TDRA | هيئة تنظيم الاتصالات والحكومة الرقمية
TELECOMMUNICATIONS AND DIGITAL GOVERNMENT REGULATORY AUTHORITY

United Arab Emirates

Mobile Network Quality of Service Benchmarking Report

Media Report 2023

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BACKGROUND

The UAE is an ICT leader in the Gulf region. The Telecommunications And Digital Government Regulatory Authority (TDRA) plays a vital role in maintaining the highest standards of the ICT sector. It is achieved by ensuring country-wide reach of mobile services and a constant improvement in the quality of offered services. To encourage the highest standards in mobile services, the TDRA has carried out an extensive benchmarking survey of the Mobile networks in the UAE. The results of the survey are discussed with mobile licensees (Etisalat and du) to enable the operators to further enhance the quality of mobile services offered.

1. The survey was conducted in Q3 2023, covering more than 28,948 km of the UAE's roads, making approximately 79,542 voice calls on each operator's network and testing the full range of data services available across all technologies (2G, 3G, 4G and 5G).

2. All Emirates and regions including Abu Dhabi, Dubai, Sharjah, Ajman, Um-Al Quwain, Ras Al-Khaimah, Al-Fujairah, Al-Ain, and the Western Region were covered. Testing was performed in the cities and towns of all the emirates as well as on the main roads in the UAE. Quality of mobile services was also tested in 50 key indoor locations across the UAE.

WHAT WAS MEASURED?

The survey addressed 2nd, 3rd, 4th and 5th generation mobile networks for both licensees (du and Etisalat). Key performance indicators used in the survey include:

1. VOICE CALL SETUP SUCCESS RATE
2. VOICE CALL COMPLETION RATE
3. VOICE CALL DROP RATE
4. VOICE QUALITY
5. COVERAGE LEVEL
6. DATA TRANSFER RATE
7. LATENCY

DEFINITION

USER SIMULATION QUALITY OF SERVICE (QOS)

1. **Voice Call Completion Success Rate:** Is the measure of calls that were successfully set up and normally terminated, note that a high Call Completion Success Rate is desirable.

2. **Voice Call Setup Success Rate:** Percentage of attempts that resulted in successful voice call setup, note that a high Call Setup Success Rate is desirable.

3. **Voice Call Drop Rate:** This refers to the disconnection of mobile calls by the network during a 90-second call-holding period for each call, note that a low Call Drop Rate is desirable. The target is to achieve a ratio of less than 2% call drop rate.

4. **Voice Quality:** The overall voice quality rate is equal to the average voice quality on the downlink and uplink, which refers to the network's ability in achieving an acceptable level of voice quality using the Mean Opinion Score (MOS) measure and a score of 2.8 has been set as the MOS threshold, where a high Voice Quality Rate is desirable.

5. **Coverage level:** This is based on the signal strength and refers to the network's ability in achieving a signal strength of -100 dBm or higher, which is considered a level of good coverage, enough to provide a typical user with all requested services.

6. **Data Transfer Rate:** This is the rate at which data is transmitted over the application protocol levels. Provided in Megabits per second (Mbps). HTTP protocols have been tested:

   HTTP (Hyper Text Transfer Protocol): used to transfer files from a Web server onto a browser to view a Web page that is on the Internet. May use 1 or more TCP connections, depending on the configuration. A 1 GB file was used to test the network speed from a performance point of view, over a period of 10 seconds in downlink and a 400MB file was used in uplink.

7. **Data Latency:** This metric reflects the time (in ms) that data packets need to travel from a User Terminal through the operator's network, to a remote server and return – also known as Average Ping Duration. The shorter the Data Latency, the better user perceived responsiveness of the data network, which is important for real-time applications. In each test, a series of 10 pings are sent and the average round trip time is calculated.

