



1. BACKGROUND

Uganda Communications Commission (the Commission) was established by the Uganda Communications Act 2013 to champion the development of a modern communications sector which includes telecommunications, broadcasting, radio communications, postal communications, data communication and infrastructure. The functions of the Commission include to promote and safeguard the interests of consumers and operators as regards the quality of communications services and equipment.

In the period 8th – 23rd December 2022, the Commission conducted measurements of mobile voice telephony and data services in Uganda to assess the Quality of Service (QoS) received by consumers of these services in the areas of Kampala, Mukono and Entebbe. The operators reviewed during this exercise were Airtel Uganda Limited (Airtel), MTN Uganda Limited (MTN), Tangerine Limited (T/A Lycamobile) and Uganda Telecommunications Corporation Limited (UTCL). However, UTCL's data services were not measured.

Voice services were benchmarked against the Commission QoS standard. In the case of data, measurements were conducted with respect to the upload speed, download speed, latency, and packet loss.

2. INTERPRETATION

The following information is provided to facilitate the consideration of the findings.

A. Quality of Service (QoS) is defined as the totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service. QoS covers the entire communication path from end-to-end between user-to-user or user-to-content interfaces.

B. Call Attempt means an attempt to achieve a connection to one or more devices attached to a telecommunications network which commences when the destination address information required for setting up the call is sent by the user.

C. Blocked call means a call attempt that fails to achieve a connection to the destination party and therefore not receiving an alerting or ring tone, busy tone, answer signal or announcement.

D. Dropped call means a call terminated by the network before it is ended by either party participating in the call.

E. A successful call means a call that:

- Rings and is terminated with a 'no answer' message from the network or voice mail services or an announcement that the subscriber is not available.
- Is responded to by the network with:
 - a busy signal indicating the called party is on another call,
 - a network announcement that a wrong (invalid or non-existent) number has been dialled, or
 - rings, is answered and terminated by either call party.

F. Data means the form in which information moves around the internet or in which information is processed or stored by a communication device.

G. Data Throughput means the amount of (number of data packets) that gets transferred from one point on the network to another in a given amount of time. It is measured in bits per second (bps).

H. Latency means the time taken for a packet of data to travel from a user's device to destination device.

I. Packet Loss depicts the level at which data sent is dropped along the route and therefore, unable to reach its intended destination.

J. The Commission **standard for voice QoS** as indicated below:

SN	Parameter	Definition	Target
1.	Blocked Call Rate (BCR)	maximum proportion of successful call attempts on the network that should be blocked	≤2%
2.	Dropped Call Rate (DCR)	maximum proportion of successful call attempts on the network that should be dropped	≤2%
3.	Call Setup Success Rate	proportion of call attempts with an indication of call connection (alerting, busy tone or announcement) within 12 seconds from the instant the user initiates a request	≥95%

K. The **speech quality** of voice calls as measured against the International Telecommunications Union's standard - Mean Opinion Score (MOS).

Quality scores	
5	Excellent
4	Good
3	Fair
2	Poor
1	Bad

3. SUMMARY OF THE FINDINGS

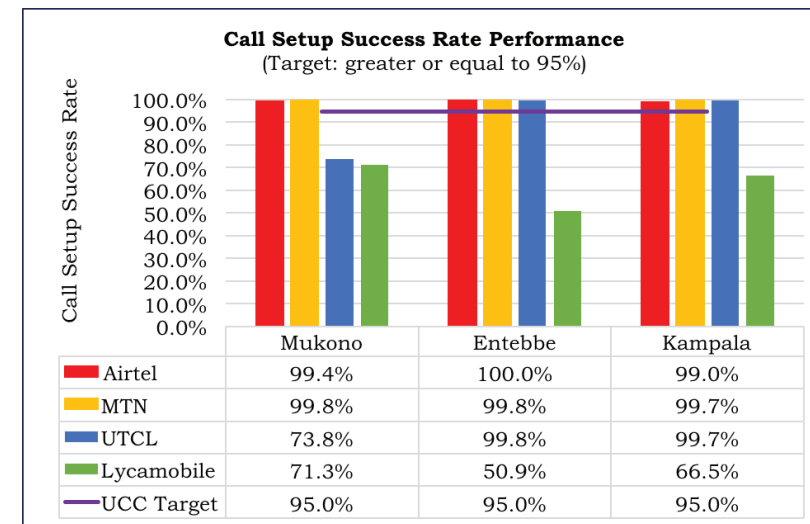
The findings are presented as follows:

Figure 1 through **figure 4** show a summary of the QoS results for the mobile voice services.

Figure 5 through **figure 8** presents the average download throughput, average upload throughput, average latency and average packet loss.

