REPORT ON QUALITY-OF-SERVICE (QoS) PERFORMANCE
BY MOBILE NETWORK OPERATORS
FOR FY 2022-2023

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REPORT ON QUALITY-OF-SERVICE (QoS) PERFORMANCE BY THE MOBILE NETWORK OPERATORS FOR FY 2022-2023

I.   INTRODUCTION

The Authority monitors the quality of mobile cellular services provided by mobile network operators to ensure compliance with the licenses and consumer protection. The quality of service (QoS) is performed according to the industry guidelines contained in the Quality-of-Service Assessment Framework put in place by the Authority. This framework provides for three platforms: End-to-end testing vide Drive and Walk tests, Network Performance NP-QoS that runs on a 24/7 dashboard, and Quality of Experience (QoE) done via consumer satisfaction surveys.

The Authority conducted a quality of service assessment on the three mobile networks (MNOs), namely Telkom Kenya Limited, Airtel Networks Kenya Limited, and Safaricom PLC in accordance with the framework guidelines. This report details the results of the three components, i.e., End-to-End QoS, Network Performance (NP) QoS and Quality of Experience (QoE). The exercise was conducted in 44 out of the 47 counties for the end-to-end testing, while the NP QoS report provides countrywide snapshots derived randomly from the near real-time data dumbs uploaded on the NP system by MNOs. The QoE values were extracted from the countrywide survey. The report also highlights progress made on the service rollout requirements.

The end-to-end QoS assessment results are detailed in Table 3, while compliance to license rollout targets assessment is provided in Table 4. NP QoS assessment is reported in Table 5, while QoE status is given in Table 6. The results from the components herein are aggregated, and a per cent is derived, which determines the   extent to which a licensee has complied with the minimum QoS requirements. A licensee is deemed compliant if they meet at least 80% of the target through individual Key Performance Indicators (KPIs).

II.   KEY PERFORMANCE INDICATORS MEASURED

The table below shows the parameters that were measured for each segment, i.e. Voice, Data Internet and SMS.

i.   The Measurement Parameters

VOLUME	SMS	DATA
Unsuccessful call ratio.	Successful SMS Ratio	Latency (delays and buffering)
		Data transfer failure ratio and Throughput of successful data transfer
Dropped call ratio	Completion Rate for SMS	Internet Accessibility
Call set up time		HTTP set-up failure ratio and HTTP set-up time
Voice quality (MOS, POLQA)	End-to-end delivery time for SMS	HTTP Completion Failure Ratio and HTTP Completion Time
Handover		HTTP generic scenario availability

ii. Measurement Parameters and Targets

The table below shows the Key Performance Indicators in assessing Quality of Service;

Table 2: Measurement Parameters and Targets

| Service	Parameters	Targets
Voice	Unsuccessful call ratio	<=5%
	Dropped call ratio	<=2%
	Call set up time	Mean value <= 8s for GSM and <= 12s for LTE
	Voice quality (MOS, POLQA)	>= 3.4 (Narrow Band)
	Handover	⇨ 96%
Data	Latency	100 ms (1)
	Jitter	50 ms (1)
	Data transfer failure ratio and Throughput of successful data transfer	DL failure ratio <= 10 % UL failure ratio <= 10 %
	Ratio of Packet Loss	1 / 1,000 (1)
	Internet Accessibility	=>98 %
	HTTP set-up failure ratio and HTTP set-up time	HTTP set-up failure ratio <=2% HTTP set-up time T=95 % within 5 s
	HTTP Completion Failure Ratio and HTTP Completion Time	HTTP Completion failure ratio HTTP Completion Time
SMS	Successful SMS Ratio	> 95%
	Completion Rate for SMS	> 95%
	End-to-end delivery time for SMS	> 95% Rate of SMS completed in a delay of less than 30 s. (best practice)

III.   RESULTS

From the activities highlighted above, the performance is as detailed below:

A. End-to-End Quality of Service

End-to-end quality of service assessment is done using drive tests for outdoor sites, while walk tests are adopted for indoors. Table 3 and Figure 1 below provide a comparison of the end-to-end QoS performance for each operator with the levels attained in the previous periods. The drive tests were done across 44 counties that are currently accessible in terms of local Security.