METHODOLOGY

To ensure that the testing provides a fair competitor comparison of the service provided by the mobile networks and that it provides a reliable basis for the encouragement of ever-improving quality of service throughout the UAE, the TDRA has employed state–of–the–art test equipment and services. By using the latest equipment; the TDRA ensured the measurements were done in a manner, that was statistically valid, repeatable, technically consistent, providing absolute comparability of KPIs for all networks, technology-independent, using ITU & ETSI standards as a minimum, and robust enough to stand legal scrutiny of claims.

The equipment measures "Key Performance Indicators" that directly relate to the public's experience through Out- door (in-car user experience) and Indoor user experience. These include network coverage, dropped calls and the clarity of calls.

The ratio of Mobile Originated /Mobile Terminated voice Calls (MOC/MTC) was 1/1. The call test scenario consisted of a 90-second holding period followed by a 40-second idle time. For measurement purposes, a suitable model of a top smartphone was used.

Results Interpretation

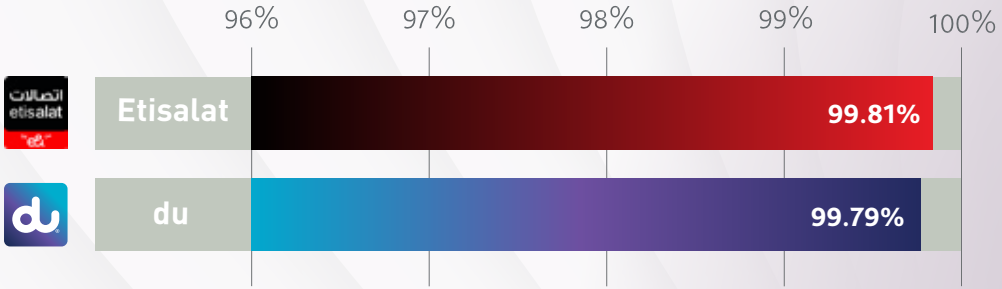
In interpreting the results, it should be noted that:

The drive test results represent a snapshot of the mobile service provider's network in-car user experience based on the specified routes during the time of day when the measurements were carried out and using a particular type of handset. The reported level of service quality may therefore not be exactly comparable with the consumer's own experience.

SURVEY RESULTS - OUTDOOR

Voice Call Completion Success Rate

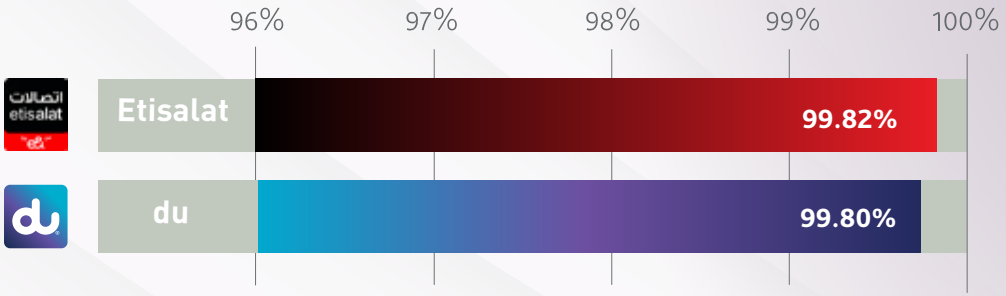
This parameter measures the capability of the network to successfully set up a call and terminate it normally.
The call completion success rate shown below is based on more than 18,000 voice call attempts per operator.



Call Completion
Success Rate in Outdoor coverage

Voice Call Setup Success Rate

This parameter measures the capability of the network to successfully set up a call.
The call setup success rate below is based on more than 18,000 voice calls attempts for each operator.

