust consultative process, the Commission may make available extracts of or entire submissions for others to read. Any commercially sensitive information should be provided under a separate cover and clearly marked "CONFIDENTIAL".

Respondents are encouraged to support their comments with reasons and where appropriate provide or refer to evidence or other relevant information in support of their comments. **Incomplete and/or late submissions will not be considered.**

The Commission thanks the public and all interested parties for their participation in this consultative process and for providing their submissions and feedback.

## GLOSSARY

CMA1998	Communications and Multimedia Act 1998 (Act 588)
Commission	Malaysian Communications and Multimedia Commission
MS	Mandatory Standards
MSQoS	Mandatory Standards for Quality of Service
NRA	National Regulatory Authority
PI	Public Inquiry
QoS	Quality of Service
QoE	Quality of Experience
WiMAX	Wireless Interoperability for Microwave Access

## PREAMBLE

1. The Commission introduced the first MSQoS for wireless broadband access service on 1<sup>st</sup> February 2016 (Determination No.1 of 2016). The document acts as a regulatory instrument to ensure that the service received by the end users from the wireless broadband service providers is at an acceptable quality of service level. The standard is a combination of network performance and customer service quality. The requirements for network performance standards were derived based on 3G, 4G and WiMAX technology deployed at that time.
2. On 1<sup>st</sup> August 2021, the Commission published an updated MSQoS for wireless broadband access service (Determination No.2 of 2021) after considering the maturity of 4G network and LTE device ownership. WiMAX broadband service gradually ceased operation in 2019, and the spectrum was largely used for 4G broadband access. The updated MSQoS imposed higher QoS standard, introduced additional QoS indicators and separated the customer service QoS to a new MSQoS for better monitoring.
3. Based on the Communications and Multimedia Facts and Figures Q1 2023 report<sup>1</sup>, mobile broadband traffic in Malaysia is currently at 1.07 Exabytes. The 'video streaming' segment generated most of the traffic (47.7%), followed by 'others' segment (22.0%) such as software updates, cloud storage, file sharing, etc. Meanwhile, 'social networking' (15.4%), 'web browsing' (10.3%), 'online meeting' (3.0%), and 'gaming segment' (1.5%) contributed to the remaining of the traffic.
4. The Commission is of the view that the QoS indicators need to be improved due to the improvement in 4G and 5G mobile network connectivity, factoring in the internet speed complaints, which was the second highest category after poor 4G coverage complaints based on "MCMC aduan" statistics from 2020 to 2023<sup>2</sup>. In addition to QoS, the Commission opine that it is time to introduce the mobile broadband QoE requirements as part of the standards to increase consumer satisfaction.
5. With the expansion of 4G network to 96.9% coverage in populated area, the emphasis is on the deployment of 5G network services to boost nationwide digital connectivity<sup>3</sup>. As of 31<sup>st</sup> May 2023, 5G network coverage in populated areas has reached 62.1% and is expected to reach 80% target by the end of 2023.

---

<sup>1</sup> [https://www.mcmc.gov.my/skmmgovmy/media/General/Resources/C-M-1Q-2023\\_ENG.pdf](https://www.mcmc.gov.my/skmmgovmy/media/General/Resources/C-M-1Q-2023_ENG.pdf)

<sup>2</sup> MCMC aduan portal

<sup>3</sup> <https://myjendela.my/Sitejendela/media/Doc/JENDELA-Phase-1-Concluding-Report.pdf>

6. On 3<sup>rd</sup> May 2023, the Malaysian government announced the adoption of Dual Network model for the 5G rollout in 2024. The transition from a single wholesale network (SWN) to Dual Network will be implemented after the SWN has achieved 80% coverage in populated areas. This model will lead to more competition in the 5G market, better end-to-end customer service, and provide long-term market sustainability.
7. The new MSQoS will establish 2 sets of Key Quality Indicators (KQI) which are the “Mandatory KQI” and the “Monitoring KQI”. The Mandatory KQI will be monitored, mandated and enforced by the Commission. Failing to meet and rectify the Mandatory KQI will result in enforcement actions. The Mandatory KQI enforces the parameters based on the 4G and 5G network utilising all allocated IMT frequency bands other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz. Meanwhile, the Monitoring KQI parameters will be monitored by the Commission and rectified accordingly by the service providers in a timely manner without any enforcement actions. The Monitoring KQI apply for 5G network operating in the IMT frequency band 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz, which are currently undergoing migration from SWN to Dual Network.
8. In developing the new network QoS parameters for the wireless broadband access service, the Commission greatly appreciates feedbacks from the experts in the relevant industries, agencies, service providers, equipment manufacturers and the consumers on the proposal for the standards.
9. Therefore, in accordance with Section 104 of the CMA1998, the Commission hereby undertakes the initiative to determine the MSQoS for wireless broadband access service.

## PUBLIC INQUIRY PROCESS

10. Section 58(2) of the CMA1998 provides that the Commission may hold a public inquiry if it is satisfied that the matter is of significant interest to either the public or to current or prospective licensees under the CMA1998. The objective of such public inquiry is to inform as well as to invite views of the public and the licensees under the CMA1998 on the matter of concern.
11. The Commission is of the view that it is appropriate in these circumstances to hold a public inquiry under section 58(2)(b) of the CMA1998, in order to obtain industry and public comment, and to promote transparency in the exercise of its powers.
12. Under section 61(1)(d) of the CMA1998, the Public Inquiry period shall be a minimum of forty-five (45) days, within which inquiry submissions are invited. In the present Public Inquiry, licensees and the public are given **49** days to formulate and submit their views on the matter.
13. The Commission shall take into consideration all submissions received within the Public Inquiry period. The Commission is required under section 65 of the CMA1998 to publish a report setting out its findings as a result of any inquiry it conducted, and such report shall be published within thirty (30) days of the conclusion of the inquiry.

## THE MANDATORY STANDARDS FOR QUALITY OF SERVICE

### PART A: THE INTERPRETATION PART OF THE STANDARDS

“4G” means Fourth-generation of mobile telecommunications technology, required by International Mobile Telecommunications for the year 2010 (IMT-ADVANCED);

“5G” means Fifth-generation of mobile telecommunications technology, required by International Mobile Telecommunications for the year 2020 (IMT-2020);

“ASP” means Applications Service Provider;

“end user” means a person who receives, requires, acquires, uses or subscribes to the public cellular service and may include a customer;

“eNodeB” means 4G wireless access node that transmit and receive communications between the end user and mobile network;

“FWA” means Fixed Wireless Access;

“gNodeB” means a 5G wireless access node that transmit and receive communication between the end user and the mobile network;

“guidelines” means a guideline issued by the Commission pursuant to paragraph ‘9’ of the Commission Determination on the Mandatory Standards for Quality of Service (Wireless Broadband Access Service);

“HTTP” means HyperText Transfer Protocol;

“IMT” means International Mobile Telecommunications;

“National POI” means a POI located in Klang Valley;

“NSP” means Network Service Provider;

“POI” means Point of Interconnection;

“PRB” means Physical Resource Block;

“regional POI” means a POI located in any states or federal territories in Malaysia;

“service provider” means an Applications Service Provider or a Network Service Provider who provides 4G and 5G mobile broadband access service to the end user;

“test server” means a server deployed by the Commission or the service provider, located in Klang Valley for the purpose of conducting end-to-end quality of service measurements;



“URL” means Uniform Resource Locator; and

“wholesale provider” means an access provider who provides 5G network access to the service provider.

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

## **PART B: THE QUALITY OF SERVICE INDICATORS, MEASUREMENTS, STANDARDS AND NOTIFICATION**

### Download Throughput

14. This parameter is defined as “the average data transfer rate in the downlink measured throughout the entire connect time from the test server to the end user, in units of Megabits per second (Mbps)”. It is measured based on the FTP download session from the start of file download until it has been successfully completed and is averaged over the total established connection test samples.
15. Table 1 exhibits several of the National Regulatory Authority (NRA) regulations on the download throughput QoS parameter for 4G and 5G networks.

<b>NRA</b>	<b>Download throughput QoS</b>
Thailand (NBTC)	FTP ratio subjected to specified bitrate not less than 75% based on the following technology: <ul style="list-style-type: none"><li>▪ 4G and 5G (other than 2.6 GHz): <math>\geq 2.5</math> Mbps</li><li>▪ 5G (2.6 GHz): <math>\geq 5</math> Mbps</li></ul> FTP average bitrate $\geq 20$ Mbps for 5G SA (2.6GHz)
Qatar (CRA)	Mean HTTP DL $\geq 20$ Mbps for: <ul style="list-style-type: none"><li>▪ 90% in urban areas</li><li>▪ 50% in non-urban areas</li></ul>
Brazil (Anatel)	Mean DL throughput based on the following technology: <ul style="list-style-type: none"><li>▪ 4G: <math>\geq 1.5</math> Mbps</li><li>▪ 5GDSS: <math>\geq 5.0</math> Mbps</li></ul>

NRA	Download throughput QoS
Germany (BNETZA)	Mean DL $\geq$ 10 Mbps
South Africa (ICASA)	Mean DL throughput for 4G technology: <ul style="list-style-type: none"> <li>▪ Application: <math>\geq</math> 10 Mbps</li> <li>▪ FTP: <math>\geq</math> 10 Mbps</li> <li>▪ HTTP: <math>\geq</math> 10 Mbps</li> </ul>
Pakistan (PTA)	Mean DL throughput for 4G technology: <ul style="list-style-type: none"> <li>▪ 2021: <math>\geq</math> 2 Mbps</li> <li>▪ 2022: <math>\geq</math> 3 Mbps</li> <li>▪ 2023: <math>\geq</math> 4 Mbps</li> </ul>

Table 1: Download throughput QoS regulations by NRA

16. The majority of data traffic is generated in downlink direction from the network to end user’s mobile devices. Primary internet application services, such as video streaming, web browsing, file downloading, and video calling, require data to be downloaded. Figure 1 below illustrates the recommendation on download throughput requirements for popular streaming applications on mobile device.

