Background

The TRA is committed to ensuring both quality and variety in telecommunication services throughout the UAE. This is an essential part of the long term plan to help the UAE become a recognized regional ICT hub. The Authority is also keen to ensure that the terms of licensees are well adhered to.

The Telecommunications Regulatory Authority (TRA) of the United Arab Emirates (UAE) has carried out an extensive benchmarking survey of the Mobile networks and services provided by mobile licensees (Etisalat and du). The survey has covered more than 13,000 Km of the UAE's roads between March – June, 2011 at peak hours during working days. All of the emirates including: Abu Dhabi, Dubai, Sharjah, Ajman, Um Al Quwain, Ras Al Khaimah, Fujairah, the Western Region and major highways were covered. The TRA has performed more than 32,000 voice test calls during the survey; Figure 1 illustrates the survey's drive test routes;

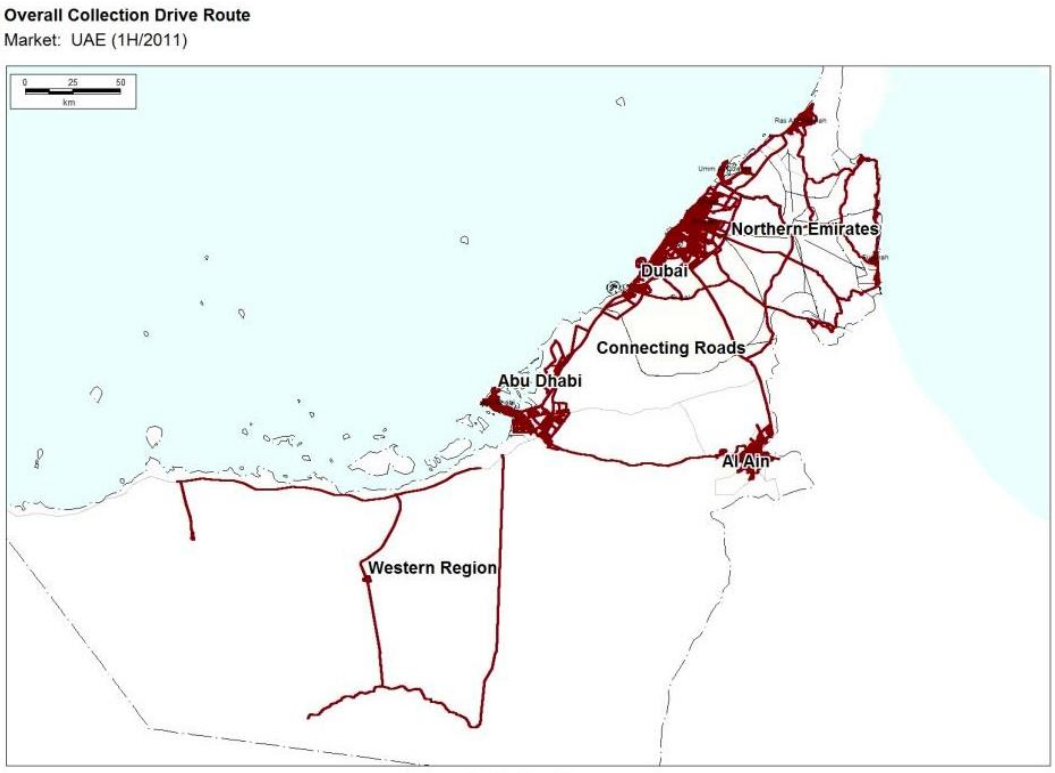

Figure 1: The drive test routes around the UAE.

What is Measured?

The survey covered both Licensees' (du & Etisalat) 2G and 3G mobile networks. The Quality of Service (QoS) parameters used in the survey include:

1. Call Completion Success Rate;
2. Service Coverage;
3. Voice Quality; and
4. Call Drop Rate.
5. Packet Data Performance (Throughput).