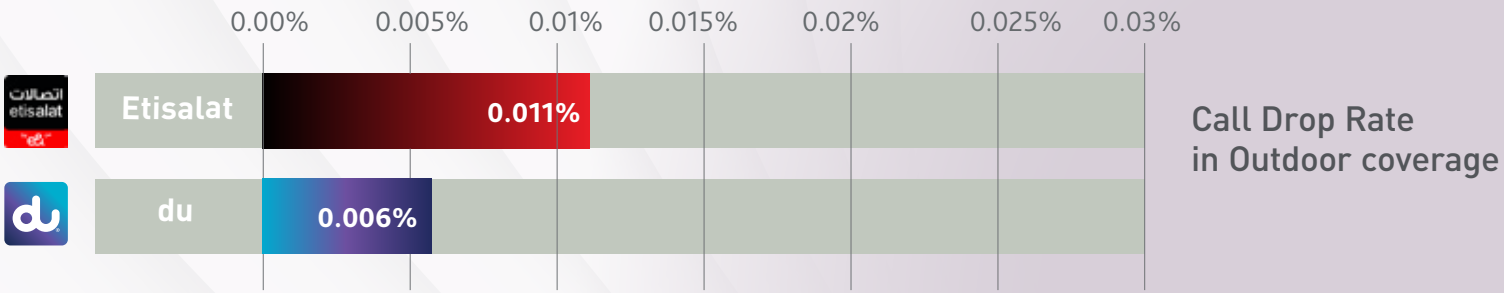


Call Setup
Success Rate in Outdoor coverage

SURVEY RESULTS - OUTDOOR

Call Drop Rate

A call is dropped when it is disconnected prematurely during the 90-second holding period. Call drop may occur due to poor coverage, interference or other network related issues. The Call Drop Rate statistics for each mobile network are shown below based on more than 18,000 voice call attempts per operator:



METHODOLOGY

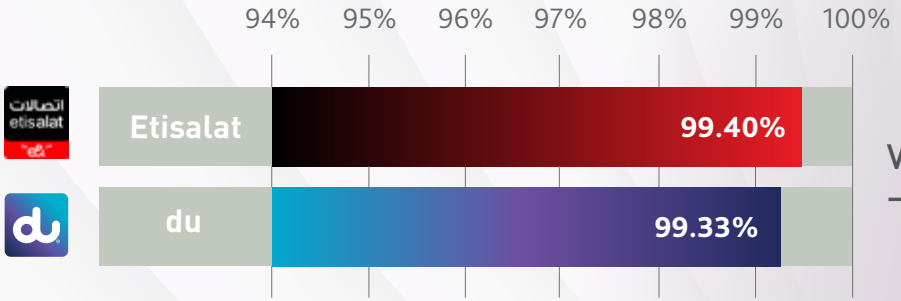
The MOS method is a means to provide an objective result of voice quality of calls in the operator's network. In each call, speech samples are sent in the uplink and downlink direction. These samples are then analyzed in both directions to measure the speech quality using the ITU-T Rec. P.863 (POLQA) algorithm. This is a recognized method widely used to evaluate voice quality showing the following categories:

Result (MOS) Quality Conversation description

Conversation description	Quality	Result (MOS)
Excellent	5	Understandable without interference noise
Good	4	Understandable with minor interference noise
Acceptable	3	Fairly understandable
Not good	2	Requires a lot of effort to understand
Poor	1	Not understandable

VOICE QUALITY - OUTDOOR

Based on the definition that an acceptable level of voice quality is one with an opinion score of at least "2.8", the percentage of samples with opinion scores greater than "2.8" for each mobile network is as shown:



