هيئة تنظيم الاتصالات
Telecommunications Regulatory Authority
مملكة البحرين – Kingdom of Bahrain

ascom

Broadband QoS Report

Quarter 4 Report

2015

Mobile Data & Voice

Fixed Broadband

Disclaimer

This study is published in accordance with Articles 3(b)(1), 3(c)(2), 3(c)(4) and Article 54 of the Telecommunications Law. The purpose of this study is to monitor and benchmark quality levels offered by Fixed Broadband Service Providers and Mobile Network Operators in the Kingdom of Bahrain. This independent study was conducted while taking into consideration the end-user experience by Ascom Network Testing and does not represent any views of the Telecommunications Regulatory Authority of the Kingdom of Bahrain ("TRA").

The data does not allow for direct comparisons to be made between each operator. It does however provide a view of how the overall performance in the Kingdom has changed over recent years. The data is derived from simulated tests placed on each network during the period mentioned in the introductions section of the report, which presents how the services performance varies and allows for comparisons between each operator to be made. This document does not however constitute commercial, legal or other advice however so described. The TRA excludes any warranty and, or liability, expressed or implied, as to the quality, completeness, adequacy and accuracy of the information, statements and statistics contained within this document. This document is a study and it is a non-binding document. It has no legal effect. This document does not represent an official position of the TRA, but is intended to stimulate debate in the part of stakeholders and public. It does not prejudice the form or content of any future proposal by the TRA.

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1. INTRODUCTION

MEASUREMENT METHOD OVERVIEW

The objective of measuring the performance of broadband and mobile internet is to facilitate clear understanding by consumers of the service quality in the Bahraini market. TRA has implemented a monitoring solution utilizing several probes across the Kingdom's regions that are deployed to simulate and collect samples of the customer experience. These probes conduct continuous tests of various services in order to enable the measurement of service quality around the clock, thus reflecting user experience for each Internet Service Provider (ISP) and Mobile Network Operator (MNO).

The test results are propagated to a backend server for analysis and reporting on a real time portal, making it possible to compare the performance of several internet and mobile service packages.

Each testing location contains two testing probes, a fixed probe and a mobile probe. The fixed probe measures different internet packages from different ISPs for Broadband Internet Services, while the mobile probe measures MNO voice and data services from a stationary prospective to purely focus on the quality of each service offered.
The Mobile probes simulates a customer experience from a stationary point of view for Mobile Services. The Stationary Mobile Testing Results presented in this report should not be confused with the results presented in the Annual QoS Mobile Audit Reports, which the Authority publishes on Annual basis after conducting a Drive Test Audit benchmarking campaign across the kingdom.

An overview of the technical solution deployed to collect these results is presented in Figure 1.

This report is based on data collected between Oct 1st, 2015 and Dec 31st, 2015, which has been averaged according to the hours of the day. Tested parameters are: HTTP, Ping, DNS and some applications like Facebook, Twitter & YouTube.

The Testing Lines package used are detailed in the Table in Annex1 for the purpose of reference; these packages have been selected to benchmark similar service offerings from the different operators in the market.

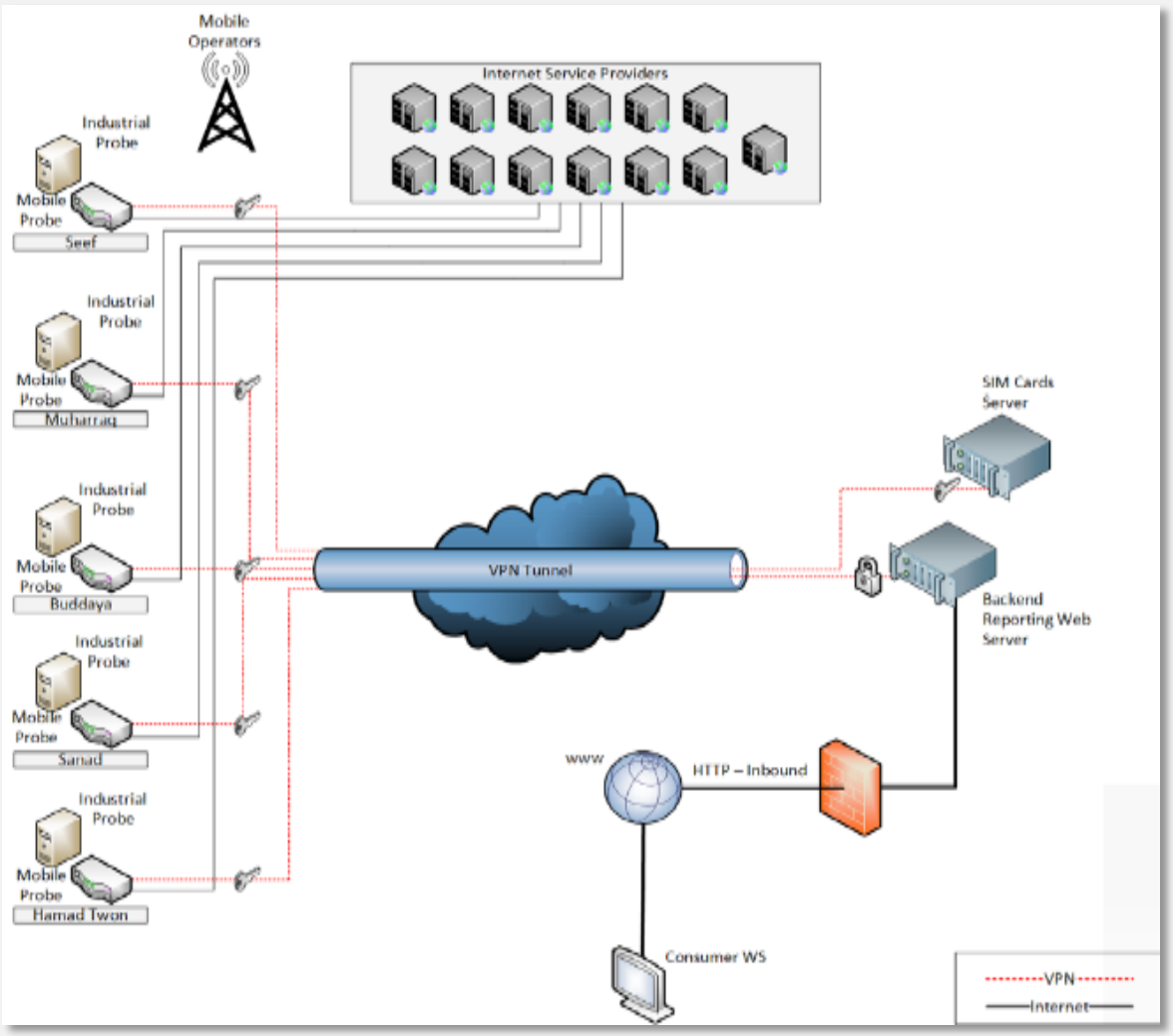


Figure 1: Overview of the Technical Solution

WHAT'S NEW TO THE REPORT

- Mobile voice and data testing.
- Over The Top (OTT) content testing.
- Comprehensive business broadband.