Table -3: Annual End-to-End QoS Performance

No.	Name	2020/2021	2021/2022	2022/2023
1	Telkom Kenya Limited	65.45%	73%	54.75%
2	Airtel Networks Kenya Limited	65.45%	79%	75.07%
3	Safaricom PLC	95.68%	95%	87.60%
4	**Industry Average**	**75.53%**	**82.3%**	**72.47%**

Figure 1 - Comparative Score
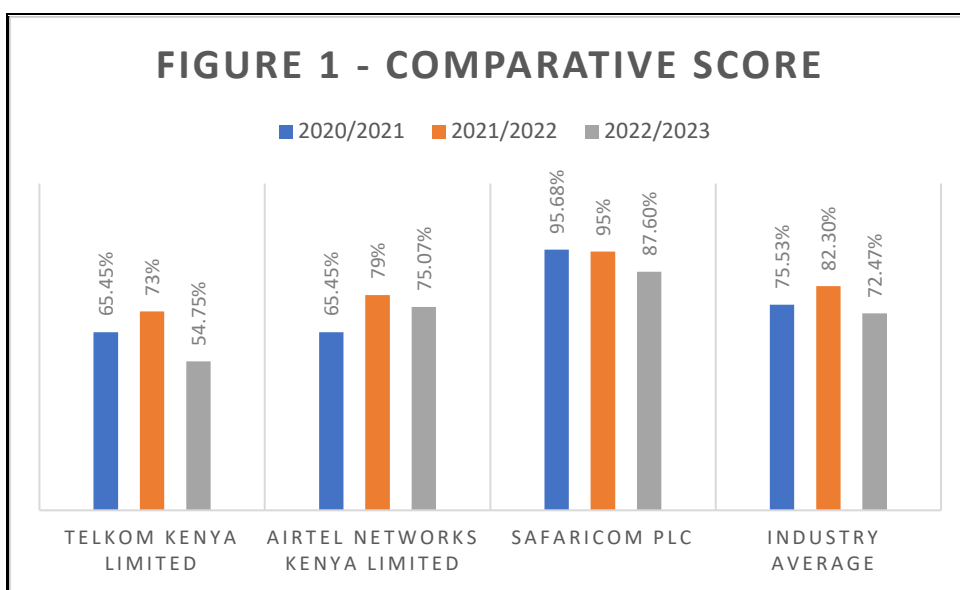
B. Network Performance Quality of Service NP-QoS

The Authority has put in place a full-time (24/7) mobile network performance monitoring system. The NP-QoS system dashboards help in assessing the state of networks at any point of interest and for recourse assessment of past events. The system can be deployed for any high-value urgent project implementation monitoring for real-time network status. Table 4 below shows the readings from the NP-QoS dashboard and summary at the end of each quarter and the average for each network;

Table 4: NP QOS Performance Results (UPTIME OF THE MNOs SITES AS BUILT)

No.	Quarter1	Quarter 2	Quarter 3	Quarter 4	Average
Telkom	99.3%	99.4%	99.5%	99.1%	**99.3%**
Airtel	87.6%	88.7%	88.4%	89.5%	**88.5%**
Safaricom	98.9%	98.8%	98.8%	98.8%	**98.8%**
Average	**94.6%**	**95.6%**	**95.15%**	**95.95%**	**95.65%**

C. Quality of Experience (QoE)

The Authority surveyed the consumer experience while using the mobile networks in the country to ascertain their satisfaction level with mobile communication services. Table 5 below summarizes the findings.

Table 5: Quality of Experience (QoE)

No.	Item	Telkom	Airtel	Safaricom	Industry
1	Subscription level	9.9%	24.2%	64.9%	**100.0%**
2	Factors Considered to join	15.4%	15.7%	43.3	**24.6%**
3	Coverage Challenges	21.3%	45.2%	15.8%	**27.43%**
4	Connectivity challenges	20.2%	16.8%	7.9%	**14.97%**
5	Loss of Service	10.5%	7.8%	8.7%	**9.0%**
6	Coverage Satisfaction	73.4%	82.4%	86.7%	**80.83%**
7	**Voice Quality Satisfaction**	**84.8%**	**87.2%**	**89.4%**	**87.13%**

The overall consumer rating for the three mobile networks is given at point 7 in Table 5 above, with Safaricom leading with 89.4%, Airtel following with 87.2% and Telkom at 84.8%

D. Overall Quality of Service from the three segments

The overall performance is summarized in table 6 below.