Definition of QoS Parameters

a) 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.
b) Service Coverage: This is based on signal strength and refers to the network's ability in achieving a signal strength of -100 dBm or higher.
c) 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 2.8 score has been set as the MOS threshold, note that a high Voice Quality Rate is desirable.
d) Call Drop Rate: This refers to the disconnection of mobile calls by the network during a 120-second call-holding period for each call, note that a low Call Drop Rate is desirable :

$$\% \text{ Dropped calls} = \frac{\text{Number of Dropped Calls}}{\text{Number of Good Initiations}}$$

e) Packet Data Performance (Throughputs): Rate at which data is transmitted over the application protocol levels. Provided in kilobit-per-second (kbps), where 1 kilobit = 1000 bits. Both FTP & HTTP have been tested.
   - FTP (File Transfer Protocol): used to upload files from a workstation to a FTP server or download files from a FTP server to a workstation. Large file (5 MB) was used for the test.
   - HTTP (Hyper Text Transfer Protocol): used to transfer files from a Web server onto a browser in order to view a Web page that is on the Internet. Small file (500 KB) was used for the test.

Methodology

To ensure that the testing provides a fair 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 TRA has employed a "state of the art" test equipment that has been used in more than 160 organizations and 70 countries. The equipment measures "key performance indicators" that directly relate to the public's experience through simulating an in-car user experience. These include network coverage, dropped calls and the clarity of calls.
The ratio of the voice calls attempts in regard to Mobile Originated Calls /Mobile Terminated Calls (MOC/MTC) was 1/1.
The call test scenario consisted of a 120 seconds holding period followed by a 45 seconds idle time.

Interpretation of Results

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;
- Consumers should not treat the drive test results as recommended best buys. Factors such as price plans, value added services, customer care and support are not captured in this report.

Survey Results

Call Completion Success Rate

This parameter measures the capability of the network to successful setting up a call and normally terminating it. The call completion success rate shown below is based on more than 16,000 voice call attempts per operator.

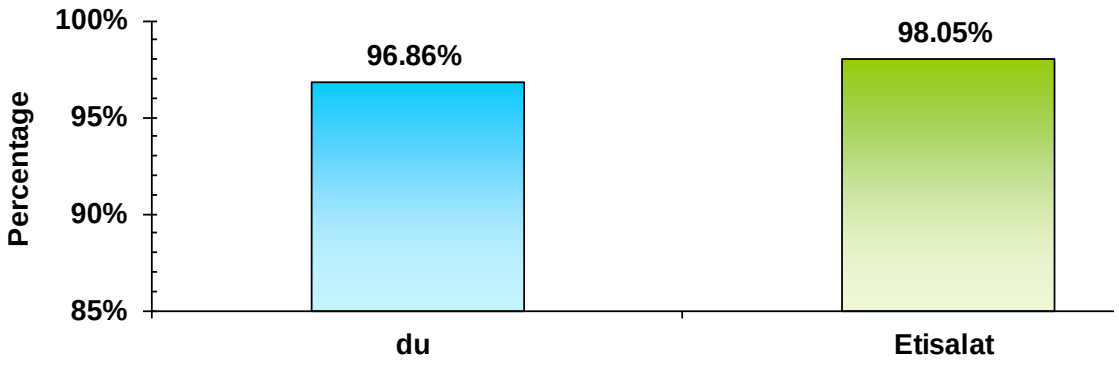

Figure 2: Call Completion Success Rate

Service Coverage

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.