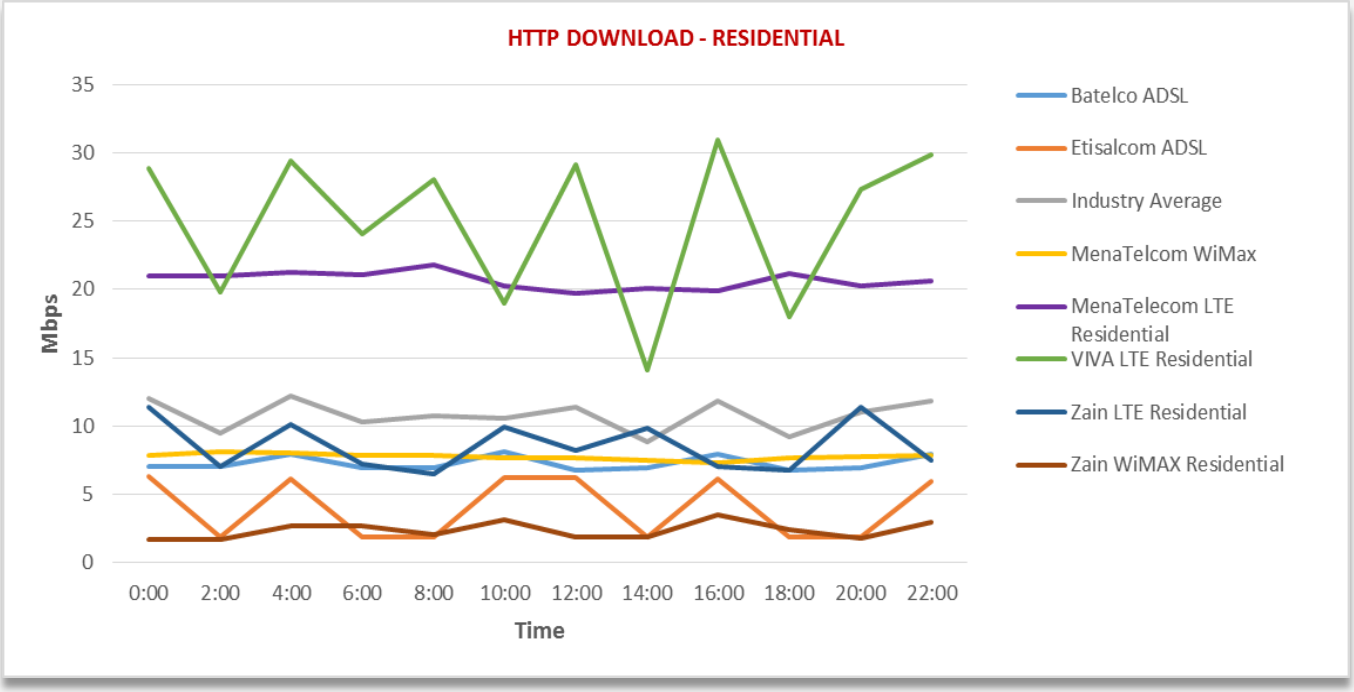
NOTICABLE EVENTS

- Average HTTP download speed for Residential packages were noticed to be approximately 10.8 Mbps.
- Average DNS resolution time reached 1.7 seconds, and
- Average Latency is at 265 milliseconds.

2. FIXED BROADBAND INTERNET TESTING
RESIDENTIAL SERVICES

2.1 HTTP DOWNLOAD SPEED FOR RESIDENTIAL PACKAGES

Testing HTTP download speed depends on various variables in the network that could impact the download performance. Following data is the result of downloading a file available on the same provider's network (on-net).



HTTP Download Speed - Chart View (Mbps)

ISP Name	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00
Etisalcom ADSL Residential	6.33	1.86	6.16	1.86	1.86	6.18	6.24	1.86	6.10	1.86	1.86	5.95
MenaTelcom WiMax Residential	7.87	8.08	7.99	7.86	7.86	7.63	7.68	7.50	7.30	7.69	7.77	7.82
Batelco ADSL Residential	7.02	7.04	7.98	6.90	6.95	8.12	6.73	6.91	7.90	6.74	6.96	7.96
MenaTelcom LTE Residential	21.01	20.94	21.21	21.11	21.81	20.28	19.71	20.08	19.88	21.17	20.29	20.65
Zain WiMAX Residential	1.66	1.72	2.71	2.73	2.02	3.18	1.89	1.90	3.55	2.39	1.80	2.99
VIVA LTE Residential	28.89	19.83	29.39	24.09	28.02	18.96	29.08	14.07	30.92	18.00	27.33	29.87
Zain LTE Residential	11.41	7.08	10.10	7.26	6.48	9.92	8.26	9.83	7.02	6.74	11.39	7.51
Industry Average	12.03	9.51	12.22	10.26	10.71	10.61	11.37	8.88	11.81	9.23	11.06	11.82

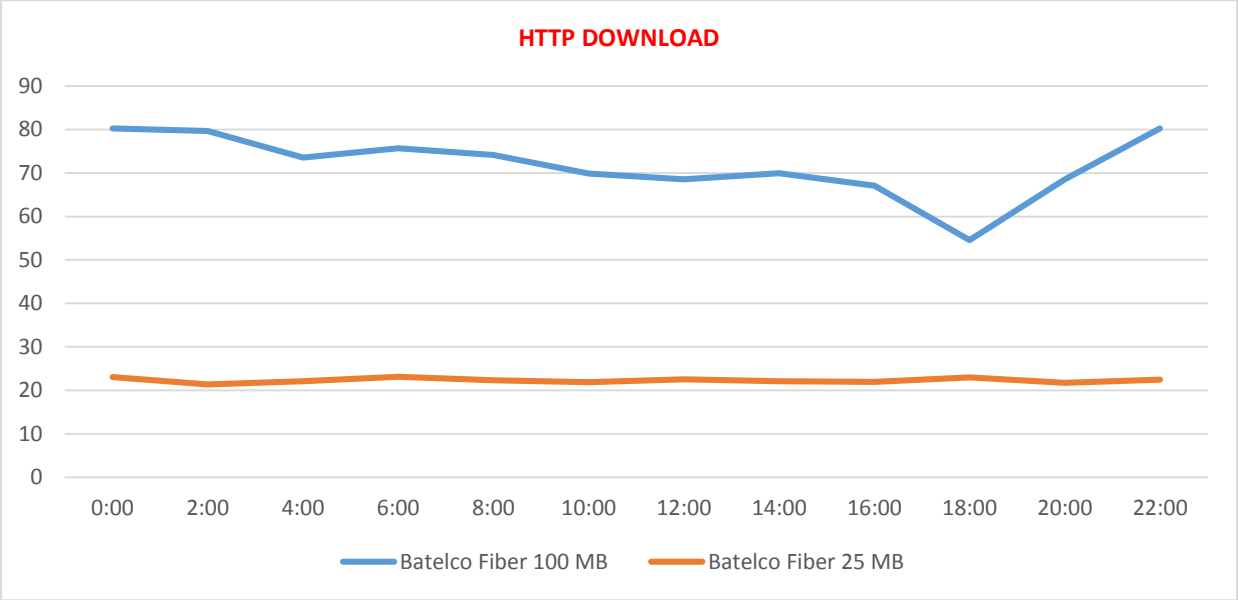
HTTP Download Speed - Summary Table (Mbps)

HIGHLIGHTS

- Industry Average HTTP download speed of 10.8 Mbps has been recorded.
- Higher HTTP download value indicates higher downlink internet speed.

2.2 HTTP DOWNLOAD SPEED FOR FIBER

HTTP Download for service packages over Fiber technology is tested separately to benchmark its performance.