Table 6: Overall Performance for 2022-2023

No.	Segment	Telkom	Airtel	Safaricom
1	End-to-end QoS (Drive Test)	54.75%	75.07%	87.60%
2	Quality of experience (QoE)	84.8%	87.2%	89.4%
3	Network Performance (NP-QoS)	99.3%	88.5%	98.8%
4	Overall Performance (75% End to End, 10% QoE and 15% NP) A, B&C	75%*A+10%*B+ 15%*C	75%*A+10%*B+ 15%*C	75%*A+10% *B+15%*C
		65%	**79%**	**90%**

The overall performance based on the three combinations and by application of the weighting allocated based on the impact and veracity of each component (line 4 in table 6 above), the official final and overall mobile networks performance is such that Telkom Kenya scored 65%, Airtel Networks Kenya Limited scored 79% and Safaricom PLC scored 90%. The import of this is that; Safaricom PLC met and exceeded the threshold of 80%, while Telkom Kenya and Airtel Networks fell short of the target threshold.

IV. DETAILED AND GRANULATED PERFORMANCE REPORTING

a) *Average MNOs performance per county as derived from end-to-end testing*

Table 7 below shows the average KPI compliance levels of the MNOs by county

Table 7: Average KPI compliance level of each MNO per county

	COUNTIES	AIRTEL	SAFARICOM	TELKOM	Average
1	Mombasa	90.91%	100.00%	72.73%	87.88%
2	Kwale	81.82%	100.00%	45.45%	75.76%
3	Kilifi	63.64%	90.91%	54.55%	69.70%
4	Lamu	81.82%	100.00%	63.64%	81.82%
5	Tana River	63.64%	90.91%	54.55%	69.70%
6	Taita/Taveta	63.64%	90.91%	54.55%	69.70%
7	Marsabit	54.55%	81.82%	45.45%	60.61%
8	Isiolo	66.67%	72.73%	45.45%	61.62%
9	Meru	81.82%	90.91%	45.45%	72.73%
10	Tharaka-Nithi	72.73%	90.91%	45.45%	69.70%
11	Embu	81.82%	90.91%	45.45%	72.73%
12	Kitui	54.55%	90.91%	54.55%	66.67%
13	Machakos	90.91%	90.91%	54.55%	78.79%
14	Makueni	63.64%	90.91%	36.36%	63.64%
15	Nyandarua	90.91%	100.00%	45.45%	78.79%
16	Nyeri	72.73%	81.82%	45.45%	66.67%
17	Kirinyaga	72.73%	90.91%	45.45%	69.70%
18	Murang'a	90.91%	90.91%	36.36%	72.73%
19	Kiambu	81.82%	100.00%	63.64%	81.82%
20	Turkana	72.73%	81.82%	63.64%	72.73%
21	West Pokot	72.73%	72.73%	54.55%	66.67%
22	Samburu	54.55%	90.91%	45.45%	63.64%
23	Transzoia	72.73%	81.82%	54.55%	69.70%
24	Uasin Gishu	72.73%	90.91%	54.55%	72.73%
25	Elgeyo/Marakwet	54.55%	90.91%	45.45%	63.64%
26	Nandi	72.73%	81.82%	45.45%	66.67%
27	Baringo	45.45%	81.82%	45.45%	57.57%
28	Laikipia	45.45%	81.82%	36.36%	54.54%
29	Nakuru	90.91%	90.91%	72.73%	84.85%
30	Narok	81.82%	90.91%	63.64%	78.79%
31	Kajiado	81.82%	63.64%	54.55%	66.67%
32	Kericho	90.91%	90.91%	54.55%	78.79%