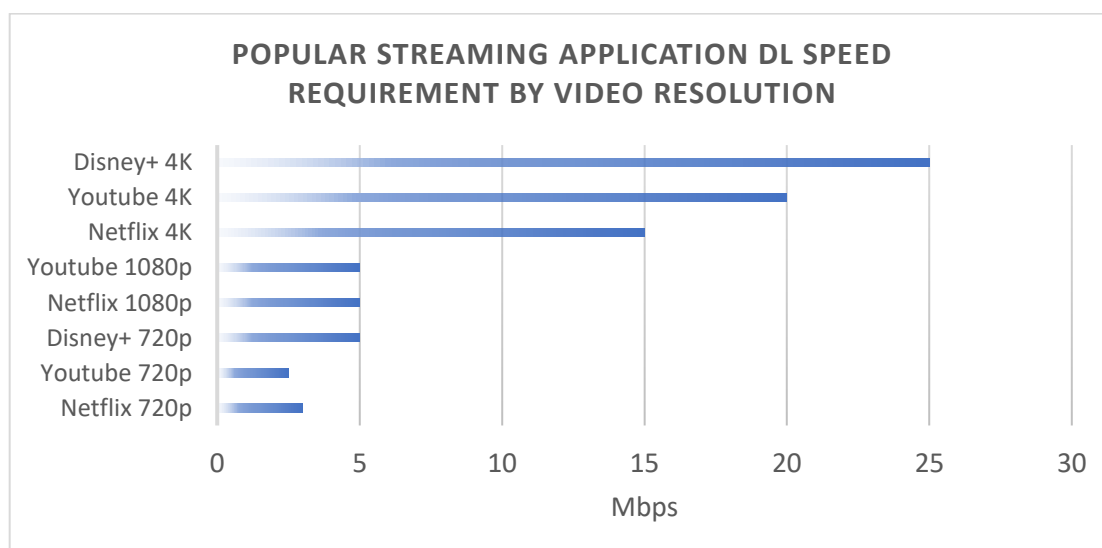


Figure 1:Download speed requirement based on streaming application<sup>4</sup>

17. Considering the download speed regulated by other regulators and based on the conclusion for service criteria assessment in the consultation report published by

<sup>4</sup> Disney+, Youtube, Netflix

Germany<sup>5</sup>, the Commission proposes an updated standards for download throughput requirements as in Table 2. A staggered approach is adopted for the download throughput parameter to ensure that service providers have sufficient time to upgrade their network accordingly.

Technology / Network	Download throughput QoS	Definition / Description / Formula	Mandatory / Monitoring
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)	Download throughput for each location measured shall be at or not less than:  i. 7.7 Mbps until 31 December 2024; and  ii. 10 Mbps from 1 January 2025 onwards,  averaged based on all test sample.	This indicator measures the average data transfer rate in the downlink, throughout the entire connection time from the test server to the end user, in units of Megabits per second (Mbps).  Formula: $\frac{DL_1 + DL_2 + \dots + DL_n}{\text{Total connected download test sample}}$ Where: <i>DL</i> = download throughput per session	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

Table 2: MCMC proposal for Download Throughput QoS

18. The download throughput QoS standard above is to be mandated and monitored for each test location.
19. To encourage deployment of 5G networks by the service providers, the Commission is

<sup>5</sup> Consultation document on consultation in connection with the assessment of minimum requirements subject to the right to supply with telecommunications services – BNeTZA, Germany

proposing additional download throughput requirements to be mandated based on each state and federal territory, comprised of measurements in 4G and 5G in all frequency bands for each quarter, as shown in Table 3 below.

Technology	Download throughput QoS	Definition / Description / Formula	Mandatory / Monitoring
4G and 5G (all allocated IMT frequency bands)	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.	<p>This indicator measures the average data transfer rate in the downlink, throughout the entire connection time from the test server to the end user, in units of Megabits per second (Mbps).</p> <p>Formula:</p> $\frac{DL_1 + DL_2 + \dots + DL_n}{\text{Total connected download test sample for each state and federal territories}}$ <p>Where:  <i>DL</i> = download throughput per session</p>	Mandatory

Table 3: MCMC proposal for Download Throughput QoS for all technologies for each state and federal territories

20. The download throughput QoS for each state and federal territory are aggregated based on overall measurements conducted in 4G and 5G networks in the respective states and federal territories.

**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).**

## Upload Throughput

21. This parameter is defined as “the average data transfer rate in the uplink measured throughout the entire connect time from the end user to the test server, in units of Megabits per second (Mbps)”. It is measured based on the FTP upload session from the start of file upload until it has been successfully completed and is average over the total established connection test samples.
22. Table 4 exhibits several of the NRA regulations on the upload throughput QoS parameter for 4G and 5G networks.

<b>NRA</b>	<b>Upload throughput QoS</b>
Thailand (NBTC)	Not less than 75% based on the following technology: <ul style="list-style-type: none"> <li>▪ 4G and 5G (except 2.6GHz): <math>\geq 0.5</math> Mbps</li> <li>▪ 5G (2.6 GHz): <math>\geq 1.25</math> Mbps</li> </ul> FTP mean bitrate $\geq 5$ Mbps for 5G SA (2.6 GHz)
Qatar (CRA)	Mean HTTP UL $\geq 10$ Mbps for: <ul style="list-style-type: none"> <li>▪ 90% in urban areas</li> <li>▪ 50% in non-urban areas</li> </ul>
Brazil (ANATEL)	Mean UL throughput based on the following technology: <ul style="list-style-type: none"> <li>▪ 4G: <math>\geq 1.5</math> Mbps</li> <li>▪ 5GDSS: <math>\geq 1.5</math> Mbps</li> </ul>
Germany (BNetzA)	Mean UL $\geq 1.3$ Mbps
South Africa (ICASA)	Mean UL throughput for 4G technology: <ul style="list-style-type: none"> <li>▪ FTP: <math>\geq 2.5</math> Mbps</li> <li>▪ HTTP: <math>\geq 2.5</math> Mbps</li> </ul>
Pakistan (PTA)	Mean UL throughput for 4G technology: <ul style="list-style-type: none"> <li>▪ 2022: <math>\geq 768</math> kbps</li> <li>▪ 2023: <math>\geq 1</math> Mbps</li> </ul>

*Table 4: Upload throughput QoS regulation by NRA*

23. Online meetings have become a part of the working norms and important for long distance learning. Furthermore, the growing trend among social media users to upload pictures, videos and go live to share updates, has resulted in an increase in demand for uplink capacity.

24. Each of the 4G service providers has been allocated with the low band spectrum in the sub-1GHz (800, 850 and 900 MHz). These low band carriers would allow service providers to provide good uplink throughput with sufficient network coverage and capacity. The upload throughput recommendations provided in Figure 2 below are based on popular Internet application services for online meetings and online mobile gaming.

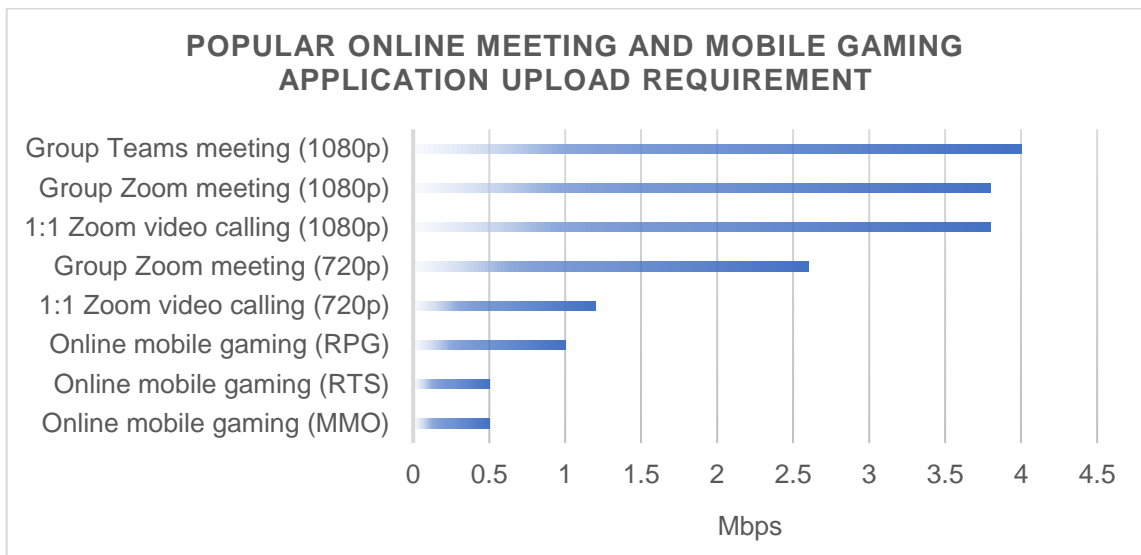


Figure 2: Upload throughput recommendations by popular internet application services<sup>6</sup>

25. Considering the upload throughput regulated by other regulators, reference on the minimum upload throughput requirement from the internet application providers and based on the conclusion in the consultation document published by Germany, the Commission proposes the following upload throughput requirement as in Table 5. Similar to download throughput requirements, the upload throughput is also adopting a staggered approach to allow for low band carriers deployment.

Technology / Network	Upload throughput QoS	Definition / Description / Formula	Mandatory / Monitoring
4G and 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz, 3.4 –	Upload throughput for each location measured shall be at or not less than:	This indicator measures the average data transfer rate in the uplink, throughout the entire connection time from the end user to the test	Mandatory

<sup>6</sup> Zoom, Microsoft Teams

Technology / Network	Upload throughput QoS	Definition / Description / Formula	Mandatory / Monitoring
3.6 GHz and 26.5 – 28.1 GHz)	i. 1.0 Mbps until 31 December 2024; and ii. 1.3 Mbps from 1 January 2025 onwards,  averaged based on all test sample.	server, in units of Megabits per second (Mbps).  Formula: $\frac{UL_1 + UL_2 + \dots + UL_n}{\text{Total connected upload test sample}}$ Where: <i>UL</i> = upload throughput per session	
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: MCMC proposal for Upload Throughput QoS

26. The upload throughput QoS standard above is to be mandated and monitored based on each test location.

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

Latency

27. This parameter is defined as “the average round-trip time taken by a standard packet to traverse the network between the end user and the test server.” It is measured based on the duration of the packet sent from the end user to the test server and returned and averaged over the total test samples.
28. Table 6 exhibits some of NRA regulations on the network latency QoS parameter for 4G and 5G networks.