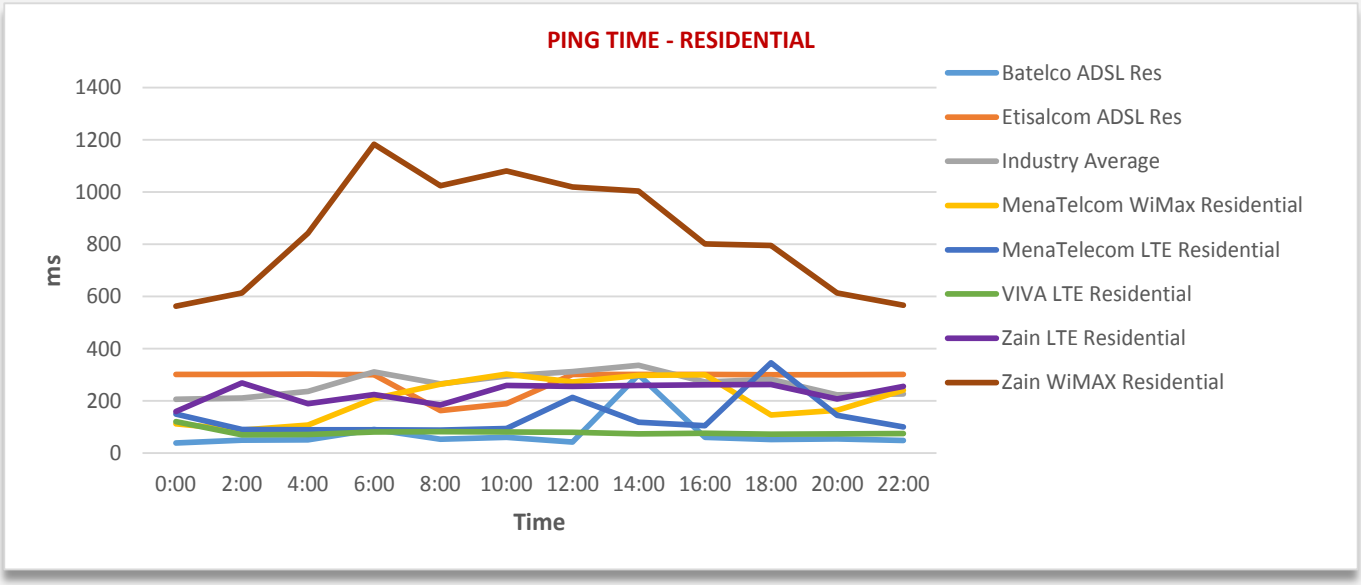


HTTP Download Speed - Chart View (Mbps)

ISP Name	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00
Batelco Fiber 25 MB	23.05	21.33	22.07	23.10	22.31	21.89	22.52	22.13	21.97	22.98	21.74	22.43
Batelco Fiber 100 MB	80.25	79.66	73.53	75.66	74.15	69.89	68.55	69.92	67.10	54.55	68.55	80.25

HTTP Download Speed - Summary Table (Mbps)

Ping time or round trip time (RTT) is a method to measure the time it takes to send a number of Bytes to a destination host and have them acknowledged. The ping test has been performed by sending 5 packets of 32 bytes each, and measuring the response time within the default timeout duration. The higher the ping time represents higher latency, so lower ping time denotes better internet application/website response.



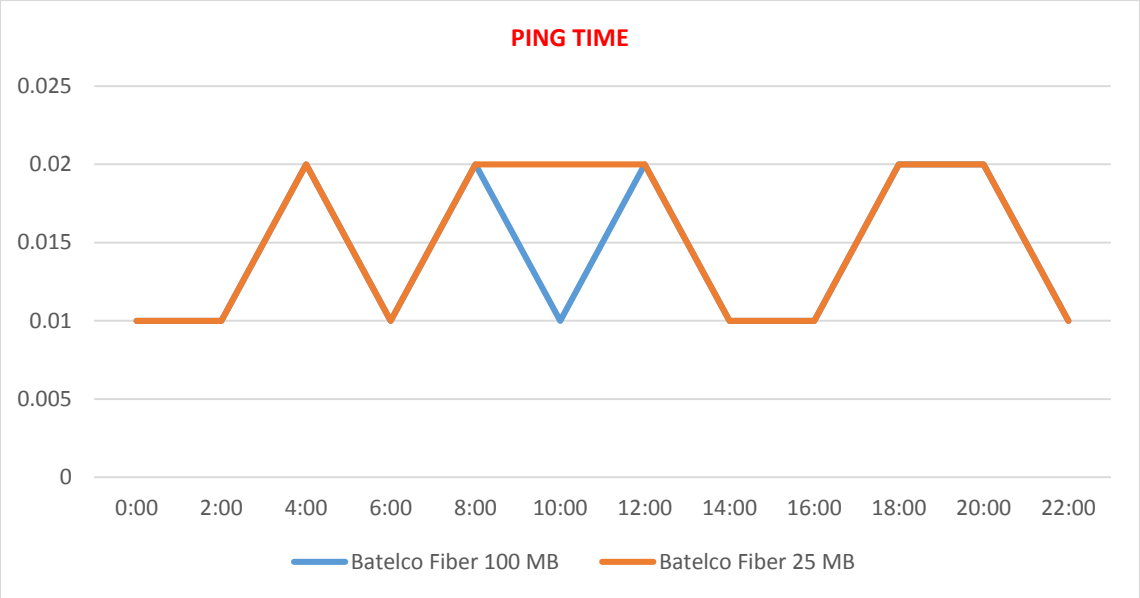
PING Time Chart View (milliseconds)

ISP Name	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00
Batelco ADSL Residential	39.00	49.00	50.00	90.00	53.00	60.00	42.00	300.00	60.00	52.00	54.00	48.00
MenaTelcom LTE Residential	149.00	90.00	89.00	89.00	88.00	94.00	213.00	118.00	105.00	346.00	145.00	100.00
Etisalcom ADSL Residential	301.00	301.00	302.00	300.00	163.00	189.00	301.00	301.00	301.00	300.00	300.00	301.00
MenaTelcom WiMax Residential	112.00	88.00	107.00	209.00	264.00	302.00	272.00	298.00	300.00	146.00	164.00	241.00
Zain WiMAX Residential	563.00	613.00	842.00	1184.00	1025.00	1081.00	1020.00	1004.00	801.00	796.00	614.00	567.00
VIVA LTE Residential	119.90	70.29	70.81	80.15	81.98	80.82	79.39	73.69	75.40	72.66	73.69	74.77
Zain LTE Residential	159.00	269.00	189.00	224.00	184.00	259.00	255.00	259.00	261.00	263.00	207.00	256.00
Industry Average	206.13	211.47	235.69	310.88	265.57	295.12	311.77	336.24	271.91	282.24	222.53	226.82

PING Time Table View (milliseconds)

- The Industry Average Latency is 265ms and is at 142 ms if excluding WiMax service packages.
- The lower the value of the ping time, the better is the network quality that will provide a higher customer experience.

2.4 PING TIME FOR FIBER PACKAGES



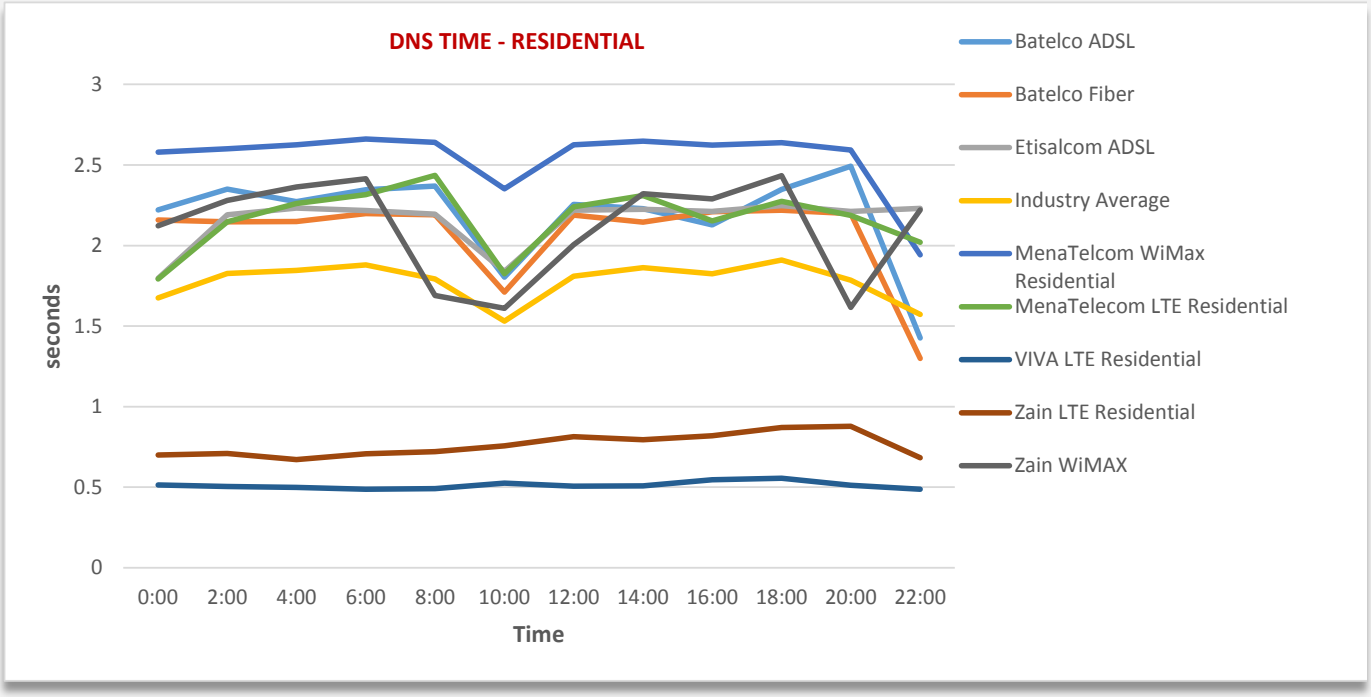
Ping Time Chart View (ms)