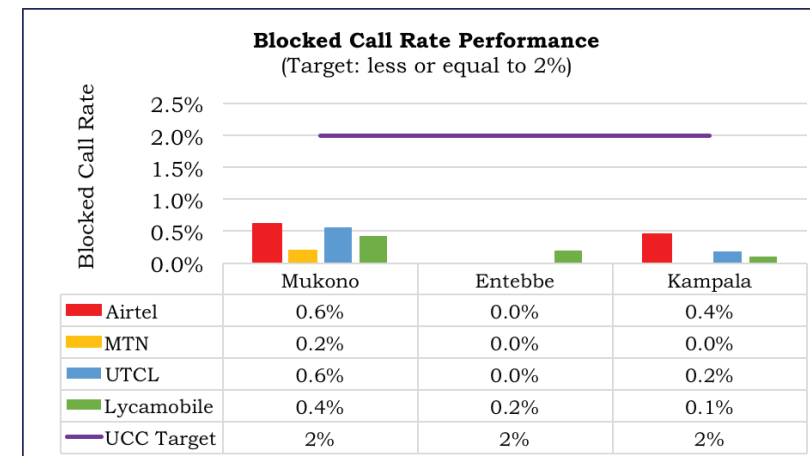
Figure 9 presents the major causes of the failures that were observed during the exercise.

Figure 1: Call Setup Success Rate performance per network per town surveyed



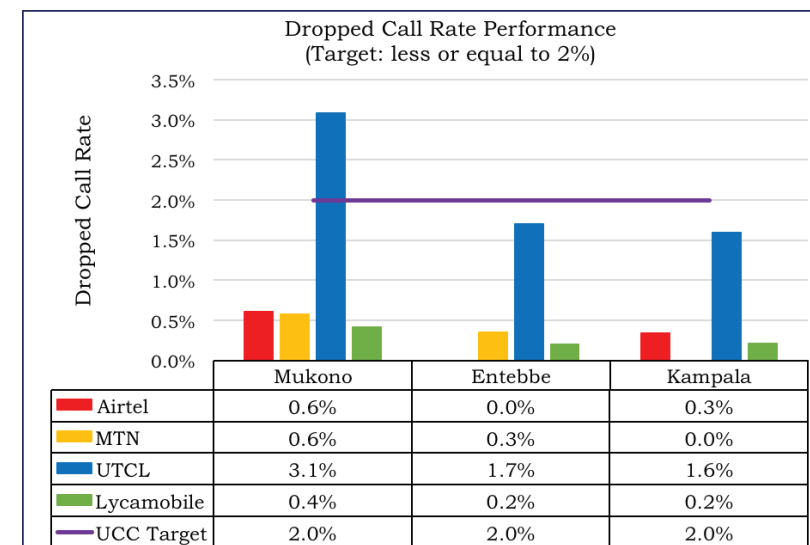
This looks at how long it takes to achieve a connection to the called party in setting up a call. The higher the call setup success rate, the better.

Figure 2: Blocked Call Rate performance per network per town



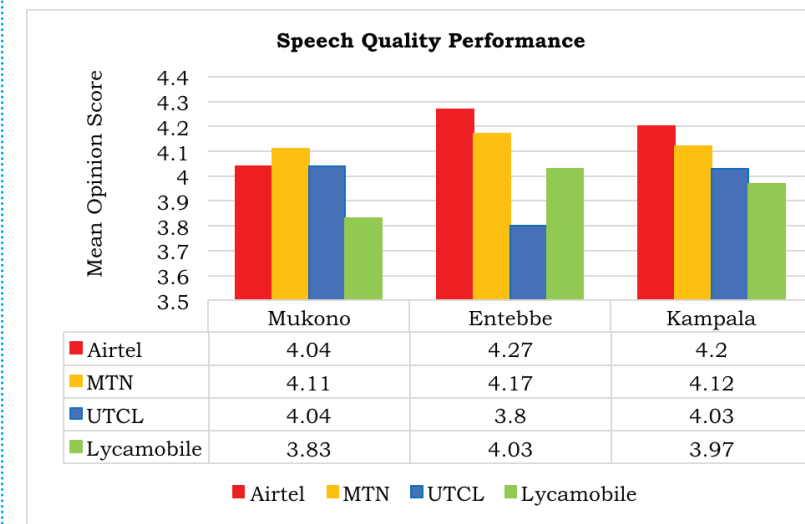
This portrays the likelihood of a call attempt achieving a connection to the called party. The lower the percentage, the better.