	COUNTIES	AIRTEL	SAFARICOM	TELKOM	Average
33	Bomet	72.73%	72.73%	54.55%	66.67%
34	Kakamega	72.73%	81.82%	63.64%	72.73%
35	Vihiga	63.64%	63.64%	72.73%	66.67%
36	Bungoma	81.82%	81.82%	63.64%	75.76%
37	Busia	63.64%	100.00%	54.55%	72.73%
38	Siaya	90.91%	90.91%	63.64%	81.82%
39	Kisumu	72.73%	72.73%	63.64%	69.70%
40	Homa Bay	90.91%	90.91%	45.45%	75.76%
41	Migori	90.91%	90.91%	63.64%	81.82%
42	Kisii	72.73%	90.91%	63.64%	75.76%
43	Nyamira	90.91%	90.91%	63.64%	81.82%
44	Nairobi City	90.91%	100.00%	90.91%	93.94%
45	Garissa*	These Counties could not be accessed for measurement due to security concerns and advisories in these counties. There are documented advisories on security and accessibility that inform the routing.			
46	Wajir*				
47	Mandera*				
Simple Average (Based on county scores)		75.07%	87.60%	54.75%	72.34%
No. of Subscribers (Q3)		17,636,324	43,727,515	2,774,254	64,138,093
Subscriber Market Share (3 MNOs Only)		27.50%	68.18%	4.33%	100% Total

b) Average KPI compliance performance using end-to-end testing

As illustrated in Figure 2 below, Safaricom PLC registered the highest overall compliance at 87.60 per cent, followed by Airtel Networks Kenya Limited at 75.07 per cent. Telkom Kenya Limited's performance was 54.75 per cent. On end-to-end tests.
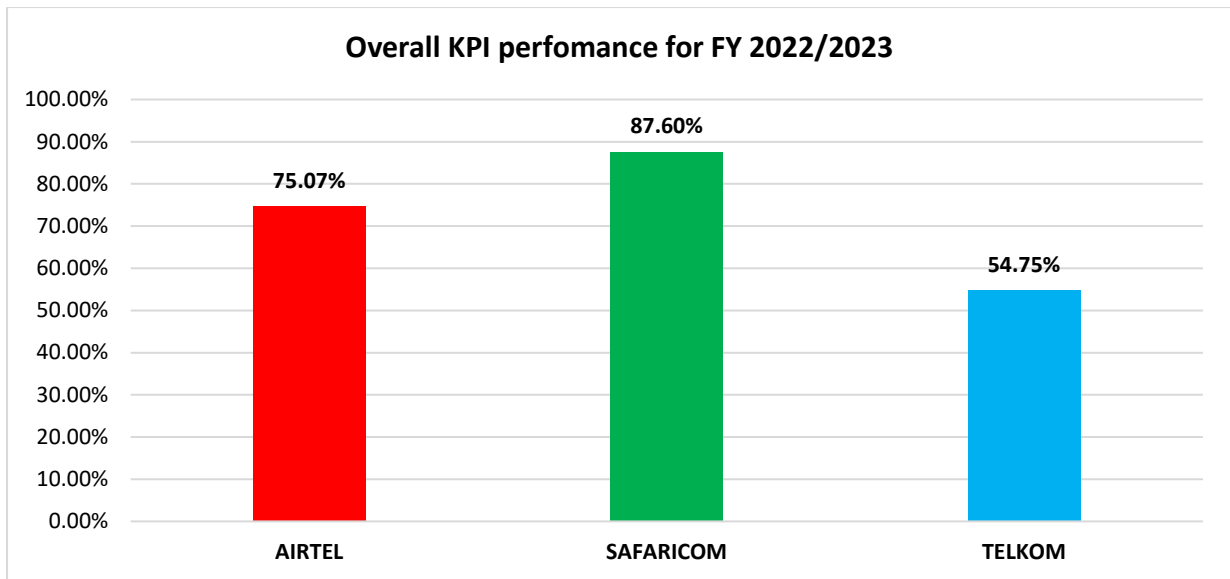
Figure 2: MNOs Average KPI compliance performance

V. ROLLOUT PERFORMANCE

Rollout obligations are embedded in Licenses to ensure the expansion of telecommunications infrastructure and systems for a wider reach to geographical areas and communities that might not exhibit commercial viability at the onset. The MNOs report on their respective compliance with rollout targets during annual compliance reporting. The Authority sampled out some areas to confirm the accuracy of the reported information and to test full compliance with the rollout plans.

Compliance to license Rollout target

The compliance with the rollout target was assessed in accordance with the license terms and conditions as annexed per operator in Table -2 below. Insecurity posed the challenge of completing the entire rollout plans, especially in the northern frontier counties.