ISP Name	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00
Batelco Fiber 25 MB	0.01	0.01	0.02	0.01	0.02	0.02	0.02	0.01	0.01	0.02	0.02	0.01
Batelco Fiber 100 MB	0.01	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.01	0.02	0.02	0.01

Ping Time Table View (ms)

2.5 DNS TIME FOR RESIDENTIAL PACKAGES

The DNS time test records the time taken (in milliseconds) to resolve a fully qualified domain name into a corresponding IP address. The DNS servers used for the query are the primary and secondary DNS servers that are dynamically assigned by the service provider when the network connection is initiated. Alternatively a specific DNS server can be used to test DNS time.



DNS Time Chart View (seconds)

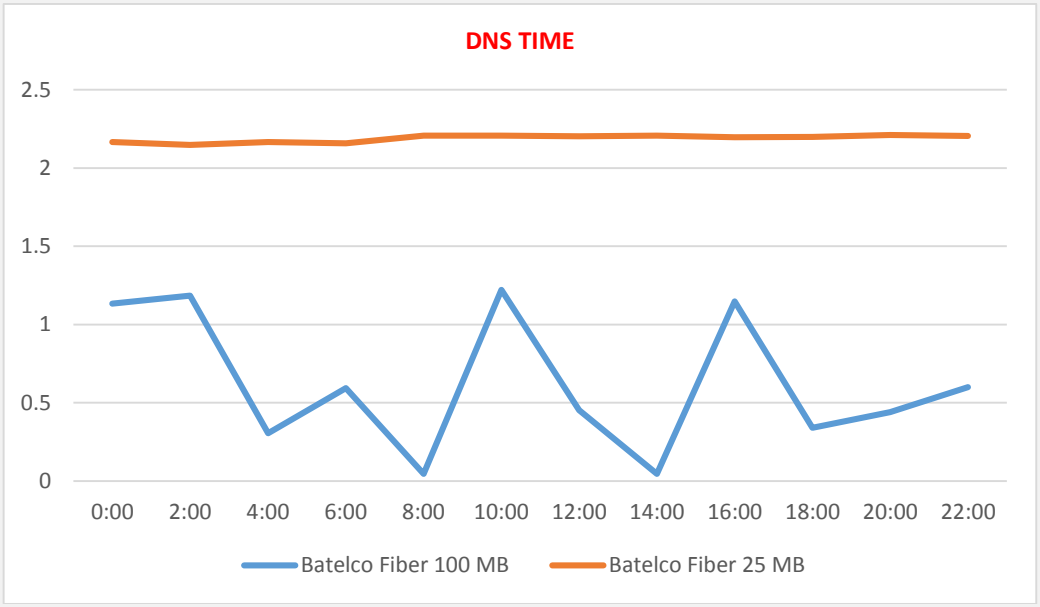
ISP Name	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00
Batelco ADSL Residential	2.22	2.35	2.27	2.35	2.37	1.80	2.25	2.23	2.13	2.35	2.49	1.43
Etisalcom ADSL Residential	1.80	2.19	2.23	2.22	2.20	1.84	2.22	2.23	2.21	2.25	2.21	2.23
MenaTelcom LTE Residential	1.79	2.15	2.26	2.32	2.44	1.83	2.24	2.31	2.15	2.27	2.19	2.02
MenaTelcom WiMax Residential	2.58	2.60	2.62	2.66	2.64	2.35	2.63	2.65	2.62	2.64	2.59	1.94
Zain WiMAX Residential	2.12	2.28	2.36	2.42	1.69	1.61	2.01	2.32	2.29	2.43	1.62	2.22
VIVA LTE Residential	0.51	0.50	0.50	0.49	0.49	0.52	0.51	0.51	0.55	0.56	0.51	0.49
Zain LTE Residential	0.70	0.71	0.67	0.71	0.72	0.76	0.81	0.79	0.82	0.87	0.88	0.68
Industry Average	1.68	1.83	1.85	1.88	1.79	1.53	1.81	1.86	1.82	1.91	1.78	1.57

DNS Time Table View (seconds)

HIGHLIGHTS

- The Industry Average DNS resolution time is 1.8 seconds.
- The lower the DNS time, the better the customer browsing experience in loading web pages.

2.6 DNS TIME FOR FIBER PACKAGES



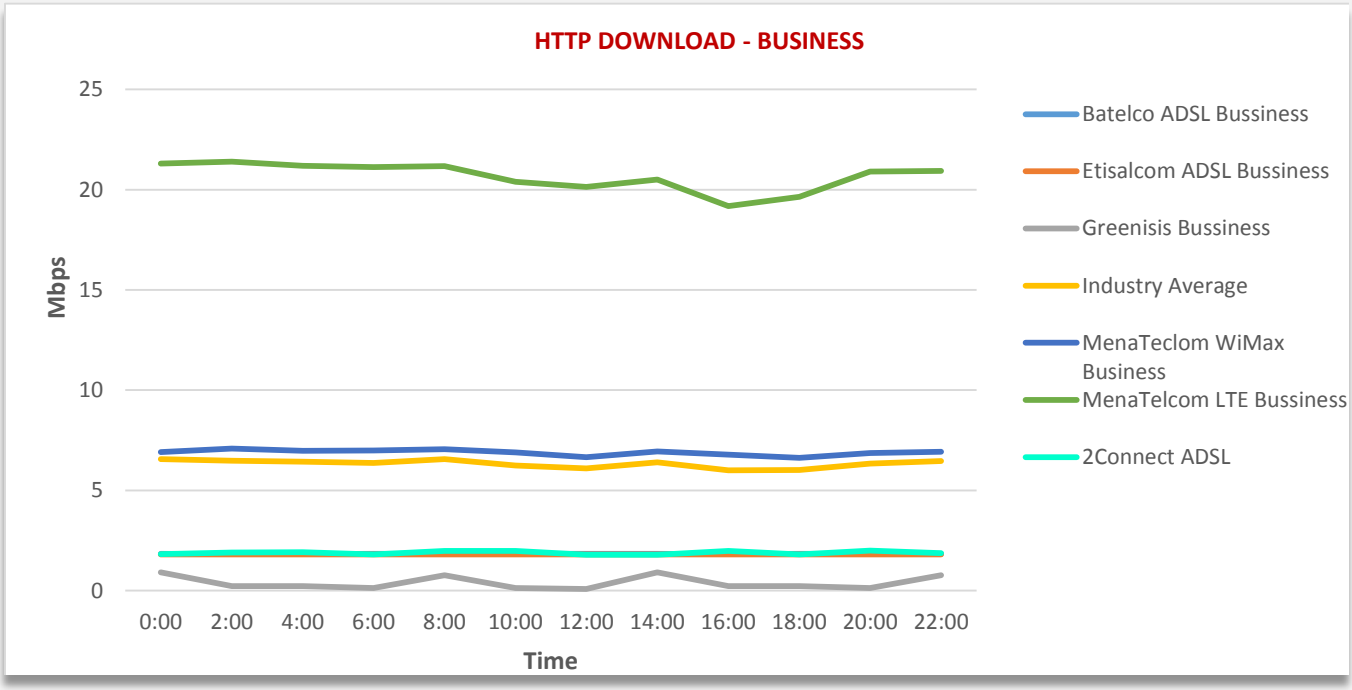
DNS Time Chart View (Seconds)