Figure 3: Dropped Call Rate performance per network per town



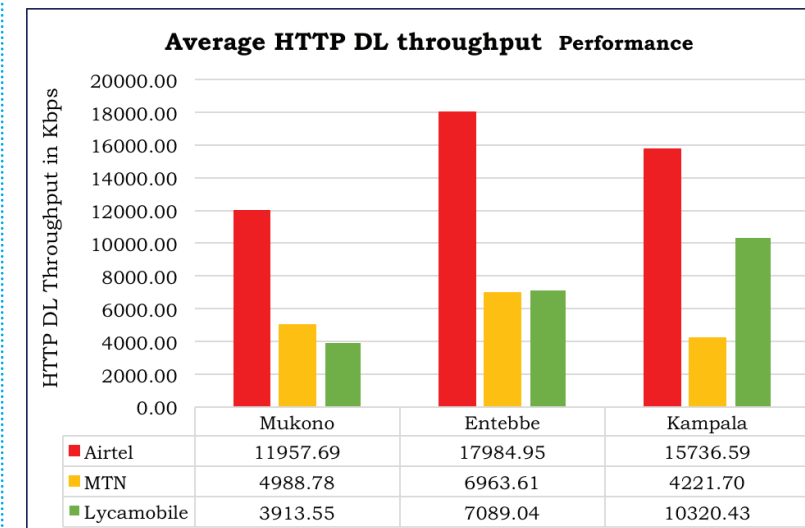
This provides insight of the likelihood of a call being sustained until either the caller or called party terminates the call. The lower the percentage, the better.

Figure 4: Speech Quality performance per network per town



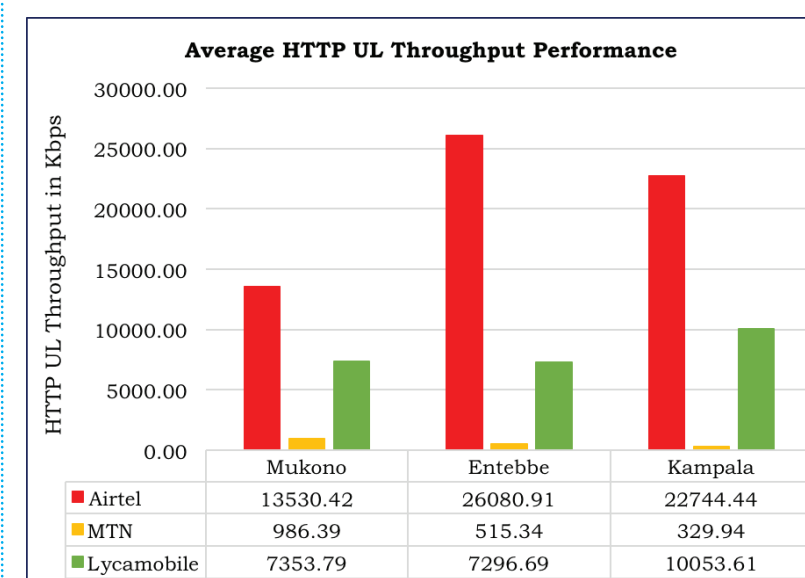
This rates the quality/clarity of the test calls. The higher the score, the better.

Figure 5: HTTP Download Throughput per operator in the three towns



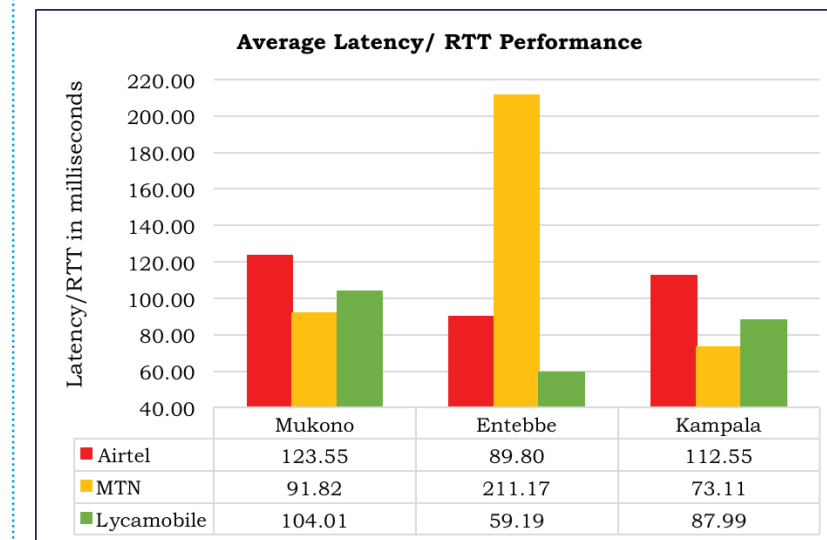
This provides an indication of speeds at which information would be downloaded on the internet or pages opened. The higher the value, the better.