Table 8: Compliance to license Roll out targets

Item	Telkom	Airtel	Safaricom	Comments
License annexed with sublocations	Yes, but lapsed 2017	Yes up to 2024(130)	Yes and up to 2022 (550)	Licenses are to be reviewed in the renewal ahead.
Total no. covered	100%	104	540	Safaricom had built over 550 sites, but 10 were destroyed and are unlit due to safety concerns.
Total no. pending	100%	26	Eight (8) sites (unlit), two (2) not rebuilt	
Percentage of roll out Compliance	100%	80%	98.18%	Airtel is still on course as per rollout period.

VI. OBSERVATIONS

From the above exercise, the Authority observed the following:

1. Airtel Kenya Networks Kenya Limited and Telkom Kenya Limited posted an overall performance of 79% and 65%, respectively, against a target of 80%. However, Safaricom PLC attained this target by achieving an overall performance of 90%, as summarized in Table 5 above.

2. Airtel Kenya Networks and Telkom Kenya failed to not only meet their coverage targets but also a number of the most critical QoS KPIs, particularly the "Unsuccessful Call Ratio" and Data Internet KPIs, which reare indicators for coverage and internet availability/accessibility, respectively. Ageing BTSs and sparse deployment of BTS are most likely the major contributing factor to the failure of Airtel and Telkom Kenya to meet the KPI thresholds. The two operators showed good performance in urbanized areas while having below-average coverage in rural areas and far-flung areas.

3. The Telkom Kenya Limited network appears to limit optimization in such a way that network coverage rapidly diminishes after about 5 km from the towncentres and serving cells. It was further noted that the MNOs are not performing optimally even in areas where they rolled out services long ago. The network upgrades and optimization due to ageing equipment, changing demographics and technology seem to pose challenges to all networks.

4. Impact of USF Projects on the QoS: The onset of USF projects has greatly enhanced the overall quality of service offered and experienced by consumers. The points of failure for Safaricom and Airtel in the early days were in the rural and far-flung areas. Deployment of USF sites in these places has enhanced connectivity and boosted the operator's quality of service in general. One is most likely to sustain or generate a call from areas that were initially a no-network zone completely.

5. Market stratification and competition have continued to impact the performance of the two players, Telkom Kenya and Airtel. It is considered that quality of service is a product of market investment levels.The investment levels are a product of subscriber numbers and revenue generation, while market balance and consumer confidence/balance is a product of regulatory interventions. The Authority, therefore, will continue to implement regulatory interventions that will balance the market and ensure the success of the different operators in order to help them grow and compete effectively.

VII. CONCLUSION

From the above analysis, the following conclusions are made;

i. Safaricom PLC scored 90% and hence achieved the minimum 80% KPI compliance threshold. The lowest score was 63.5% in Vihiga and Kajiado Counties. They shall be required to upgrade these two counties and other smaller segments noted.

ii.   Airtel Networks Kenya Limited scored 79% and hence failed to meet the minimum KPI threshold of 80% in the quality of service measured. The lowest score was 45.45% in Baringo and Laikipia Counties. They shall be required to upgrade their network.

iii.   Telkom Kenya Limited scored 65% and hence failed to meet the minimum KPI threshold of 80% in the quality of service measured. The highest performance was 72.73% in Vihiga, Mombasa, Nairobi and Nakuru. The lowest score was 36.36% in Muranga and Laikipia Counties. Telkom will be required to upgrade its network to full compliance.

iv.   Telkom Kenya performed lowest in terms of both data services and coverage of signal, as shown by the large number of unsuccessful calls and internet failure. The network coverage in rural counties was found to be very poor and does not exist in some places.

v.   Airtel's best performance was in Machakos, Mombasa, Nairobi, Kericho, Siaya and Muranga, where they scored 90.91%. The lowest performance was recorded in Baringo, Laikipia and Homabay, where they scored 45.45%.

vi.   Safaricom has better coverage in most counties compared to the other two operators. The peak performance places were Busia, Kiambu, Kwale, Mombasa, Lamu, Nyandarua, Nairobi and Mombasa. The lowest score was recorded in Vihiga and Kajiado.

vii.   The Authority has, therefore, proceeded to levy a penalty for underperformance in offering quality of service in the mobile network subsector by Telkom Kenya and Airtel Networks. The penalty was accompanied by a notice of non-compliance, which requires the networks to improve on their current performance during the next assessment and failure for which an escalated sanction level will be applied.