ISP Name	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00
Batelco Fiber 25	2.17	2.15	2.17	2.16	2.21	2.21	2.20	2.21	2.20	2.20	2.21	2.20
Batelco Fiber 100 MB	1.13	1.18	0.30	0.59	0.05	1.22	0.45	0.05	1.15	0.34	0.44	0.60

DNS Time Table View (Seconds)

3. FIXED BROADBAND INTERNET TESTING
BUSINESS SERVICES

3.1 HTTP DOWNLOAD SPEED FOR BUSINESS PACKAGES

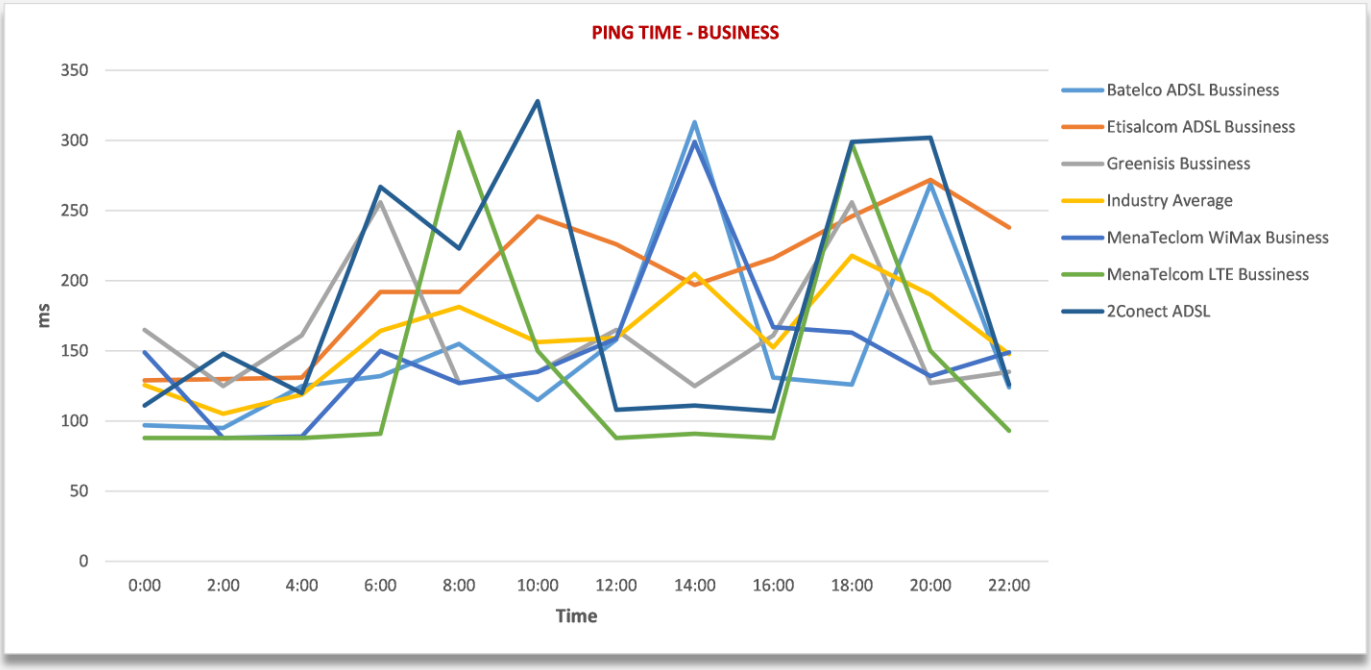


HTTP Download Speed - Chart View (Mbps)

ISP Name	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00
2Conect ADSL	1.82	1.90	1.92	1.80	1.98	1.97	1.79	1.79	1.97	1.80	1.99	1.86
Batelco ADSL Bussiness	1.83	1.81	1.81	1.83	1.83	1.83	1.83	1.83	1.82	1.83	1.83	1.83
Etisalcom ADSL Bussiness	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81
MenaTelcom LTE Bussiness	21.31	21.39	21.19	21.13	21.17	20.40	20.14	20.50	19.18	19.64	20.91	20.94
MenaTeclom WiMax Business	6.90	7.09	6.98	6.99	7.06	6.89	6.65	6.94	6.78	6.62	6.86	6.93
Greenisis Bussiness	0.92	0.23	0.23	0.12	0.77	0.13	0.09	0.92	0.23	0.23	0.12	0.77
Industry Average	6.55	6.48	6.43	6.37	6.56	6.24	6.10	6.39	5.99	6.02	6.34	6.46

HTTP Download Speed - Summary Table (Mbps)

3.2 PING TIME FOR BUSINESS PACKAGES

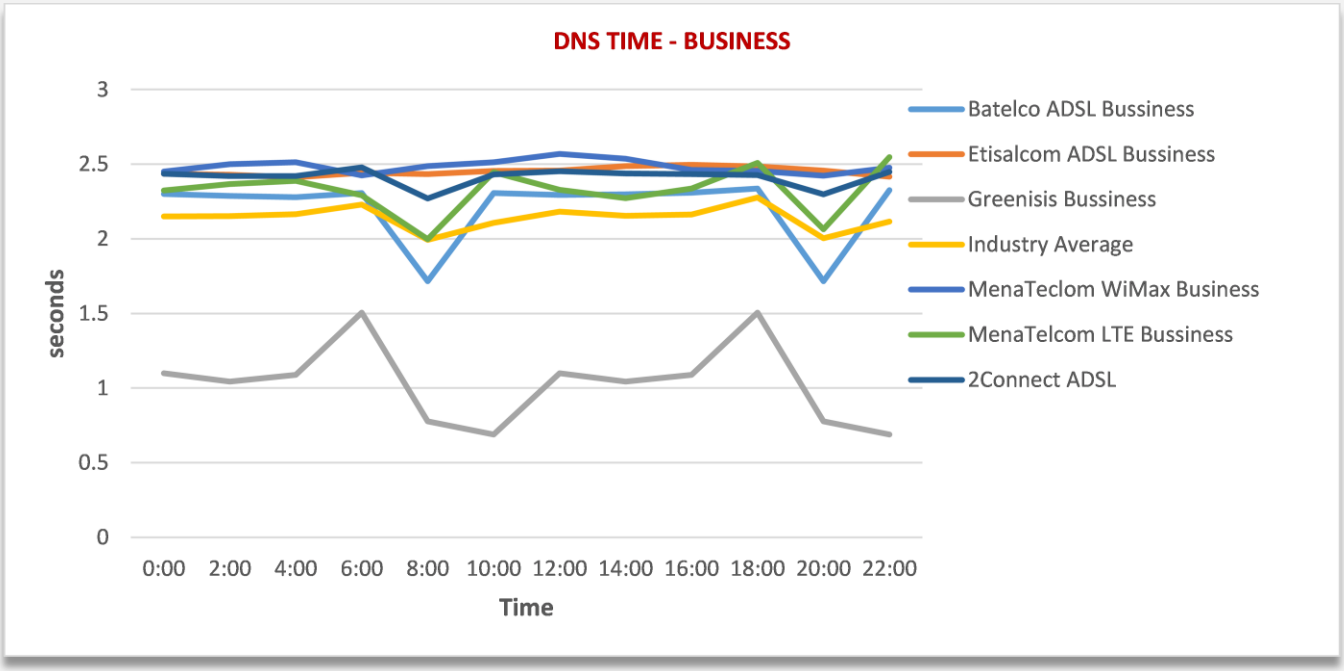


PING Time Chart View (milliseconds)