<b>NRA</b>	<b>Latency QoS</b>
Thailand (NBTC)	Not less than 80% based on the following technology: <ul style="list-style-type: none"> <li>▪ 4G, 5G NSA, 5G SA (except 2.6GHz): ≤ 150 ms</li> <li>▪ 5G SA (2.6GHz): ≤ 110 ms</li> </ul>
Qatar (CRA)	Latency ≤ 40ms for 90% of the tests to a destination hosting in Qatar and advertised as such. Destination outside Qatar shall be monitored and reported.  Shall be reported separately based on technology, but the target is assessed based on latest technology available.
Brazil (ANATEL)	<ul style="list-style-type: none"> <li>▪ 4G: ≤ 100 ms</li> <li>▪ 5GDSS: ≤ 100 ms</li> </ul>
Germany (BNetzA)	≤ 150ms round trip time
Bahrain (TRA)	≤ 100 ms
South Africa (ICASA)	4G ≤ 50 ms
Pakistan (PTA)	4G ≤ 75 ms

*Table 6: Latency QoS regulations by NRA*

29. Network latency is impacted by the distance from the user device to the measured destination server (end-to-end). The further away the server is, the longer it will take for data to travel back and forth, resulting in higher latency. Other impacting factors are network congestion, signal strength, and the end user device hardware. Table 7 below provides examples of network latency requirement based on different internet applications.

<b>Online meeting</b>	<b>VoIP and video calls</b>	<b>Online mobile gaming</b>
≤ 100 ms to 150 ms	≤ 100 ms to 150 ms	≤ 100 ms

*Table 7: Network latency requirement based on different internet segment<sup>7</sup>.*

30. Existing MSQoS specified the network latency requirement at 150 ms, considering the mixture of 3G and 4G networks in providing wireless broadband access services. Since 3G sunset has been completed and migrated to the 4G network, better network latency can be achieved due to better air interface and advanced signal processing techniques.

<sup>7</sup> Microsoft Teams, Zoom, Skype, Britishesports.org



31. Considering the network latency standards adopted by other NRA, the growing demand for internet application services with low network latency, and the deployment of wireless broadband network based on 4G technology and higher, the Commission hereby proposes the following improvements to the network latency standards as in Table 8.

Technology / Network	Latency QoS	Definition / Description / Formula	Mandatory / Monitoring
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)	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.	This indicator measures the average round-trip time taken by a standard packet to traverse the network between the end user and the test server.  Formula:  $\frac{RTT_1 + RTT_2 + \dots + RTT_n}{Total\ packet\ successfully\ returned}$	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.	Where:  $RTT = Round\ trip\ time\ per\ packet$	Monitoring

Table 8: MCMC proposal for Latency QoS

32. The network latency QoS standard is to be mandated and monitored based on each test location.

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

Packet loss

33. This parameter is defined as “the percentage of data packets transmitted that fail to arrive at its destination, between the end user and test server.” It is measured based on the total data packet transmitted from the end user to the test server but failed to arrive at its destination over the total data packet transmitted.
34. Table 9 exhibits some of NRA regulations on the network packet loss QoS parameter for 4G and 5G networks.

<b>NRA</b>	<b>Packet loss QoS</b>
Brunei (AITI)	The average packet loss for a session shall not exceed: <ul style="list-style-type: none"> <li>▪ 1% for all class of broadband access (domestic)</li> <li>▪ 3% for best effort class (any location)</li> <li>▪ 1% for video call (any location)</li> </ul>
Brazil (ANATEL)	Packet loss shall not exceed based on the following technology: <ul style="list-style-type: none"> <li>▪ 4G: <math>\leq 2\%</math></li> <li>▪ 5GDSS <math>\leq 2\%</math></li> </ul>

*Table 9: Packet loss QoS regulations by NRA*

35. Data packet losses affect the performance of a wireless broadband access service quite significantly, such as pixelated live video applications, slow web page loading and increased delay in retrieving social media feeds because of data retransmission. Data packets retransmission does not occur in a live application environment, therefore data loss during online live video streaming, e-sports gaming, and live television viewing over a wireless network will occurs.
36. Based on the benchmark from other NRA on the packet loss QoS parameter, the Commission proposes to retain the existing packet loss standard and introduce additional requirements for 5G networks as shown in Table 10 below.

<b>Technology / Network</b>	<b>Packet loss QoS</b>	<b>Definition / Description / Formula</b>	<b>Mandatory / Monitoring</b>
4G and 5G (all allocated IMT frequency band other than 703 –	Packet loss shall be at or not more than 0.5%, measured between end user to	This indicator measures the percentage of data packet transmitted that fails to arrive at its	Mandatory

Technology / Network	Packet loss QoS	Definition / Description / Formula	Mandatory / Monitoring
743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	the test server in Klang Valley.	destination, between the end user and test server.  Formula:	
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.	$\frac{\text{Total packet loss}}{\text{Total packet sent}} \times 100$	Monitoring

Table 10: MCMC proposal for Packet Loss QoS

37. The packet loss QoS parameter is to be mandated and monitored based on each test location.

**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).**

HTTP session time (web browsing)

38. This parameter is defined as “the average time period needed to successfully complete a packet switched data session.” It is measured based on the time when the user enters the web page URL until the complete web page appears in the browser window (reception of the last data packet containing the content).
39. Table 11 exhibits some of NRA regulations and monitoring on the web browsing QoE parameter for 4G and 5G networks.

NRA	Web browsing QoE
France (ARCEP)	<ul style="list-style-type: none"> <li>▪ Success rate of web downloaded ≤ 10 seconds</li> <li>▪ Success rate of web access time ≤ 5 seconds</li> </ul>

<b>NRA</b>	<b>Web browsing QoE</b>
Bahrain (TRA)	Web page loading time ≤ 3 seconds
South Africa (ICASA)	<ul style="list-style-type: none"> <li>▪ Web page download time ≤ 5 seconds</li> <li>▪ Web page completion success rate ≥ 98%</li> <li>▪ Web page access success rate ≥ 98%</li> </ul>
Pakistan (PTA)	Web page loading time ≤ 5 seconds
Thailand (NBTC)	HTTP loaded within the specified duration ratio: <ul style="list-style-type: none"> <li>▪ 4G, 5G NSA, 5G SA (except 2.6GHz): ≥ 90% within 1 minutes</li> <li>▪ 5G SA (2.6 GHz): ≥ 90% within 25 seconds</li> </ul>

Table 11: Web browsing QoE regulations by NRA

40. Based on the results of the Broadband Quality of Experience Survey (BQoES) 2021 report<sup>8</sup>, the two main reasons for web browsing service dissatisfaction reported by the respondents were “waiting for page to load” and “slow download from web pages”. Other reasons included “web pages not displaying smoothly” and “images for web pages not displayed”.
41. Considering the web browsing QoE parameter adopted by other NRAs and the summary of the BQoES 2021 survey, the Commission proposes the following new standard for web browsing QoE parameters as in Table 12.

<b>Technology / Network</b>	<b>Web browsing session time QoE</b>	<b>Definition / Description / Formula</b>	<b>Mandatory / Monitoring</b>
4G and 5G (all allocated IMT frequency band other than 703 – 743 MHz, 758 – 798 MHz,	HTTP session time for each location measured shall be at or not more than 5 seconds averaged based on all test sample.	This indicator measures the average time period needed to successfully complete a packet switched data session.  This represents the time when the user enters the web page URL until the complete web	Mandatory

<sup>8</sup> <https://www.mcmc.gov.my/skmmgovmy/media/General/pdf2/Broadband-Quality-of-Experience-Survey-2021-1.pdf>

Technology / Network	Web browsing session time QoE	Definition / Description / Formula	Mandatory / Monitoring
3.4 – 3.6 GHz and 26.5 – 28.1 GHz)		page appears.  Formula:  $\frac{WB_1 + WB_2 + \dots + WB_n}{\text{Total successful web browsing session}}$	
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.	Where:  <i>WB</i> = web browsing session completion time per session	Monitoring

Table 12: MCMC proposal for Web Browsing session time QoE

42. The QoE parameter for web browsing session time is to be mandated and monitored based on each test location. Five (5) most commonly use webpages will be selected by the Commission to be measured.

**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).**

Video streaming access time

43. This parameter is defined as “the average time of a service access from requesting the stream at the portal until the reception of the first stream data packet at the user equipment”. It is measured based on the time taken from the user clicking the button to access the service to a point of time when streams start to play.
44. Table 13 exhibits some of NRA regulations and monitoring on the video streaming QoE parameter for 4G and 5G networks.

<b>NRA</b>	<b>Video streaming QoE</b>
France (ARCEP)	Success rate of video streamed with the following quality: <ul style="list-style-type: none"> <li>i. Decent quality <ul style="list-style-type: none"> <li>a. 95% of streaming resolution <math>\geq</math> 360p;</li> <li>b. Load time <math>\leq</math> 15 seconds;</li> <li>c. Disturbance <math>\leq</math> 5 seconds</li> </ul> </li> <li>ii. Perfect quality <ul style="list-style-type: none"> <li>a. 95% of streaming resolution <math>\geq</math> 720p;</li> <li>b. Load time <math>\leq</math> 10 seconds;</li> <li>c. Disturbance <math>\leq</math> 0.5 seconds</li> </ul> </li> </ul>
South Africa (ICASA)	<ul style="list-style-type: none"> <li>▪ Video streaming setup success rate <math>\geq</math> 98%</li> <li>▪ Video streaming completion success rate <math>\geq</math> 98%</li> <li>▪ Video streaming reproduction cut off ratio <math>\geq</math> 98%</li> </ul>
Thailand (NBTC)	<p>Streaming accessibility ratio based on the following technology:</p> <ul style="list-style-type: none"> <li>▪ 4G, 5G NSA, 5G SA (except 2.6GHz) <math>\geq</math> 85%</li> <li>▪ 5G SA (2.6 GHz) <math>\geq</math> 90%</li> </ul> <p>Streaming reproduction success ratio based on the following technology:</p> <ul style="list-style-type: none"> <li>▪ 4G, 5G NSA, 5G SA (except 2.6GHz) <math>\geq</math> 85%</li> <li>▪ 5G SA (2.6 GHz) <math>\geq</math> 90%</li> </ul>

Table 13: Video streaming QoE regulations by NRA

45. BQoES 2021 report highlighted that regarding the video streaming segment, the respondents informed that “video stalls and buffers” are the top reason for service dissatisfaction. It was followed by “video is slow to load and start”, “video playback fails” and “picture quality of the video is low” respectively.
46. Considering the video streaming QoS parameter adopted by other NRA, and the issues highlighted in the BQoES 2021 report for the video streaming segment, the Commission proposes the following new standard for video streaming QoE parameter as in Table 14.