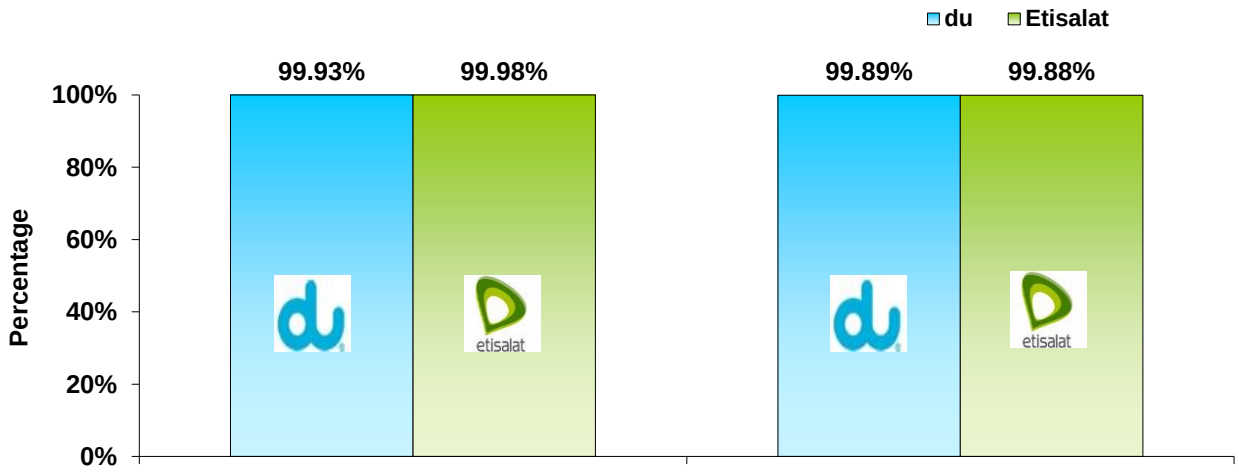

Figure 3: Coverage Level in *Single Mode (2G) and **Dual Mode (2G/3G)

*Single Mode: Here the mobile device is locked to the 2G Network (GSM) and not allowed to handover to the 3G Network (UMTS).
** Dual Mode: Here the mobile device is allowed to handover between both 2G and 3G networks based on the received signal from the network.

Voice Quality

The Mean Opinion Score (MOS) rating is a means to provide a technology-independent, objective score of the audio-voice quality of a call on an operator's network. In each call, five speech samples are sent on the uplink and another five speech samples are sent on the downlink. The speech samples are then analyzed on both ends for any distortions which will be due to network processing and interference. The level of distortion is rated using the Mean Opinion Score (MOS) method. MOS is a generally accepted and commonly used subjective quality rating scheme with the following ratings:

Score	Quality	Description of Speech
5	Excellent	Understandable with no distortion
4	Good	Easily understandable with some noise
3	Fair	Understandable with some effort
2	Poor	Understandable with much effort
1	Bad	Not understandable

Table 1. MOS distortion values.

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:

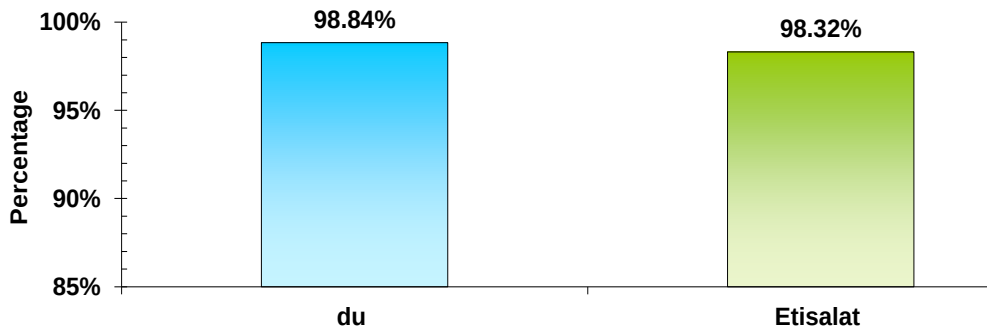

Figure 4: Voice Quality (MOS)

Call Drop Rate

A call is "dropped" when it is disconnected prematurely during the 120-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 16,000 voice call attempts per operator:

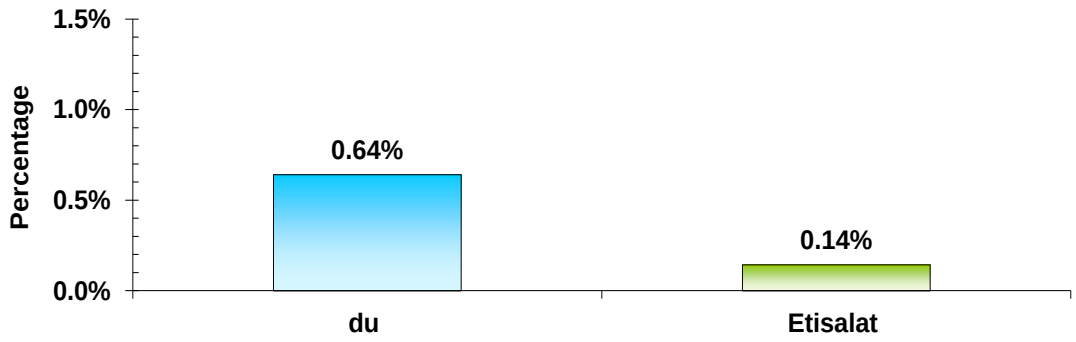

Figure 5 : Call Drop Rate

Packet Data Performance

Packet Data Performance (Throughputs): Rate at which data is transmitted over the application protocol levels. Provided in kilobit-per-second (kbps), where 1 kilobit = 1000 bits. Both FTP & HTTP have been tested.