ISP Name	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00
2Conect ADSL	111.00	148.00	120.00	267.00	223.00	328.00	108.00	111.00	107.00	299.00	302.00	126.00
Batelco ADSL Bussiness	97.00	95.00	125.00	132.00	155.00	115.00	158.00	313.00	131.00	126.00	269.00	124.00
Etisalcom ADSL Bussiness	129.00	130.00	131.00	192.00	192.00	246.00	226.00	197.00	216.00	246.00	272.00	238.00
MenaTeclom WiMax Business	149.00	88.00	89.00	150.00	127.00	135.00	159.00	299.00	167.00	163.00	132.00	149.00
MenaTelcom LTE Bussiness	88.00	88.00	88.00	91.00	306.00	150.00	88.00	91.00	88.00	298.00	150.00	93.00
Greenisis Bussiness	165.00	125.00	161.00	256.00	127.00	135.00	165.00	125.00	161.00	256.00	127.00	135.00
Industry Average	125.60	105.20	118.80	164.20	181.40	156.20	159.20	205.00	152.60	217.80	190.00	147.80

PING Time Table View (milliseconds)

3.3 DNS TIME FOR BUSINESS PACKAGES



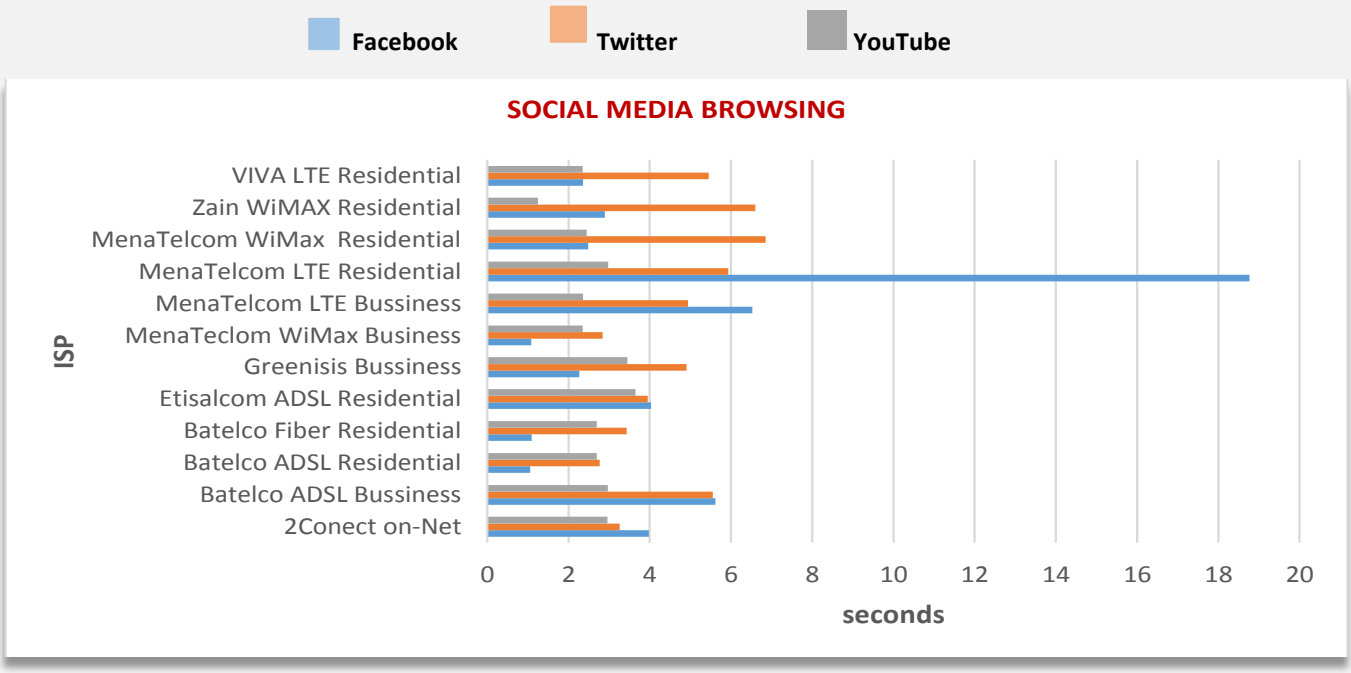
DNS Time Chart View (Seconds)

ISP Name	00:00	02:00	04:00	06:00	08:00	10:00	12:00	14:00	16:00	18:00	20:00	22:00
2Conect ADSL	2.44	2.42	2.42	2.48	2.27	2.43	2.45	2.44	2.43	2.43	2.30	2.45
Batelco ADSL Bussiness	2.30	2.29	2.28	2.31	1.72	2.31	2.29	2.30	2.31	2.34	1.72	2.33
MenaTeclom WiMax Business	2.45	2.50	2.51	2.43	2.49	2.51	2.57	2.54	2.46	2.45	2.42	2.48
Etisalcom ADSL Bussiness	2.44	2.43	2.41	2.44	2.43	2.46	2.46	2.49	2.50	2.49	2.46	2.42
MenaTelcom LTE Bussiness	2.32	2.37	2.39	2.29	2.00	2.45	2.33	2.27	2.34	2.51	2.06	2.55
Greenisis Bussiness	1.10	1.04	1.09	1.51	0.78	0.69	1.10	1.04	1.09	1.51	0.78	0.69
Industry Average	2.15	2.15	2.16	2.23	1.99	2.11	2.18	2.16	2.16	2.28	2.00	2.12

DNS Time Table View (Seconds)

4. SOCIAL MEDIA BROWSING

Social media testing aims to measure the response time of using most common interactive social sites via an internet browser. Test indicates the time it takes to load the page using a browser.



Social Media Browsing Time Chart View (Seconds)

ISP Name	Facebook	Twitter	Youtube
2Conect on-Net	3.98	3.26	2.96
Batelco ADSL Bussiness	5.62	5.55	2.97
Batelco ADSL Residential	1.06	2.77	2.69
Batelco Fiber Residential	1.09	3.43	2.69
Etisalcom ADSL Residential	4.03	3.95	3.65
Greenisis Bussiness	2.27	4.91	3.45
MenaTeclom WiMax Business	1.08	2.84	2.35
MenaTelcom LTE Bussiness	6.53	4.94	2.36
MenaTelcom LTE Residential	18.77	5.93	2.98
MenaTelcom WiMax Residenti	2.48	6.85	2.45
Zain WiMAX Residential	2.89	6.6	1.25
VIVA LTE Residential	2.36	5.45	2.35

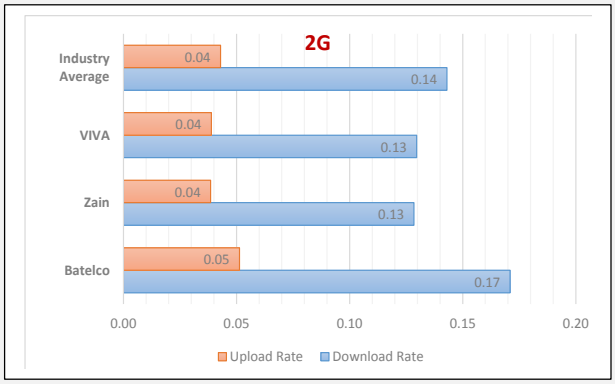
Social Media Browsing Time Table View (Seconds)

5. STATIONARY MOBILE TESTING

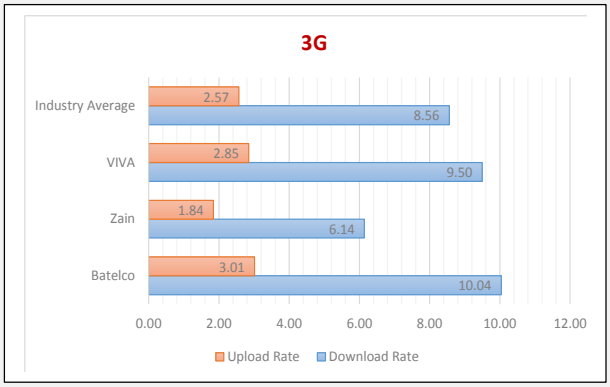
5.1 STATIONARY MOBILE DATA TESTING – HTTP

GSM (2G)

Data Download Transfer Rate is the amount of data transferred from the network to the client. In mobile data networks, the download transfer rate depends on the mobile network technology. GSM - or 2G - has an average data speed of 144 Kbps.