Figure 6: HTTP Upload Throughput per operator in the three towns



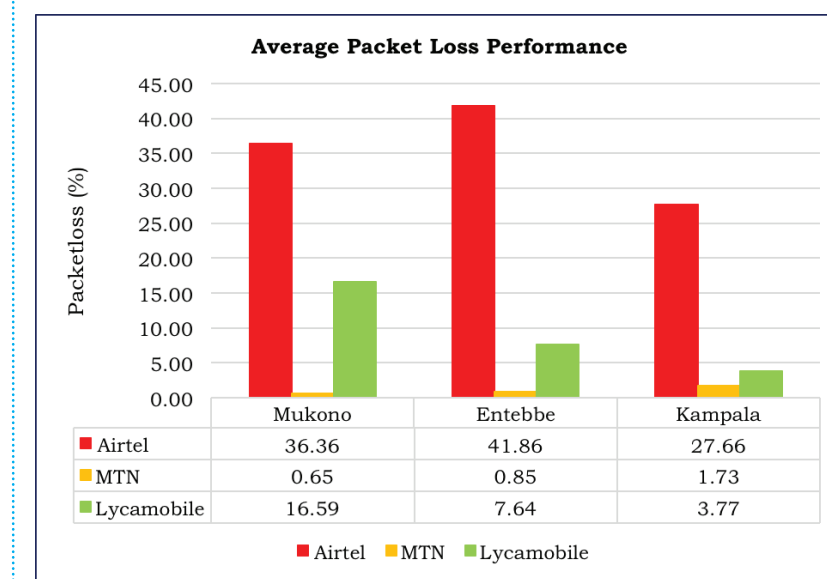
This provides an indication of speeds at which information is uploaded to the internet. The higher the value, the better.

Figure 7: Operators graphical presentation of the average Latency in the three towns



This measures reaction time of the network or application - how long it takes from when a request is sent to when a response is received. The lower the value, the better.

Figure 8: Operators graphical presentation of the average Packet Loss in the three towns

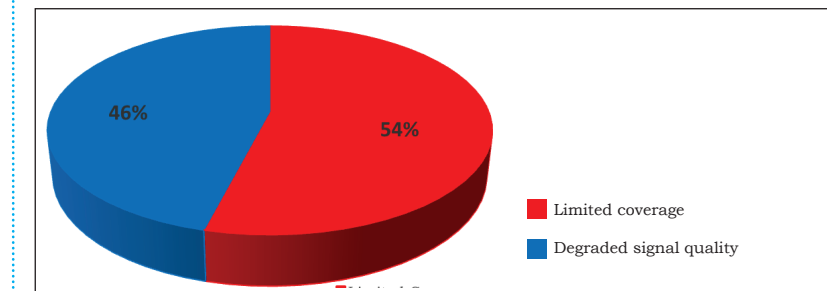


Major causes of inadequate or degraded voice performance

The following were the top contributors to the performance degradation observed:

- Degraded signal quality:** Degradation in the quality of the network signal due to interference to the radio signal majorly originating from either another radio in the same network using the same frequency or due to other radio systems in the area e.g., illegal signal boosters.
- Limited coverage:** areas where there is no signal or the signal strength/level is too low for a phone to connect to the mobile network.

Figure 9: Proportion of causes of inadequate or degradation in performance observed



4. CONCLUSION

It was noted that coverage remains a significant factor with several blackspots (geographical areas with poor or no communication coverage) especially for UTCL and Lycamobile. The causes of these blackspots include:

- geographical terrain – valleys and sides of hills
- placement of tower/mast relative to location – the radio or phone signal reduces with distance away from the towers
- physical obstructions (e.g., buildings and trees)
- dense and metallic building material impacting signal penetration and in turn indoor coverage is affected.

The QoS was also significantly affected by the interference to the cellular networks caused by illegally installed signal boosters. The Public is urged to always contact your mobile network operator to assist with proper installation of signal enhancements equipment or apparatus.

The Commission in its effort to ensure improvement in QoS

- has engaged the operators on remedial plans to address the observed causes of deterioration in service,
- is monitoring implementation by the operators of their licence obligation to rollout their respective networks to 90% of the geographical coverage of Uganda within 5 years,
- advocating other government agencies and communities to facilitate deployment of the necessary infrastructure to achieve desired coverage and performance and
- is clamping down and confiscating illegal signal boosters.

The Commission remains committed to empowering consumers to exercise choice of provider and to ensuring the availability of quality and modern communication services to foster the realisation of the transformation of Uganda into a modern and prosperous country.

Executive Director