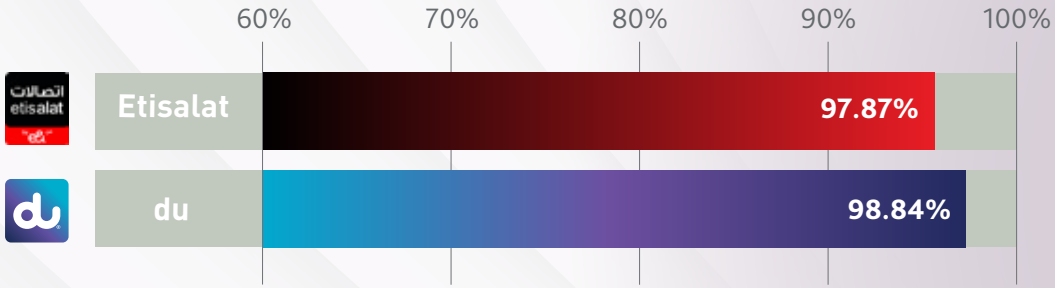
Voice quality (% of sample with MOS →2.8) in Outdoor coverage

SERVICE COVERAGE – 5G OUTDOOR

This parameter measures the availability of service coverage in the regions. Therefore, it measures the network's ability to achieve the minimum signal strength of - 128dBm.

Charts in this section were constructed based on data from a scanner which continuously measured all available technologies and carriers, and their respective signal level.

Apart from the percentage of good coverage, an absolute level of 5G Service Coverage is presented below. This metric was constructed with minimal required signal strength considered as RSRP → -128 dBm



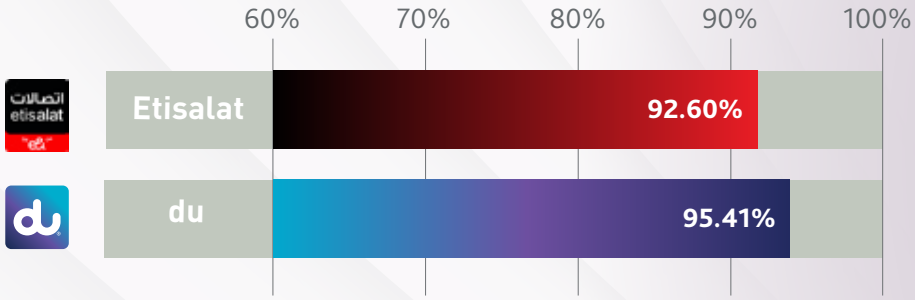
5G Service Coverage
(% of unique geographic locations
with SS RSRP → -128 dBm)

GOOD COVERAGE - LTE (4G) OUTDOOR

This parameter measures the availability of service coverage in the regions. Therefore, it measures the network's ability to achieve the minimum signal strength of - 110dBm.

Charts in this section were constructed based on data from a scanner which continuously measured all available technologies and carriers, and their respective signal level.

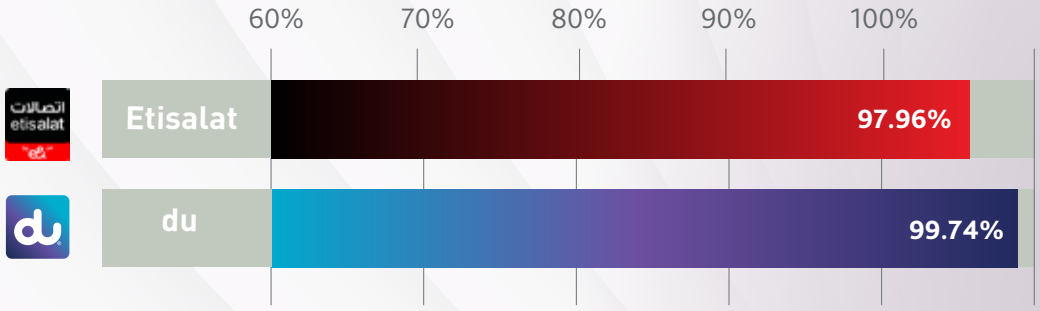
Since LTE has been widely deployed , an absolute level of LTE Good Coverage is presented below. This metric was constructed with minimal required signal strength considered as RSRP → -110 dBm