2G Download & Upload Transfer Rate (Mbps)



3G Download & Upload Transfer Rate (Mbps)

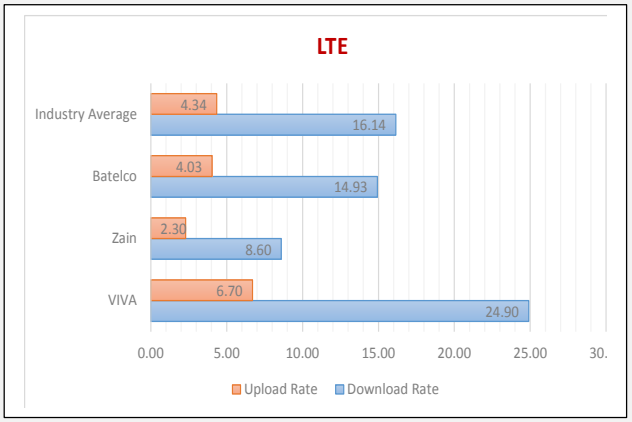
UMTS (3G)

There is high demand for mobile data applications, and new technologies are continuously being introduced to the market for addressing the ever increasing bandwidth requirements of these applications.
UMTS has thus been introduced as the third generation mobile network technology with an average data speed of over 2Mbps. It is also known as 3G.

LTE (4G)

Long-Term Evolution is a new wireless standard introduced as the fourth generation mobile network technology (also known as 4G). It provides high speed data transfer for mobile phones and data terminals.

One of the key features of LTE is that it provides an average download data rate of up to 150 Mbps.



LTE Download & Upload Transfer Rate (Mbps)

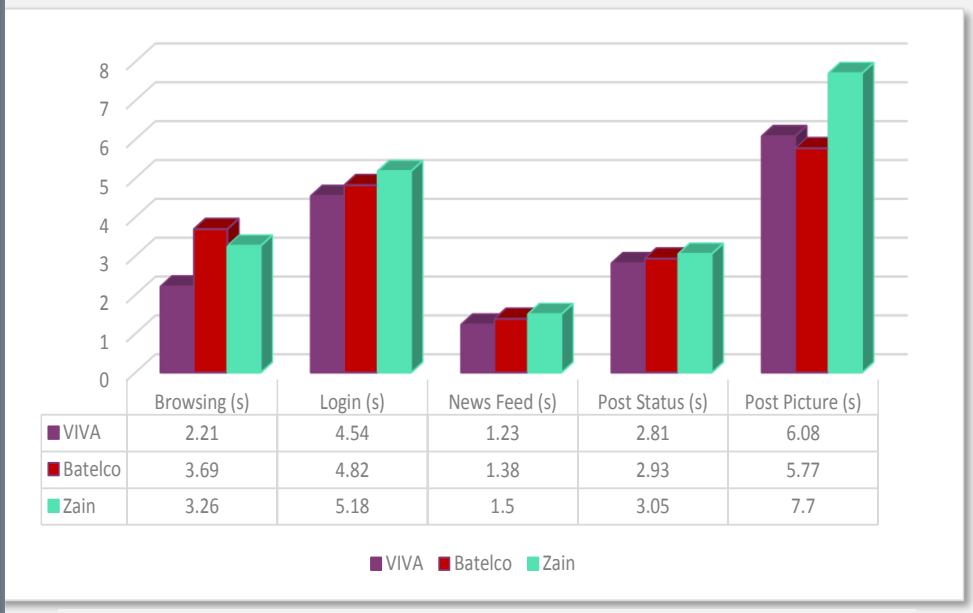
5.2 STATIONARY MOBILE APPLICATION TESTING

Facebook is one of the top social networks used in the world. Most smartphones have Facebook applications that keep their users connected around the clock, sharing photos and moments with friends.

Facebook application testing reflects the end-user experience on smartphones by mimicking user routine in the Facebook mobile app.

Facebook testing methodology simulates users' activities on mobile application. The scenario starts by attaching to mobile network APN, then requesting the Facebook mobile website (http://m.facebook.com), and providing user credentials in order to access personal account activities.

The response time is then measured for each of the following activities: load news feed, change personal status, and upload a photo of 800x600 pixels.



	Browsing (s)	Login (s)	News Feed (s)	Post Status (s)	Post Picture (s)
VIVA	2.21	4.54	1.23	2.81	6.08
Batelco	3.69	4.82	1.38	2.93	5.77
Zain	3.26	5.18	1.5	3.05	7.7

Facebook Mobile QoS (seconds)

Browsing
Facebook main page Response time

Login
Response time for Facebook login

News Feed
Response time of retrieving new feed in main page

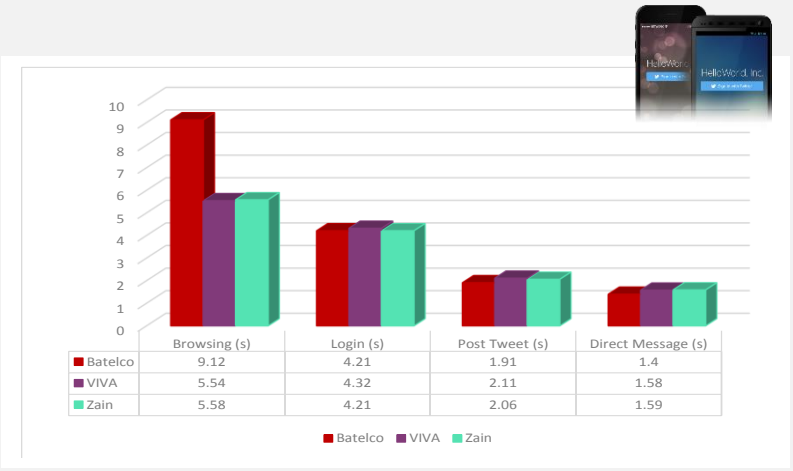
Post Status
Response time of updating personal status

Post Picture
Response time for uploading a picture.

Twitter testing methodology aims to measure the experience of using the twitter mobile application. The main activities are:

- Browse twitter mobile URL http://mobile.twitter.com
- Provide username and password
- Post a tweet
- Send direct message to a friend

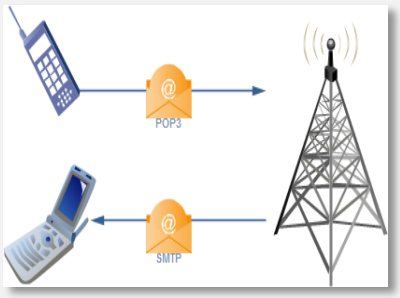
The Response time of each activity is reported to reflect twitter QoS on mobile network.

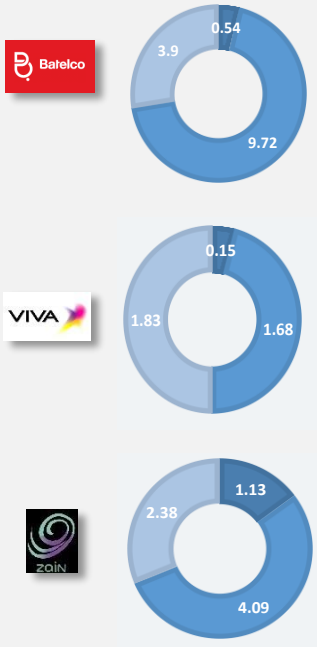


Twitter Mobile QoS (seconds)

There are many different email applications available on the internet and mobiles handsets such as Gmail, outlook live, yahoo, etc.