<b>Technology</b>	<b>Video streaming access time QoE</b>	<b>Definition / Description / Formula</b>	<b>Mandatory / Monitoring</b>
4G and 5G (all allocated IMT frequency band)	Video streaming access time for each location	This indicator measures the average time of a service access from requesting the	Mandatory

other than 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	measured shall be at or not more than 6 seconds averaged based on all test sample.	stream at the portal until the reception of the first stream data packet at the user equipment.  This represents the time from user clicking a button to access the service to point of time when streams start to play.	
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.	Formula: $\frac{SA_1 + SA_2 + \dots + SA_n}{total\ connected\ streaming\ session}$ Where: <i>SA = Streaming access time per session</i>	Monitoring

Table 14: MCMC proposal for Video Streaming access time QoE

47. The QoE parameter for video streaming access time is to be mandated and monitored based on each test location. Two (2) different video sources from YouTube application with 4K video resolution with a duration of more than 60 seconds will be selected by the Commission to be measured for each location.

**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).**

Service accessibility

48. This parameter is defined as “the successful attempt ratio of the user equipment to obtain service and establish a connection to the server for download, upload, web browsing and video streaming”. It is measured based on the successful attempted service but not limited to FTP, video streaming, and web browsing sessions.

49. Table 15 exhibits some of NRA regulations and best practices on the service accessibility QoS parameter.

<b>NRA</b>	<b>Service accessibility QoS</b>
Thailand (NBTC)	<ul style="list-style-type: none"> <li>▪ FTP success ratio <math>\geq 80\%</math> (DL)</li> <li>▪ FTP success ratio <math>\geq 70\%</math> (UL)</li> <li>▪ HTTP loaded within 1 minutes for 4G and 5G <math>\geq 90\%</math></li> <li>▪ Streaming accessibility ratio for 4G and 5G <math>\geq 85\%</math></li> </ul>
Brunei (AITI)	<ul style="list-style-type: none"> <li>▪ PDP context activation success ratio <math>\geq 95\%</math></li> </ul>
Qatar (CRA)	<ul style="list-style-type: none"> <li>▪ Network data retainability <math>\geq 98\%</math> based on successful ETSI Kepler reference page download</li> </ul>
Vietnam (VNTA)	<ul style="list-style-type: none"> <li>▪ Failed service access ratio <math>\leq 5\%</math></li> </ul>

*Table 15: Service accessibility QoS regulations by NRA*

50. Thailand, Brunei, and Vietnam enforced the QoS parameter on service accessibility in their regulation, while Qatar specified this parameter for performance monitoring targets.
51. Some of the factors that may impact service accessibility are signal quality, network congestion, and interference. Setting the minimum target for this parameter will ensure that the service providers will manage the consumer's quality of experience. The Commission hereby proposed a new standard for service accessibility as in Table 16.

<b>Technology / Network</b>	<b>Service accessibility QoS</b>	<b>Definition / Description / Formula</b>	<b>Mandatory / Monitoring</b>
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)	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.	This indicator measures the successful attempt ratio of user equipment to obtain service and establish connection to the server for download, upload, web browsing and video streaming.	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.	Formula: $\frac{\textit{Total successful attempt to establish connection}}{\textit{Total attempt to establish connection}}$	Monitoring
--	--	--	------------

Table 16: MCMC proposal for Service accessibility QoS

52. The service accessibility QoS standard above is to be mandated and monitored based on each test location.

**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).**

Network Utilisation

53. There are four QoS indicators for network utilisation to be adopted in the new MSQoS for wireless broadband access service. The QoS indicators for network utilisation are:
- i. Physical Resource Block (PRB) utilisation
  - ii. Transport utilisation
  - iii. Point of Interconnection (POI) utilisation; and
  - iv. Core network (CN) utilisation
54. PRB utilisation is defined as “the percentage of the highest downlink PRB utilisation over one busy hour of each day, averaged over one month period for every serving sector of eNodeB and gNodeB.” Busy hours shall be determined based on the highest downlink resources utilised and the highest number of connected users over one hour window.
55. Transport utilisation is defined as “the percentage of peak downlink transport utilisation over one hour window of each day, averaged over one month period for each transport node.” Each transport node for access layers (from eNodeB or gNodeB), aggregation layers, trunked, and to the core network is to be measured separately.
56. POI utilisation is defined as “the percentage of peak downlink POI utilisation over one

hour window of each day, averaged over one month period for POI.” It is measured by determining the daily peak percentage of POI utilisation and averaging it over the total measurement duration.

- 57. CN utilisation is defined as “the percentage of peak downlink core network utilisation over one hour window of each day, averaged over one month period for each service impacting network element or network function in the Evolved Packet Core (EPC) and 5G Core (5GC).” It is measured by determining the daily percentage utilization of elements in the EPC and functions in the 5GC and averaging it over the total measurement duration.
- 58. Table 17 exhibits some of NRA regulations and monitoring on the network utilisation QoS parameter for 4G and 5G networks.

NRA	Network utilisation QoS
Singapore (IMDA)	Local bandwidth utilisation (4G network) between: <ul style="list-style-type: none"> <li>▪ eNodeB to SGW (average bandwidth utilisation during one busy hour per working day)</li> <li>▪ PGW to internet (aggregated link utilisation during busy hour)</li> </ul>
Brunei (AITI)	Aggregate installed capacity in terms of international bandwidth and registered peak utilisation of above capacity not to exceed 75% during busy hour.

*Table 17: Network utilisation QoS regulations by NRA*

- 59. Implementing network utilisation QoS standards is to ensure optimal performance of the service provider’s network. It also enables the Commission to identify any potential bottlenecks or congestion on the network and ensure the service providers take the necessary steps to address them. This helps to maintain a high-quality user experience and improve the overall QoS.
- 60. Considering the network utilization QoS standards adopted by other NRA, and the need to have a regulatory measurement on the network utilization QoS performance, the Commission propose the following network utilization QoS standard as in Table 18.

Technology / Network	Network utilisation QoS	Definition / Description / Formula	Mandatory / Monitoring
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)	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.	<p>This indicator measures the percentage of the highest downlink PRB utilisation over one (1) busy hour of each day, averaged over one (1) month period for every serving sector of eNodeB and gNodeB.</p> <p>Formula:</p> $\frac{\sum_{day=1}^{day=N} \text{Busy hour utilisation of each sector}}{\sum_{day=1}^{day=N} \text{Capacity of each sector}} \times 100$ <p>Busy hour shall be determined based on the highest downlink resources utilised and the highest number of connected users over one (1) hour window.</p>	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.	<p>This indicator measures the percentage of peak downlink transport utilisation over one (1) hour window of each day, averaged over one (1) month period for each transport node.</p> <p>Formula:</p> $\frac{\sum_{day=1}^{day=N} \text{Peak utilization of transport node}}{\sum_{day=1}^{day=N} \text{Capacity of transport node}} \times 100$ <p>Each transport node for access layers (from eNodeB or gNodeB), aggregation layers, trunked and to the core network is measured separately.</p>	

Technology / Network	Network utilisation QoS	Definition / Description / Formula	Mandatory / Monitoring
	<p>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.</p>	<p>This indicator measures the percentage of peak downlink core network utilisation over one (1) hour window of each day, averaged over one (1) month period for each service impacting network element or network function in the Evolved Packet Core (EPC) and 5G Core (5GC).</p> <p>Formula:</p> $\frac{\sum_{day=1}^{day=N} \text{Peak downlink utilisation of core network}}{\sum_{day=1}^{day=N} \text{Capacity of core network}} \times 100$	
<p>5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)</p>	<p>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.</p>	<p>This indicator measures the percentage of the highest downlink PRB utilisation over one (1) busy hour of each day, averaged over one (1) month period for every serving sector of gNodeB.</p> <p>Formula:</p> $\frac{\sum_{day=1}^{day=N} \text{Busy hour utilisation of each sector}}{\sum_{day=1}^{day=N} \text{Capacity of each sector}} \times 100$ <p>Busy hour shall be determined based on the highest downlink resources utilised and the highest number of connected users over one (1) hour window.</p>	<p>Monitoring</p>

Technology / Network	Network utilisation QoS	Definition / Description / Formula	Mandatory / Monitoring
	<p>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.</p>	<p>This indicator measures the percentage of peak downlink transport utilisation over one (1) hour window of each day, averaged over one (1) month period for each transport node.</p> <p>Each transport node for access layers (from eNodeB or gNodeB), aggregation layers, trunked and to the core network is measured separately.</p> <p>Formula:</p> $\frac{\sum_{day=1}^{day=N} \text{Peak utilization of transport node}}{\sum_{day=1}^{day=N} \text{Capacity of transport node}} \times 100$	
	<p>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.</p>	<p>This indicator measures the percentage of peak downlink POI utilisation over one (1) hour window of each day, averaged over one (1) month period for POI.</p> <p>Point of interconnection is the demarcated point for exchange traffic between 5G wholesale provider network and 5G access seekers network.</p> <p>Formula:</p> $\frac{\sum_{day=1}^{day=N} \text{Peak utilization of POI}}{\sum_{day=1}^{day=N} \text{Capacity of POI}} \times 100$	

Technology / Network	Network utilisation QoS	Definition / Description / Formula	Mandatory / Monitoring
	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.	<p>This indicator measures the percentage of peak downlink core network utilisation over one (1) hour window of each day, averaged over one (1) month period for each service impacting network element or functions in the 5G Core (5GC).</p> <p>Formula:</p> $\frac{\sum_{day=1}^{day=N} \text{Peak downlink utilisation of core network}}{\sum_{day=1}^{day=N} \text{Capacity of core network}} \times 100$	

Table 18: MCMC proposal on Network Utilisation QoS

61. The proposed QoS standard for network utilization is to be mandated and monitored for each eNodeB and gNodeB, transport network nodes, POI at national and state levels, and core network elements in EPC for 4G, as well as network functions in 5GC for 5G.

**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).**

Network availability

62. There are three QoS indicators for network availability to be adopted in the new MSQoS for wireless broadband access network. The QoS indicators for network availability are:
- i. Network availability (access and aggregation);
  - ii. Point of interconnection (POI) availability; and
  - iii. Core network (CN) availability.
63. Network availability (access and aggregation) is defined as “the percentage of time the network is able to deliver service to end user”. It is measured based on the total uptime of the end-to-end network, from access to the aggregation network over the total measurement duration.