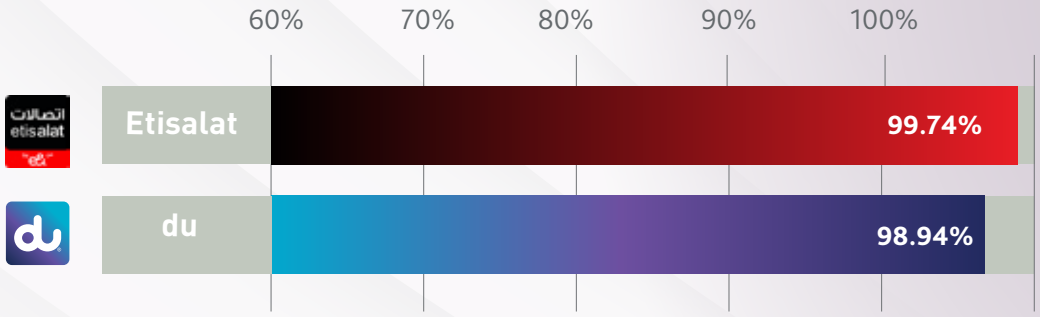
LTE Service Coverage
(% of unique geographic locations with RSRP
→ -110 dBm)

GOOD COVERAGE - GSM and UMTS - OUTDOOR

This parameter measures the availability of service coverage in the regions. Therefore, it measures the network's ability to achieve the minimum signal strength of - 100dBm.
Charts in this section were constructed based on data from a scanner which continuously measured all available technologies, carriers and their respective signal level.



GSM Good coverage
(% of samples with RxLev → -100 dBm)



UMTS Good coverage
(% of samples with RSCP → -100 dBm)

DATA TRANSFER RATE - OUTDOOR

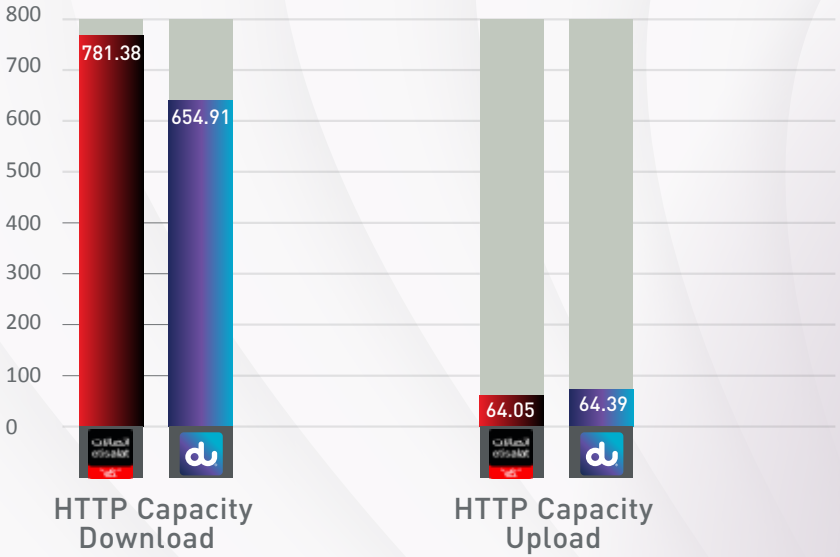
1. **Packet Data Performance (Throughputs):**
   application protocol layers. Provided in Megabits per second (Mbps), where 1 Megabit = 1,000,000 bits. Both FTP & HTTP have been tested.

2. **HTTP (Hyper Text Transfer Protocol):**
   This test was used to transfer small files from a Mobile Device onto the Server. A file size of 1 MB was used for the test.

3. **HTTP Browser test:**
   This test was used to download a complete web page using the HTTP protocol.

4. **Capacity Test:**
   This test provides a level of real-world throughputs that the network can deliver under stressed, highly-utilized conditions. The capacity test sets up multiple, simultaneous and parallel HTTP threads which transfer large files (1GB) in downlink and (400MB)in uplink, over a fixed period of time (10s) to exercise the Mobile network, to 100% of its technical capability.