Nonetheless, these are all implemented using standard protocols for sending/ receiving emails and attachments. In email testing scenario, the methodology implemented is to use Gmail server for sending an email by POP3 protocol, to a recipient using SMTP.



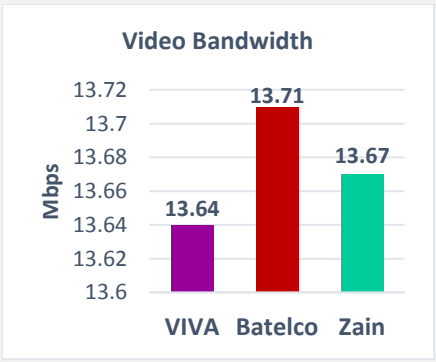


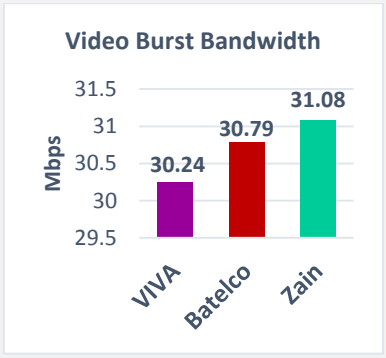
Email Methodology

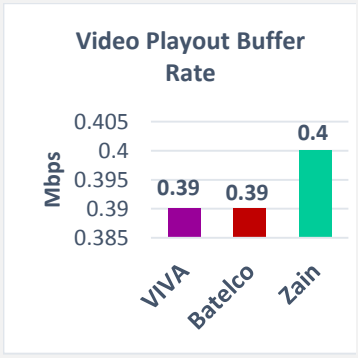
- Sender logs in to pop.gmail.com
- Sender sends email with 200 KB attachment.
- Recipient logs in to smtp.gmail.com
- Recipient receives the email
- Recipient downloads the attachment

YouTube

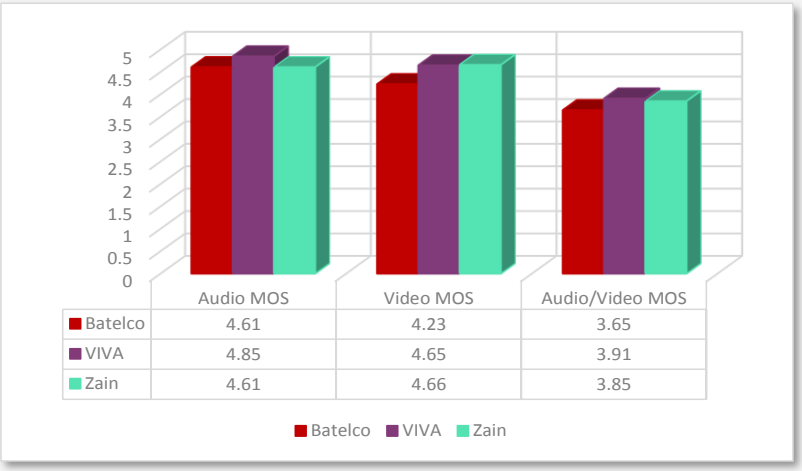
For those who stream videos from online sources, the speed at which data can be sent to their devices is critical. If your connection is not fast enough, streaming video can sometimes stall as it fills the buffer in the receiving device. Or, the content provider might send a lower-quality stream because it senses that your available speed cannot handle higher quality steams.
What many refer to as “Internet speed” is actually the bandwidth available to accept data from the Internet into your device. Measured in Megabits per Second (Mbps), it is the amount of data that can be transferred from the server to your connected device in one second.







YouTube Mobile QoS (Mbps)



YouTube MOS (1-5)

Mean opinion score (MOS) is a test used in telephony networks to obtain the human user’s view of the quality of the network. The MOS is the arithmetic mean of all the individual scores, and can range from 1 (worst) to 5 (best).

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

6. MOBILE VOICE AND SMS TESTING

MOBILE VOICE CALLS

Voice calls QoS is measured by placing voice calls from each operator for 60 seconds. Calls are done On-Net (within the operator's network) and Off-Net (to other network operators). Call setup time is the overall time taken from dialing a number until the ringing tone is played, it is measured in seconds. Voice call score is an indication of the call quality, ranged from 1 (Poor) to 5 (Excellent).

Operator	Call Setup Time (On-Net) (sec)	Call Setup Time (Off-Net) (sec)
VIVA	4.9	6.6
Batelco	4.8	4.7
Zain	4.9	4.4

VOICE CALLS SETUP TIME (Sec)

Operator	Call Quality Score
VIVA	4.36
Batelco	4.25
Zain	4.35

VOICE CALLS Quality (1-5)

SMS (Short Messaging Service)

SMS (Short Messaging Service) is tested by sending Unicode text in the size of 120 bytes. The duration of sending and receiving a one-part SMS is calculated in seconds.

Operator	Send SMS Time (sec)	Receive SMS Time (sec)
VIVA	2.15	2.99
Batelco	1.85	2.53
Zain	1.76	2.27

SMS SEND vs RECEIVE TIME (Sec)

7. ANNEX - Testing Lines package

Service Provider	Package description	Package Type	Advertised Package	Access Network Technology	Download Threshold	Download Speed	Upload Speed	Throttle Speed
Batelco	Residential	Postpaid	Value packages - Medium	ADSL	200GB	8Mbps	2Mbps	2Mbps
	Residential	Postpaid	Superfast Packages - Superior	Fiber	350GB	25Mbps	2.5Mbps	5Mbps
	Residential	Postpaid	Superfast Packages - Superior	Fiber	500GB	100 Mbps	10Mbps	15Mbps
	Business	Postpaid	Broadband Business	ADSL	Unlimited	2Mbps	1Mbps	Unlimited
	Residential/ Business	Mobile Postpaid	4G LTE Smart Packages	4G LTE	100 GB	Up to 150Mbps	Up to 150Mbps	Unlimited
	Residential	Mobile Prepaid	SimSim Super Packages	4G LTE	100 GB	Up to 150Mbps	Up to 150Mbps	Unlimited
Zain	Residential	Postpaid	Value20	WiMax	80GB	up to 20 Mbps	up to 5 Mbps	Unlimited
	Residential/ Business	Mobile Postpaid	Smart Plans	4G LTE	100 GB	Up to 150Mbps	Up to 150Mbps	Unlimited
	residential	Mobile Prepaid	Dangrous Prepaid	4G LTE	100 GB	Up to 150Mbps	Up to 150Mbps	Unlimited
MenaTelcom	Residential	Postpaid	menaHome	WiMax	80GB	18Mb	1Mb	2Mb
	Business	Postpaid	menaBusiness	WiMax	(Unlimited)	18Mb	2Mb	Unlimited
	Residential	Postpaid	menaHome	4G LTE	100 GB	Up to 150Mbps	Up to 4Mb	3Mb
	Business	Postpaid	MenaBusiness	4G LTE	150 GB	Up to 150Mbps	Up to 4Mb	3Mbps
Etisalcom	Residential	Postpaid	eDSL 8	ADSL	Unlimited	8Mbps	2 Mbps	Unlimited
	Business	Postpaid	eDSL 2	ADSL	Unlimited	2Mbps	1 Mbps	Unlimited
Greenisis (BB)	Business	Postpaid	Greenisis Turbo	Mobile Broadband Wireless Access (MBWA)	Unlimited	2Mbps	768Kbps	Unlimited
2Connect	Business	Postpaid	Internet	ADSL	100GB	2Mbps	2Mbps	Unlimited
Viva	Residential/ Business	Mobile Postpaid	Unlimited Smart	4G LTE	100 GB	Up to 150Mbps	Up to 150Mbps	Unlimited
	Residential	Mobile Prepaid	Viva Prepaid	4G LTE	100 GB	Up to 150Mbps	Up to 150Mbps	Unlimited