64. POI availability is defined as “the percentage of time the POI is delivering services”. It is measured based on the total uptime for each POI over the total measurement duration.
65. Core network availability is defined as “the percentage of time the core network is able to deliver service. This includes any service impacting network element or network function in the Evolved Packet Core (EPC) and 5G Core (5GC) is measured”. It is measured based on the total uptime of the Evolved Packet Core (EPC) network elements and 5G Core (5GC) network functions over the total measurement duration.
66. Table 19 exhibits some of NRA regulations and monitoring on the network availability QoS parameter for 4G and 5G networks.

NRA	Network availability QoS
Thailand (NBTC)	Network unavailability standards: <ul style="list-style-type: none"> <li>▪ Number of cell outages for more than 4 hours in a month &lt; 10 times per 100 cells</li> <li>▪ Number of cell outages continuously more than 24 hours in a month &lt; 3%</li> <li>▪ Cumulative cell outage in a month &lt; 1%</li> </ul>
Brunei (AITI)	Service availability standards: Intermittent aberrations and transient degradations not to exceed 1 hour per month on aggregate basis
Bahrain (TRA)	Core network availability for mobile service $\geq 99.9\%$
South Africa (ICASA)	<ul style="list-style-type: none"> <li>▪ Proportion of time licensee’s network resources are available for end user <math>\geq 95\%</math></li> <li>▪ Proportion of time licensee’s network services are operational <math>\geq 95\%</math></li> </ul>
Pakistan (PTA)	<ul style="list-style-type: none"> <li>▪ Network downtime <math>\leq 1\%</math> (reported separately for 2G, 3G and 4G sites)</li> </ul>

*Table 19: Network availability QoS regulations by NRA*

67. Implementation of network availability QoS standards is important to ensure that network downtime is kept to a minimum level and to protect the consumers from prolonged inaccessibility to the internet services. Network outages can have a significant impact on consumers, businesses, and the economy. The Commission will be able to ensure that consumers have access to a reliable telecommunications service.

68. Considering the requirements to implement network availability QoS standards based on the benchmark from other NRA and its importance, the Commission proposes the following standards for network availability QoS as in Table 20.

Technology / Network	Network availability QoS	Definition / Description / Formula	Mandatory / Monitoring
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)	Percentage of network availability (access and aggregation) shall be at or not less than 99.50% for each quarter.	<p>This indicator measures the percentage of time the network is able to deliver service to end user.</p> <p>Network shall be considered available if the eNodeB or gNodeB can provide service (Radio Bearer) between end user and core network.</p> <p>Formula:</p> $\frac{\text{Measured Time}_A - \text{UAT}}{\text{Measured Time}_A} \times 100$ <p>Where:  <i>UAT = Unavailable time in minutes</i>  <i>Measured Time<sub>A</sub> = Total measurement time in minutes for all access and aggregation</i></p>	Mandatory
	Percentage of core network availability shall be at or not less than 99.97% for each quarter.	<p>This indicator measures the percentage of time the core network is able to deliver service. This includes any service impacting network element or network function in the Evolved Packet Core (EPC) and 5G Core (5GC) is measured.</p> <p>Formula:</p>	



Technology / Network	Network availability QoS	Definition / Description / Formula	Mandatory / Monitoring
		$\frac{\text{Measured Time}_c - \text{UAT}}{\text{Measured Time}_c} \times 100$ <p>Where:  <i>UAT = Unavailable time in minutes</i>  <i>Measured Time<sub>c</sub> = Total measurement time in minutes for core network</i></p>	
5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	<p>Percentage of network availability (access and aggregation) shall be at or not less than 99.70% for each quarter.</p>	<p>This indicator measures the percentage of time the network is able to deliver service to end user.</p> <p>Network shall be considered available if the gNodeB can provide service (Radio Bearer) between end user and core network.</p> <p>Formula:</p> $\frac{\text{Measured Time}_A - \text{UAT}}{\text{Measured Time}_A} \times 100$ <p>Where:  <i>UAT = Unavailable time in minutes</i>  <i>Measured Time<sub>A</sub> = Total measurement time in minutes for all access and aggregation</i></p>	Monitoring
	<p>Percentage of POI availability shall be at or not less than 99.97% for each quarter.</p>	<p>This indicator measures the percentage of time the POI is delivering services.</p> <p>Formula:</p>	

Technology / Network	Network availability QoS	Definition / Description / Formula	Mandatory / Monitoring
		$\frac{\text{Measured Time}_P - UAT}{\text{Measured Time}_P} \times 100$ <p>Where:  <i>UAT = Unavailable time in minutes</i>  <i>Measured Time<sub>P</sub> = Total measurement time in minutes for POI</i></p>	
	<p>Percentage of core network availability shall be at or not less than 99.97% for each quarter.</p>	<p>This indicator measures the percentage of time the core network is able to deliver service. This includes any service impacting network element or network function in 5G Core (5GC).</p> <p>Formula:</p> $\frac{\text{Measured Time}_C - UAT}{\text{Measured Time}_C} \times 100$ <p>Where:  <i>UAT = Unavailable time in minutes</i>  <i>Measured Time<sub>C</sub> = Total measurement time in minutes for core network</i></p>	

Table 20: MCMC proposal for Network Availability QoS

69. The proposed network availability QoS standards are to be mandated and monitored for every access and aggregation network, POI at the state and national levels, and core networks elements in 4G and functions in 5G.

**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).**

## 5G Single Wholesale Network QoS Requirements

70. Pursuant to the new direction of the government to move from 5G Single Wholesale Network (SWN) to 5G Dual Network model, a separate set of quality indicators are to be monitored for the 5G Single Wholesale Network (SWN). These QoS parameters are important to be monitored during the transition period from 5G SWN to the Dual Network to ensure that the SWN and service providers maintain the required service level during the transition process.
71. The proposed QoS parameters are to be monitored by the Commission and 5G SWN providers based on network statistics reporting. The data collected from the Operations Support System (OSS) are to be monitored, reported and improved if it is not meeting the standards.
72. Therefore, in order to monitor the 5G network QoS of the SWN, the Commission proposes the following QoS requirements as shown in Table 21.

<b>Technology / Network</b>	<b>QoS indicator</b>	<b>QoS standard</b>
5G (allocated IMT frequency band in 703 – 743 MHz, 758 – 798 MHz, 3.4 – 3.6 GHz and 26.5 – 28.1 GHz)	Latency (ms)	Mean latency for each service provider calculated via network statistic shall be not more than: <ul style="list-style-type: none"> <li>i. 35 ms, between end user to the national POI; OR</li> <li>ii. 15 ms, between end user to the regional POI.</li> </ul>
	Packet loss (%)	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.
	Download throughput (Mbps)	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.

Technology / Network	QoS indicator	QoS standard
	Upload throughput (Mbps)	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 (%)	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: MCMC proposal for 5G Service KQI standards

73. The proposed 5G KQIs standards are to be monitored by the 5G SWN based on each of the gNodeB and for individual access seekers for all the QoS indicators.

**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).**

#### **PART C: APPLICABLE GUIDELINES**

74. The Commission has developed a set of guidelines that formulate the measurement procedures, test methodology, reporting templates, applicable timelines, measurement location conditions and explanatory notes to the standards proposed in this document. The said guideline is annexed in Appendix I – Guidelines to the Commission Determination on the Mandatory Standards for Quality of Service (Wireless Broadband Access Service).

**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).**

# APPENDIX I



**Suruhanjaya Komunikasi dan Multimedia Malaysia**

*Malaysian Communications and Multimedia Commission*

**DRAFT GUIDELINES TO THE COMMISSION  
DETERMINATION  
ON THE MANDATORY STANDARDS FOR QUALITY OF  
SERVICE  
(WIRELESS BROADBAND ACCESS SERVICE)  
DETERMINATION NO. X OF YYYY**

**(SKMM(T)06-SEIR/140.003/Jil. 3 ('X'))**

**DD MM YYYY**

## TABLE OF CONTENTS

<b>INTERPRETATION</b>	<a href="#"><u>3</u></a>
<b>PART A: OBJECTIVE AND SCOPE</b>	<a href="#"><u>5</u></a>
<b>PART B: KEY QUALITY INDICATORS (KQI) ASSESSMENT</b>	<a href="#"><u>5</u></a>
<b>PART C: MEASUREMENT METHODOLOGY FOR QUALITY OF SERVICE AND QUALITY OF EXPERIENCE</b>	<a href="#"><u>7</u></a>
C.1 End-to-end measurement	<a href="#"><u>8</u></a>
C.1.1 End-to-end Measurement Methodology	<a href="#"><u>8</u></a>
C.1.2 Measurement Location Conditions	<a href="#"><u>12</u></a>
C.2 Network Statistic Data Reporting	<a href="#"><u>13</u></a>
C.2.1 Network Utilisation and Availability	<a href="#"><u>13</u></a>
C.2.2 5G Access Network Statistic	<a href="#"><u>15</u></a>
C.3 Service Prioritisation, Misrepresentation and Exemption	<a href="#"><u>16</u></a>
<b>PART D: REQUIREMENT FOR REPORT SUBMISSION</b>	<a href="#"><u>16</u></a>
D.1 Subjected Areas for Mandatory Standards	<a href="#"><u>18</u></a>
<b>PART E: EFFECTIVE DATE AND COMMISSION CONTACT</b>	<a href="#"><u>18</u></a>

## INTERPRETATION

4G	4th generation of mobile telecommunication technology, required by International Mobile Telecommunications for the year 2010 (IMT-ADVANCE)
5G	5th generation of mobile telecommunication technology, required by International Mobile Telecommunications for the year 2020 (IMT-2020)
CIMS	Communication Infrastructure Management System
CDN	Content Delivery Network
End user	A person who receives, requires, acquires, uses or subscribes to the public cellular service and may include a customer
eNodeB	4G wireless access node that transmit and receive communications between the end user and mobile network
ETSI	European Telecommunications Standards Institute
FTP	File Transfer Protocol
FWA	Fixed Wireless Access
gNodeB	5G wireless access node that transmit and receive communications between the end user and the mobile network
GPS	Global Positioning System
HTTP	HyperText Transfer Protocol
IMT	International Mobile Telecommunications
KQI	Key Quality Indicators
Klang Valley	Area centred in Federal Territories of Kuala Lumpur and surrounding cities in Selangor districts
National POI	a POI located in Klang Valley
POI	Point of Interconnection
PRB	Physical Resource Block
QoE	Quality of Experience



QoS	Quality of Service
Regional POI	a POI located in any states or federal territories in Malaysia
RSRP	Reference Signal Receive Power
Service provider	Applications Service Provider or a Network Service Provider who provides 4G and 5G wireless broadband access service to the end user
Test server	A server deployed by the Commission or the service provider, located in Klang Valley for the purpose of conducting end-to-end quality of service measurement
UE	User equipment, a device allowing a user access to network service via radio interface
URL	Uniform Resource Locator
WGS	World Geodetic System
Wholesale provider	An access provider who provides 5G network access to the service provider

## **PART A: OBJECTIVE AND SCOPE**

1. These guidelines are developed by the Malaysian Communications and Multimedia Commission (the "Commission") pursuant to Paragraph 'x' of the Commission Determination on the Mandatory Standards for Quality of Service (Wireless Broadband Access Service), Determination No. X of YYYY ("Mandatory Standards").
2. These guidelines set out the measurement methodology, test parameters, reporting procedures, templates, and explanatory notes for the purpose of network quality assessment.
3. These guidelines are applicable for terrestrial wireless broadband access and fixed wireless access (FWA) services using 4G and 5G network including 5G Non- Standalone (NSA) and 5G Standalone (SA).
4. All parties including but not limited to wholesale provider, service provider and any appointed third party shall conduct wireless broadband measurement and the report shall be provided to the Commission based on the guidelines set in this document.