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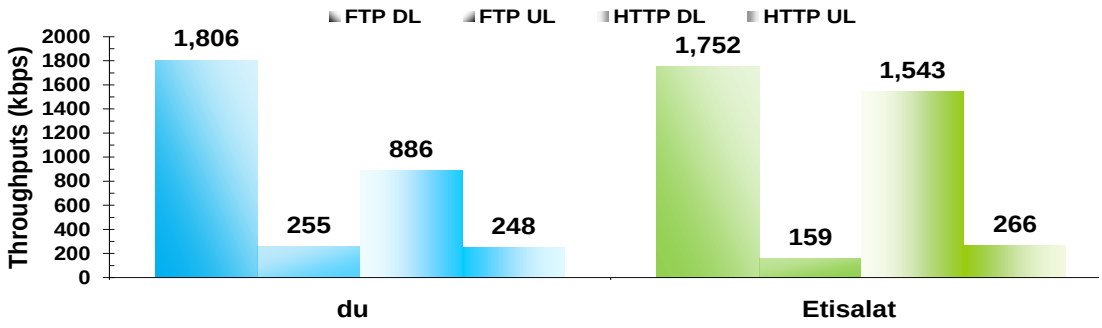
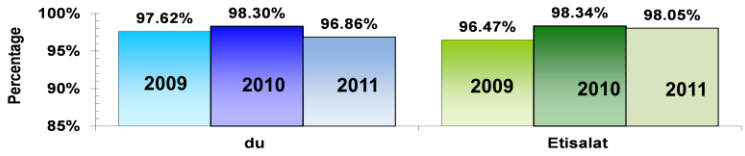


Figure 6 : Packet Data Throughput Performance

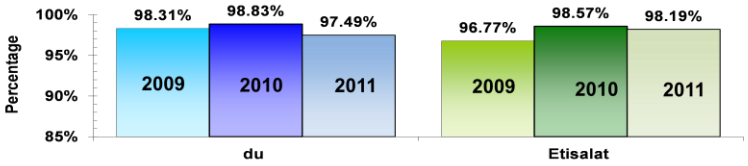
Trending of Mobile Networks Performance (2009 Vs 2010 Vs 2011)

The below graph (Figure 7) compares the performance of both Etisalat's and du's mobile networks in terms of the major Quality of Service Parameters (between 2009, 2010 and 2011).

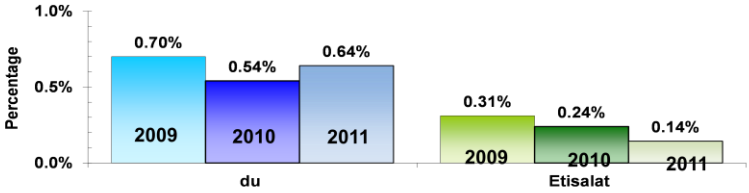
- Call Completion Success Rate –



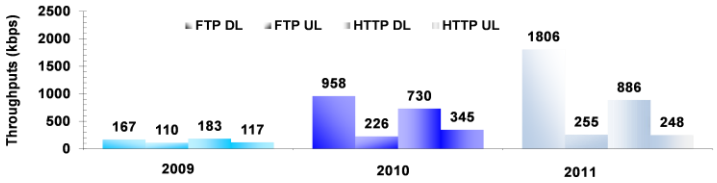
- Call Setup Success Rate –



- Call Drop Rate –



- Per-task Harmonic Mean Throughput (du)



- Per-task Harmonic Mean Throughput (Etisalat)

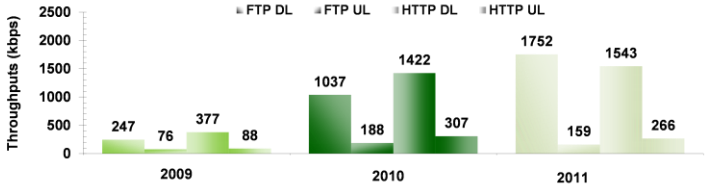


Figure 7 : Trending of Mobile Networks Performance (2009 Vs 2010 Vs 2011)