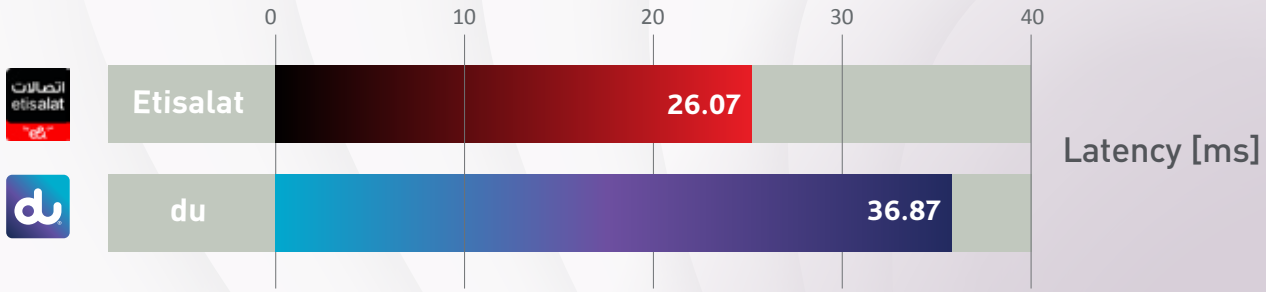
Data transfer rate in Auto Mode (5G/4G/3G/2G)



Data Transfer Rate [Mbps]

Delay before a transfer of data begins(Lower is Better) OUTDOOR

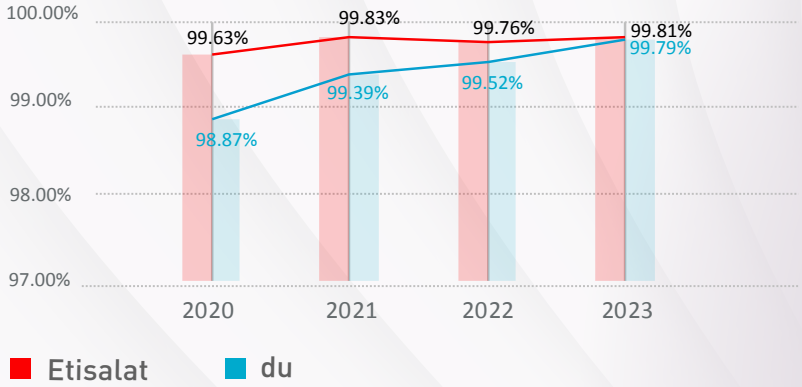
Latancy in Auto Mode (5G/4G/3G/2G)



MOBILE NETWORK PERFORMANCE TRENDS (2016 - 2023) in the Outdoor Survey

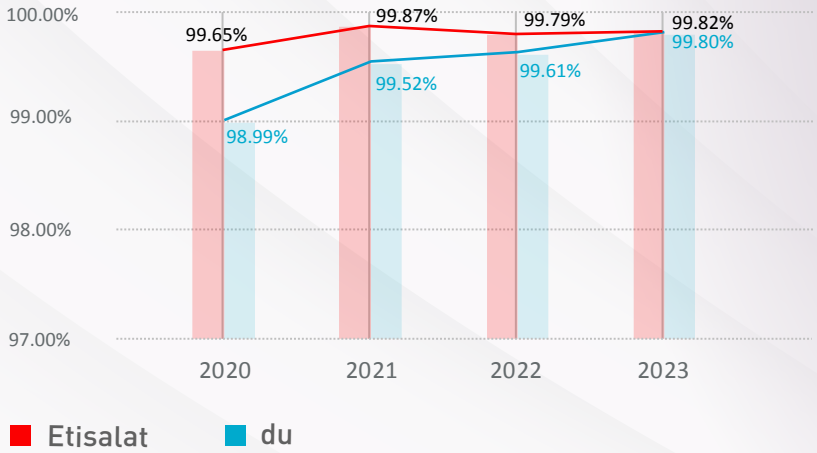
The below graphs compare the performance of both Etisalat's and Du's mobile networks in terms of the major Quality of Service Parameters over the past 8 years (2016 - 2023)