## **PART B: KEY QUALITY INDICATORS (KQI) ASSESSMENT**

5. The Mandatory Standards for Quality of Service (MSQoS) Wireless Broadband Access Service (wireless BAS) establishes two (2) sets of Key Quality Indicators (KQI) which are **Mandatory KQI** and **Monitoring KQI**.
  - a. **Mandatory KQI:**

This quality indicator shall be monitored, mandated, and enforced by the Commission. The Mandatory Key Quality Indicators shall also be monitored, reported, and rectified by the relevant NSPs and ASPs based on the minimum requirements of these standards.
  - b. **Monitoring KQI:**

This quality indicator shall be monitored by the Commission. The Monitoring Key Quality Indicators shall also be monitored, reported, and rectified by the relevant NSPs and ASPs based on the minimum requirements of these standards.

6. Both the Mandatory KQI and Monitoring KQI shall be assessed via two (2) different methods depending on the parameters, which are:
  - a. End-to-end measurement:  
On-field measurement conducted using user equipment (UE) installed with wireless broadband measurement software. This is applicable to wireless BAS including FWA measurement.
  - b. Network statistic data reporting:  
Data extracted from the Operating Support System (OSS) or Two-Way Active Measurement Protocol (TWAMP). Parameter includes network utilisation, availability and other 5G access network performance.
7. Mandatory KQI and Monitoring KQI for end-to-end measurement is required for the service providers based on the type of network service provided, and the frequency bands of the network, as shown in Table 1 below. All KQIs depicted in Table 1 is measured for each location, except for the "Download throughput per area (all technology)" which will be measured for every state and federal territory.

Table 1: KQI end-to-end measurement for wireless BAS

<b>Key Quality Indicators</b>	<b>5G service</b> (Using frequency bands 703-743 MHz, 758-798 MHz, 3.4-3.6 GHz & 26.5-28.1 GHz)	<b>4G &amp; 5G service</b> (Using all frequency bands except 703-743 MHz, 758-798 MHz, 3.4-3.6 GHz & 26.5-28.1 GHz)
Download throughput	Monitoring	Mandatory
Upload throughput	Monitoring	Mandatory
Latency	Monitoring	Mandatory
Packet loss	Monitoring	Mandatory
Service Accessibility	Monitoring	Mandatory
HTTP session time (web browsing)	Monitoring	Mandatory
Video streaming access time	Monitoring	Mandatory
Download throughput per area (all technology)	Mandatory	

8. Mandatory KQI and Monitoring KQI for network statistics data reporting is required for the service providers based on the type of network service provided, and the frequency bands of the network, as shown in Table 2 below.

Table 2: KQI network statistic for wireless BAS

<b>Key Quality Indicators</b>	<b>5G network</b> (Using frequency bands 703-743 MHz, 758-798 MHz, 3.4-3.6 GHz & 26.5-28.1 GHz)	<b>4G &amp; 5G network</b> (Using all frequency bands except 703-743 MHz, 758-798 MHz, 3.4-3.6 GHz & 26.5-28.1 GHz)
PRB utilisation	Monitoring	Mandatory
Transport utilisation	Monitoring	Mandatory
POI utilisation	Monitoring	<i>Not applicable</i>
Core network utilisation	Monitoring	Mandatory
Network availability (access and aggregation)	Monitoring	Mandatory
POI network availability	Monitoring	<i>Not applicable</i>
Core network availability	Monitoring	Mandatory

9. The Monitoring KQI for 5G access network statistics data reporting is required for 5G wholesale provider as shown in Table 3 below. This Monitoring KQI will also be a requirement for any network sharing model adopted by Entity A and Entity B after the transition from 5G single wholesale network to 5G Dual Network.

Table 3: KQI access network statistic for 5G wholesale network

<b>Key Quality Indicators</b>	<b>5G wholesale network</b> (Using frequency bands 703-743 MHz, 758-798 MHz, 3.4-3.6 GHz & 26.5-28.1 GHz)
Download throughput	Monitoring
Upload throughput	Monitoring
Latency	Monitoring
Packet loss	Monitoring
Service Accessibility	Monitoring

## **PART C: MEASUREMENT METHODOLOGY FOR QUALITY OF SERVICE AND QUALITY OF EXPERIENCE**

10. Quality of wireless BAS network is assessed by way of end-to-end measurement and network statistic data reporting. This section explains the methodology and procedure for the respective network quality assessment.

## C.1 End-to-end measurement

- The end-to-end measurement shall be conducted based on the KQI for Quality of Service (QoS) and Quality of Experience (QoE) as shown in Table 4.

Table 4: Key Quality Indicators for QoS and QoE

QoS	QoE
Download throughput Upload throughput Latency Packet loss Service accessibility	HTTP session time (web browsing) Video streaming access time

- The end-to-end measurement for QoS shall be tested between user equipment to test server located in Klang Valley, while for QoE shall be tested between user equipment to the respective Content Delivery Network (CDN) server.

### C.1.1 End-to-end Measurement Methodology

- The diagram below depicts the end-to-end measurement overview involving 4G and 5G network:

Figure 1: End-to-end measurement diagram for 4G or 5G network

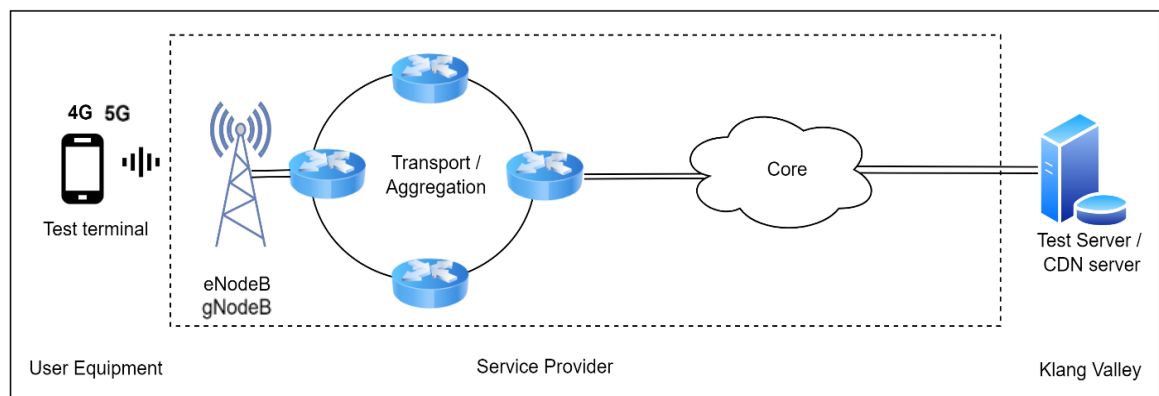
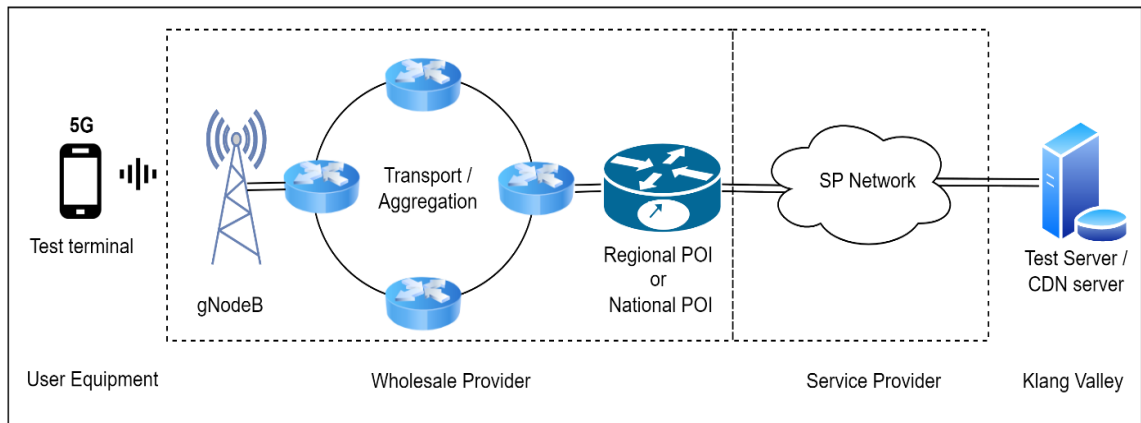


Figure 2: End-to-end measurement diagram for 5G wholesale network



14. Table 5 below describes the test procedures for specific QoS and QoE end-to-end measurement.

Table 5: Test procedures for QoS and QoE measurement

Item	Description
Download throughput	a. Based on File Transfer Protocol (FTP) with the minimum file size of 1GB <sup>9</sup> or 100MB <sup>10</sup> . b. File size is subjected to the Commission’s discretion. c. Minimum sample for each location is 6 samples.
Upload throughput	a. Using File Transfer Protocol (FTP) with the minimum file size of 100MB <sup>1</sup> or 10MB <sup>2</sup> . b. File size is subjected to the Commission’s discretion. c. Minimum sample for each location is 6 samples.
Latency	a. Measures the round-trip time (RTT) using Internet Control Message Protocol (ICMP). b. Standard packet size of 64 to 128 bytes with minimum of 100 samples for each location. c. Connection timeout and wait time shall be set at 10 seconds. d. Test time duration shall be set at 10 seconds.
Packet loss	a. Measures the percentage of packet loss based on the latency test samples for each location.
Service accessibility	a. Successful attempt ratio of all samples for download, upload, web browsing and video streaming tests for each location.
HTTP session time (web browsing)	a. Test webpage shall be from 5 different web pages commonly used in Malaysia. b. Web page selection is subjected to the Commission’s discretion.

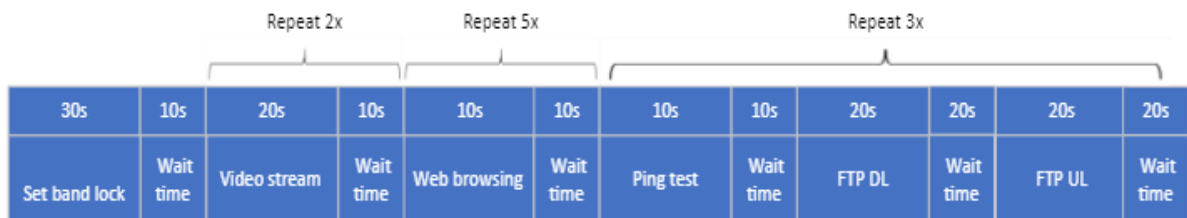
<sup>9</sup> Wireless Broadband Access and FWA service using 5G (operating in the IMT frequency band 703-743 MHz, 758-798 MHz, 3.4-3.6 GHz & 26.5-28.1 GHz)

<sup>10</sup> Wireless Broadband Access and FWA service using 4G network (all allocated IMT frequency band) & 5G network (all allocated IMT frequency band other than 703-743 MHz, 758-798 MHz, 3.4-3.6 GHz & 26.5-28.1 GHz)

Item	Description
	c. Connection timeout and wait time shall be set at 10 seconds. d. Browsing duration shall be set at 10 seconds for each web page. e. Minimum samples at each location for each web page is 2 (10 samples in total).
Video streaming access time	a. The source of video streaming shall be a 4K video resolution from two different YouTube content with a duration of more than 1 minute. b. The higher picture quality setting shall be applied on YouTube application of the test UE. c. Connection timeout and wait time shall be set at 10 seconds. d. Streaming duration shall be set at 20 seconds for each video source. e. Minimum samples at each location for each video content is 2 (4 samples in total).
Download throughput per area	a. All download throughput samples for all technology (4G and 5G) shall be averaged for each state and federal territories within a quarter.

15. Testing sequence for QoS and QoE test shall be conducted as figure 3:

Figure 3: Testing sequence for QoS and QoE



Note: 1. Source for each video stream test shall be from difference URL link  
 2. Source for each web browsing test shall be from difference URL link

16. The UE or test terminal setting is set differently for Mandatory KQI and Monitoring KQI. The measurement shall be conducted as stated in Table 6.

Table 6: Test terminal or UE setting for wireless BAS

Monitoring KQI	Mandatory KQI
a. All test terminals shall be locked to 5G frequency bands 703-743 MHz, 758-798 MHz, 3.4-3.6 GHz & 26.5-28.1 GHz.  b. For location where there is only one 5G network, shared by Entity A and	a. All test terminals shall be excluded bands 703-743 MHz, 758-798 MHz, 3.4-3.6G Hz & 26.5-28.1 GHz.  b. The measurement shall be conducted concurrently for

Monitoring KQI	Mandatory KQI
<p>Entity B, the measurement shall be conducted in sequential manner for each service provider.</p> <p>c. For locations where two different 5G networks are available, provided by Entity A and Entity B, the measurement shall be conducted concurrently only for 1 service provider from different entity.</p>	<p>multiple service provider testing.</p>

17. The measurement tools used for the tests shall comply with the relevant recommendations from European Telecommunications Standards Institute (ETSI)'s standards or equivalent.
18. The test logs produced by the tools must be compatible with the Commission's requirement for the purpose of the Commission's verification and analysis.
19. Geographical positioning will be based on the Global Positioning System (GPS) and the WGS-84 digital map or its equivalent.
20. Serving site identification, network configurations and frequency bands for each test location shall be recorded as required in the reporting template presented within this guideline.
21. All test log files shall be kept accordingly for at least 24 months from the date of report submission and shall be presented to the Commission as and when required.
22. The measurement shall be performed at outdoor or indoor common areas, by way of drive test, stationary test or walk test.
23. The Commission may at its discretion, performed measurement to the test server hosted by the Commission, wholesale provider or service provider for audit purposes, where deemed necessary.
24. All tests may be performed at any day of the week.



### C.1.2 Measurement Location Conditions

25. The Commission may list out the locations prior to the measurement exercise. Locations measured by service providers shall not be the same unless requested by the Commission for retesting or verification of network improvements.
26. The requirement for measurement location is selected based on the following conditions:
  - a. Outdoor measurement conditions: Residential areas, industrial areas, tourism areas, educational institutions, business districts, highways, federal roads, state roads<sup>11</sup>, railways, and public facilities (airports, train stations, healthcare facilities, etc.).
  - b. Indoor measurement conditions: Indoor common areas for residential, tourism, educational institutions, business districts, government, exhibition, and public facilities (airports, train stations, healthcare, etc.).
  - c. Special consideration shall be given at the Commission's discretion for areas where limited access or space is required to provide network services, such as tunnels, private areas, basements, buildings above 12 floors, etc.
27. Every service provider shall select at least 200 distinctive locations for Mandatory KQI and 50 distinctive locations for Monitoring KQI (5G) for end-to-end measurement in each quarter, nationwide, subject to availability of service in that particular region or state.
28. The test locations shall be evenly distributed across all 6 regions, covering all states and federal territories. Meaning, at least 41 to 42 locations are to be measured for each region in every quarter. Every state or federal territories must have a minimum of 50 locations measured within a year. If 5G wireless broadband service is not widely available in a particular state at that point of time, measurement shall be performed on other state or region to meet the minimum test locations.
29. The regions shall be categorized as below:
  - Northern: Perak, Pulau Pinang, Kedah and Perlis.
  - Central: Selangor, Negeri Sembilan, Wilayah Persekutuan Putrajaya, Kuala Lumpur and Labuan.
  - Southern: Johor and Melaka.
  - Eastern: Pahang, Kelantan, and Terengganu.
  - Sabah: Sabah.
  - Sarawak: Sarawak.

---

<sup>11</sup> Source from [www.jkr.gov.my](http://www.jkr.gov.my)

## C.2 Network Statistics Data Reporting

30. There are two types of network statistics data shall be reported to the Commission which are:
- Network utilisation and network availability data, for 4G and 5G network deployed by the service providers; and
  - 5G access network statistic data, by 5G wholesale provider or any of the entities providing access to 5G using any network sharing model after the transition to Dual Network.

### C.2.1 Network Utilisation and Availability

31. Service providers are required to monitor, record and submit the network utilisation and network availability data to the Commission, based on the definition stated in table 7 below:

Table 7: Network statistics data reporting for 4G and 5G network

<b>KQI</b>	<b>Description and definition of reporting requirement</b>
PRB utilisation	<ol style="list-style-type: none"> <li>This indicator measures the percentage of the highest downlink PRB utilisation over one (1) busy hour of each day, averaged over one (1) month period, for every serving sector of each eNodeB or gNodeB.</li> <li>Busy hour shall be determined based on the highest downlink resources utilised, combine with the highest number of connected users at that particular sector, over one (1) hour window.</li> </ol>
Transport utilisation	<ol style="list-style-type: none"> <li>This indicator measures the percentage of peak downlink transport utilisation over one (1) hour window of each day, averaged over one (1) month period, for each transport node.</li> <li>Each transport node for access layers (from eNodeB or gNodeB), aggregation layers, trunked and to the core network is measured separately.</li> </ol>
POI utilisation	<ol style="list-style-type: none"> <li>This indicator measures the percentage of peak downlink POI utilisation over one (1) hour window of each day, averaged over one (1) month period for POI.</li> <li>Point of interconnection is the demarcated point for exchange traffic between 5G wholesale provider network and 5G access seekers network.</li> </ol>

<b>KQI</b>	<b>Description and definition of reporting requirement</b>
Core Network utilisation	a. This indicator measures the percentage of peak downlink core network utilisation over one (1) hour window of each day, averaged over one (1) month period for each service impacting network element or network function in the Evolved Packet Core (EPC) and 5G Core (5GC).
Network availability (access and aggregation)	a. This indicator measures the percentage of time the network is able to deliver service to end user. b. Network shall be considered available if the eNodeB or gNodeB can provide service (Radio Bearer) between end user and core network.
POI availability	a. This indicator measures the percentage of time the POI is delivering services.
Core Network availability	a. This indicator measures the percentage of time the core network is able to deliver service. This includes any service impacting network element or network function in the Evolved Packet Core (EPC) and 5G Core (5GC) is measured.

32. The network statistic data on network utilisation and network availability shall be obtained from actual network monitoring.
33. Any part of the network utilisation which do not comply with the required standards shall be rectify within 14 days. In any specific month within the reporting period, where any part of the network utilisation exceeded the required standards, improvement of the network capacity shall be performed. For example, the network utilisation for transport A in month 1 exceeded the threshold, but fall below the threshold in month 2, improvement of transport A still need to be performed to avoid any future network congestion.
34. For POI network utilisation rectification process, which involves more than one (1) party, service providers shall make a request to wholesale provider to upgrade the POI within the first 7 days and the wholesale provider is required to upgrade the POI within the next 7 days.
35. Any partial network failure which causes the service not able to be fully functional or intermittent in nature, shall be consider as part of network unavailability.

36. The Commission may at its discretion, acquire a more granular set of data or data within specific period, on network utilisation and availability. These data should be made available to the Commission by the service providers or wholesale provider.