Voice Call Completion Success Rate



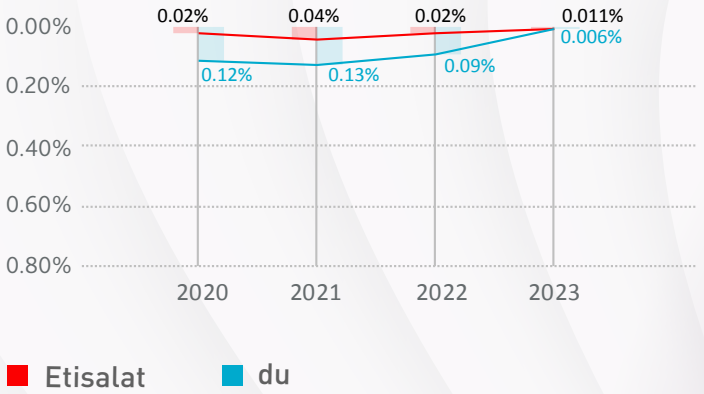
Voice Call Completion Success rate in Outdoor Coverage -Trend

Voice Call Setup Success Rate



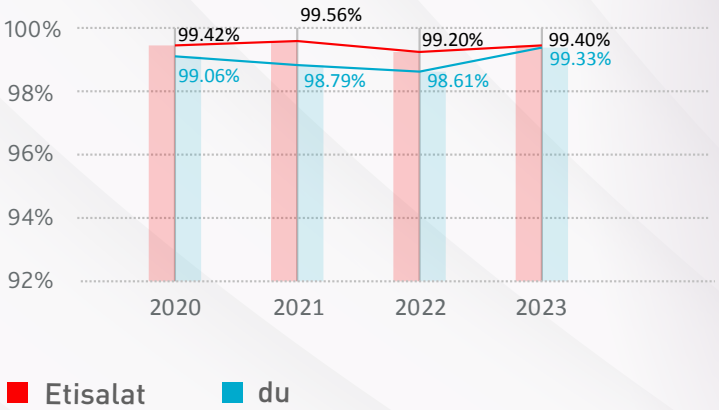
Voice Call Setup Success Rate in Outdoor Coverage - Trend

Voice Call Drop Rate



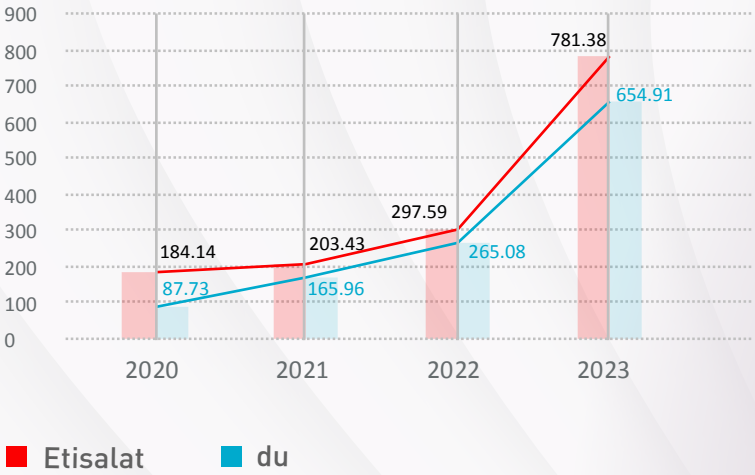
Voice Call Drop Rate in Outdoor Coverage -Trend

Voice Quality

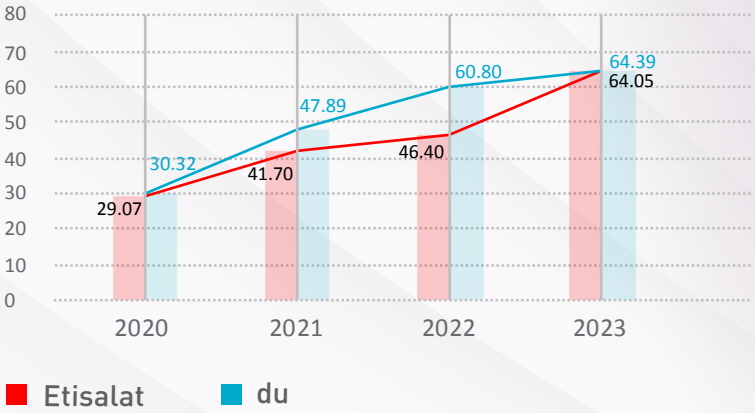


Voice quality (% of samples with MOS → 2.8) in Outdoor coverage - Trend

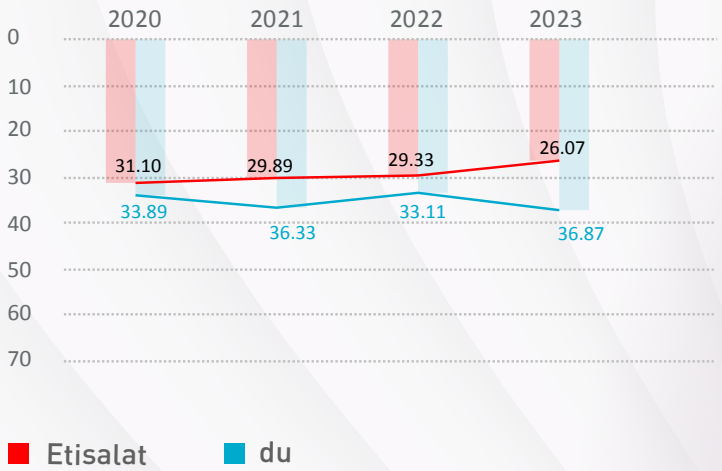
HTTP Capacity Downlink Data Transfer Rate in Auto Mode (5G/4G/3G/2G) Outdoor coverage - Trend Average Data Transfer Rate [Mbps]



HTTP Capacity Uplink Data Transfer Rate in Auto Mode (5G/4G/3G/2G) Outdoor coverage - Trend Average Data Transfer Rate [Mbps]



Latency in Auto Mode (5G/4G/3G/2G)
Outdoor coverage - Trend Average Round Trip Time [ms]



CONCLUSION

This survey of the quality of services of the mobile networks shows the continuous improvements achieved by both Licensees (Etisalat and du). Year on year KPI improvements are especially visible in data services. There was substantial increase in 5G Service coverage which is widely commercially launched.Next generation features like VoLTE were incorporated in networks to improve voice quality , elevating the user experience. The results were also compared with other ICT advanced countries in the world using the data of similar Benchmarking Surveys conducted in those countries. Mobile operators in the UAE have achieved a competitive performance compared with other ICT advanced countries.

The survey has also confirmed efficient utilization of radio frequencies allocated by the TDRA to both Etisalat and du.

Outlook

The survey has demonstrated fast adoption of the latest mobile technologies which include 5G by both Licensees (Etisalat and du). It is benefiting mobile services users by providing top class mobile data services and optimizing network resources. With the demand for mobile data services increasing ,TDRA expects Etisalat and du to continue to enhance their networks to maintain the high standard of services despite higher traffic in the networks. The TDRA will continue to work closely with the operators providing feedback on the quality of mobile network to the Licensees. We see that this framework of cooperation with operators, produces tangible results for the consumers with overall quality of mobile services improving year on year. High standards of mobile services in the country provide firm basis on which the UAE-ICT leadership in the region can be built.

Thank you