### C.2.2 5G Access Network Statistic

37. 5G Access network statistic is the performance of the 5G single wholesale network, including download, upload, latency, packet loss, and service accessibility between end user and POI, shall be calculated via network statistic.
38. The 5G access network statistics data reporting is applicable to 5G wholesale provider that provides 5G access network, operating in allocated IMT frequency bands 703–743 MHz, 758–798 MHz, 3.4–3.6 GHz and 26.5–28.1 GHz.
39. Wholesale providers or any of the Entities in 5G dual Network are required to monitor, record, and submit the 5G access network performance data to the Commission, based on the definition stated in table 8 below:

Table 8: 5G access network statistics data reporting

<b>KQI</b>	<b>Description and definition of reporting requirement</b>
Download Throughput	This indicator measures the volume of downloaded data traffic per second to the end user.
Upload Throughput	This indicator measures the volume of uploaded data traffic per second from the end user.
Latency	This indicator measures the average round-trip time taken by a standard packet to traverse the network between the end user and the regional or national POI.
Packet Loss	This indicator measures the percentage of data packet transmitted that fails to arrive at its destination, between the end user and regional or national POI.
Service Accessibility	This indicator measures the probability that a service can be obtained when requested by the user.  Network statistics calculated the ratio of successful end user registration, to the number of attempts.

40. For any region with regional or state POI, the network statistics shall be calculated between the end user and the regional or state POI. For any region without regional POI, the test shall be calculated between the end user and the national POI.

41. The network statistics data shall be based on hourly period. The Commission may at its discretion, acquire a more granular set of data or raw data. These data should be made available to the Commission by the wholesale provider.
42. The network statistics data shall be separated by service provider for each KQI.

### **C.3 Service Prioritisation, Misrepresentation and Exemption**

43. A validation procedure shall be applied to avoid any service/application prioritisation to ensure the test is conducted in a fair manner representing real user experience. These prioritisations include but not limited to the following:
  - a. SIM-based prioritisation.
  - b. Service based prioritisation such as, application, port number, IP address, type of service, etc.
44. Any service provider or wholesale provider found to perform any alteration to the network configuration or manipulation of test results or network statistics at any location, shall be considered as non-compliance to the Mandatory Standards for each of the location.
45. Any data provided to the Commission shall not be misrepresented. Any misrepresentation of data or false reporting shall be considered as non-compliance to the Mandatory Standards for each location or sites.
46. A Service provider shall be exempted from compliance with the mandatory standard or provisions of this document to the extent it is unable to comply for any specific location due to damage to network facility caused by force majeure or by third parties on condition that the event is reported in time. Any exemption is subjected to the Commission discretion.

### **PART D: REQUIREMENT FOR REPORT SUBMISSION**

47. All reports that are required to be submitted to the Commission should be sent to address and/or email as below. The Commission shall notify the service providers and wholesale provider of any changes to the reporting address or email.

Malaysian Communications and Multimedia Commission  
MCMC Tower 1, Jalan Impact, Cyber 6,  
63000 Cyberjaya  
Selangor Darul Ehsan

Email: [srcd@mcmc.gov.my](mailto:srcd@mcmc.gov.my); and  
[qos.dept@mcmc.gov.my](mailto:qos.dept@mcmc.gov.my)

48. These reports shall be in the form as described below, in pdf and Microsoft Excel formats. Each report shall be accompanied by a declaration signed by the Chief Executive Officer (or any other person that holds an equivalent designation) of the service provider duly authorised by the board of directors, stating that each report is true and accurate.
49. The wholesale provider and service providers shall submit the reports based on the following timeline stated in Table 9 below:

Table 9: Reporting Timeline

No	Item	Reporting Period	Submission Date	Report Template
1	Wireless BAS Measurement Report	Quarterly	By 30 <sup>th</sup> of the following month of each quarter	Annex 1
2	Network Utilisation Report	Quarterly	By 30 <sup>th</sup> of the following month of each quarter	Annex 2
3	Network Availability Report	Quarterly	By 30 <sup>th</sup> of the following month of each quarter	Annex 3
4	Access Network Statistics Report	Monthly	By 15 <sup>th</sup> of the following month	Annex 4

50. The wireless BAS end-to-end measurement report submitted shall include all relevant information regarding the test conducted including but not limited to:
- Time and date for each test conducted for each location.
  - Information on the measurement system used for the test.
51. Service providers and wholesale provider shall provide proof of network improvement or rectifications and any relevant information for verification by the Commission including access to raw data and real-time network data.

52. Service providers and wholesale provider shall keep the report for at least 24 months from the date of report submission.

#### **D.1. Subjected Areas for Mandatory Standards**

53. The Mandatory Standards for wireless BAS shall be enforced in all states and federal territories in Malaysia.
54. The standards for end-to-end measurement conducted by any party shall be enforced per location except for the parameter on download throughput per area (all technology).
55. The standards for network utilisation shall be enforced for each network node including each transport, POI and core network. The PRB network utilisation shall be enforced for each serving sector of gNodeB or eNodeB.
56. The standards for network availability shall be enforced for all access and aggregation network. Network availability for each POI and core network shall be enforced separately.

#### **PART E: EFFECTIVE DATE AND COMMISSION CONTACT**

57. These guidelines shall come into effect on DD MM 2023, and shall continue to be effective unless modified, varied, or revoked by the Commission

**Format for End-to-end Measurement Report**

Table 10: End-to-end measurement report

No.	Date and Time	Location Name	Latitude, Longitude	State	[1] Serving Site ID	[2] Serving Site Technology and frequency bands	[3] PRB Utilisation (%)	[4] Backhaul Type	Backhaul capacity (Mbps)	[5] Backhaul Utilisation (%)	Avg. Signal Strength (RSRP in dBm)	[6] Avg. DL Speed (Mbps)	[7] Avg. UL Speed (Mbps)	[8] Avg. Round-Trip Time (ms)	[9] Packet Loss (%)	Avg. HTTP session time (s)	Avg. Video streaming access time (s)	[10] Service Accessibility (%)
1																		
2																		
...																		
n																		

Notes:

- [1] Site identification name (same as CIMS data)
- [2] Frequency band configuration for each base station
- [3] Average PRB utilisation eNodeB/gNodeB utilisation during test hour
- [4] Microwave or fibre or satellite backhaul
- [5] Average backhaul utilisation during test hour
- [6] Based on application throughput downlink average
- [7] Based on application throughput uplink average
- [8] Based on successful ping transmitted and received
- [9] Based on ping transmitted but was not received at sender
- [10] Based on successful attempt ratio of all download, upload, web browsing and video streaming tests



**Format for Network Utilisation Report**

Table 11: PRB utilisation report

No.	Service Provider	Serving Site ID	Serving Sector ID	Coordinate (Longitude & Latitude)	[1] Serving Site Type	State	[2] Frequency Configuration	[3] PRB Utilisation (%)			Network Improvement/ Rectification
								1st Month	2nd Month	3rd Month	
1											
2											
...											
n											

**Notes:**

[1] Type of serving site is specified for outdoor and indoor

[2] Frequency band configuration for each gNodeB or eNodeB

[3] Percentage of downlink PRB utilisation over one (1) busy hour of each day for every serving sector of a gNodeB or eNodeB averaged over one (1) month period

Table 12: Backhaul/transport network utilisation report

No.	Service Provider	[1] Transport ID	[2] Applicable Serving Site ID	Coordinate (Longitude & Latitude)	State	Transport Type (Microwave/ Fiber)	[3] Bandwidth Capacity (Mbps)	Bandwidth Utilisation (%)						Network Improvement/ Rectification
								1st Month		2nd Month		3rd Month		
								[4] Uplink	[5] Downlink	[4] Uplink	[5] Downlink	[4] Uplink	[5] Downlink	
1														
2														
...														
n														

**Notes:**

[1] All transport network for access, aggregation, trunked and metro

[2] If the transport network connects to a specific gNodeB or eNodeB

[3] Total bandwidth capacity (in Mbps) of each transport

[4] Percentage of peak uplink network utilisation over one (1) hour window of each day, averaged over one (1) month

[5] Percentage of peak downlink network utilisation over one (1) hour window of each day, averaged over one (1) month

Table 13: POI network utilisation report

No.	Service Provider	POI Network ID	Regional/National	Coordinate (Longitude & Latitude)	State	POI Network Capacity (Mbps)	POI Network Utilisation (%)						Network Improvement/Rectification
							1st Month		2nd Month		3rd Month		
							[1] Uplink	[2] Downlink	[1] Uplink	[2] Downlink	[1] Uplink	[2] Downlink	
1													
2													
...													
n													

**Notes:**

- [1] Percentage of peak uplink network utilisation over one (1) hour window of each day, averaged over one (1) month
- [2] Percentage of peak downlink network utilisation over one (1) hour window of each day, averaged over one (1) month

Table 14: Core network utilisation report

No	Service Provider	Core Network Function/Element	Coordinate (Longitude & Latitude)	State	Core Network Capacity			Core Network Utilisation on throughput and subscriber (%)									Network Improvement/Rectification
					Uplink	Downlink	Subs	1st Month			2nd Month			3rd Month			
								[1] Uplink	[2] Downlink	[3] Subs	[1] Uplink	[2] Downlink	[3] Subs	[1] Uplink	[2] Downlink	[3] Subs	
1																	
2																	
...																	
n																	

**Notes:**

- [1] Percentage of peak uplink network utilisation over one (1) hour window of each day, averaged over one (1) month
- [2] Percentage of peak downlink network utilisation over one (1) hour window of each day, averaged over one (1) month
- [3] Percentage of peak simultaneous active users over total capacity of users in over one (1) hour window of each day, averaged over one (1) month

**Format for Network Availability Report**

Table 15: Network availability report (Access and Aggregation)

No.	Service Provider	Total access network (gNodeB or eNodeB)	Total access network downtime (minutes)	% Network Availability (Access and Aggregation)	Network Improvement/Rectification
1					

Table 16: POI availability report

No.	Service Provider	POI ID	Total POI downtime (minutes)	State	% POI Network Availability	Network Improvement/Rectification
1						
2						
...						
n						

Table 17: Core network availability report

No.	Service Provider	Core Network Function / Element	Total downtime (minutes)	State	% Core Network Availability	Network Improvement/Rectification
1						
2						
...						
n						

**Format for 5G Access Network Statistics Report**

Table 18: 5G wholesale access network statistics report

No.	Service Provider	Base station ID (gNodeB)	Serving Site Type (indoor/outdoor)	Cluster ID	State	Download Throughput (Mbps)	Upload Throughput (Mbps)	Latency (ms)	Packet loss (%)	Service Accessibility (%)
1										
2										
...										
n										

**Notes:**

Access network statistics report shall be provided for each service providers.