Network Performance Report 2018:

Measuring Malaysia Broadband and Voice Performance

January 2019

About this document

The report contains data and analysis on the network performance of Malaysia's wireless (mobile) broadband, wired (fixed-line) broadband and public cellular (voice) services; based on measurement conducted by the MCMC in year 2018.

The report provides information on the average performance of voice network and broadband network for both mobile and fixed broadband services, which are presented at a national level. Data collected were from measurement surveys and analysis conducted by the MCMC on a nationwide scale from January to December 2018.

This report is intended to provide consumers with useful information on the performance of the mentioned services. The publishing of this report is in accordance with MCMC's effort to carry out and publish research on the quality of services experienced by the consumers based on the relevant Commission Determination on the Mandatory Standards for Quality of Service.

Key Metrics Measured

Throughput - refers to how much data can be transferred per unit of time across a network from one location to another, experienced by end user as internet speed. Higher throughput means better internet speeds.
Network Latency - refers to the Return Trip Time (RTT) of data transfers on a network, how long it takes for the data to travel to its destination. Low latency is considered better than high latency.
Packet Loss - refers to amount of data sent which are unable to reach its intended destination. Low packet loss indicates the network able to transfer data from the user end to the destination host with high reliability.
Call Setup Success Rate (CSSR) - refers to voice calls made by user and successfully established, allowing communication. High CSSR indicates good network accessibility.
Dropped Call Rate (DCR) - refers to voice calls made by user and successfully established but was cut off before the speaking parties able to complete the intended call or before any one of them hang up. Low DCR indicates good network retainability.

Fundamentals of the assessment

The results provide valuable insight into each related service performance, with the exceptions of:

- The information presented in this report concerning wireless and wired broadband only relates to download speeds, upload speeds, network latency and packet loss. Other factors relating to the consumer experience of using broadband services (such as traffic management policies, Over-the-Top (OTT) applications, data allowances, customer service, billing etc.) are not covered in this report.

- In terms of mobile broadband and voice performance, the results may vary which is dependent on a number of factors including distance from the base station, whether the user is inside a building or outdoors, and whether stationary or in motion.
- The number of people concurrently accessing a network in the same location or area can affect service performance. Hence, the performance available to any individual consumer will vary both by time and by location.
- This report represents information on recorded results of the related service performance during the measurement period in the locations in which tested by the MCMC. However, the service providers are continuously expanding and optimizing their networks, so the general performance results set out in this report may not represent current or future performance.
- It is important to note that the results shown here do not reflect the Malaysian-wide performance and is limited to the areas being measured. However, the measurements were done in major cities for each regional areas to reflect on the performance in high demand areas.

Published by:
Malaysian Communications and Multimedia Commission
MCMC Tower 1
Jalan Impact
Cyber 6
63000 Cyberjaya, Selangor Darul Ehsan
T: +60 3 86 88 80 00 F: +60 3 86 88 10 00
Toll Free: 1-800-888-030
W: www.mcmc.gov.my

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Wireless Broadband Access

Nationwide overall performance

Results for wireless broadband performance are illustrated by figures shown below. The requirement is to have at least 1Mbps throughput for at least 80% of the time. Other aspects of the network performance being measured are the network latency must not be more than 250 ms packet round trip time (RTT) at least 70% of the time and packet loss not more than 3%.

Figure 1 describes the headline key metrics based on Mandatory Standards for Quality of Service (MSQoS) for Wireless Broadband at an aggregate level across Malaysia. Measurements were conducted from January to November 2018.

Figure 1: Key metrics scorecard for wireless broadband – Nationwide:

Service Provider	Average Download Speed	% of Speeds over 1Mbps	% of the time latency ≤ 250 ms	Packet Loss %
Celcom	19.92 Mbps	96.91 %	99.83 %	0.12 %
DiGi	23.10 Mbps	98.49 %	99.36 %	0.12 %
Maxis	35.02 Mbps	99.89 %	99.94 %	0.02 %
U Mobile	13.10 Mbps	89.07 %	98.69 %	0.03%
Webe	9.73 Mbps	87.90 %	99.01 %	0.53 %
YES (LTE)	17.52 Mbps	99.51 %	99.51 %	0.03 %
YES (WiMAX)*	6.84 Mbps	88.83 %	98.29 %	0.65 %

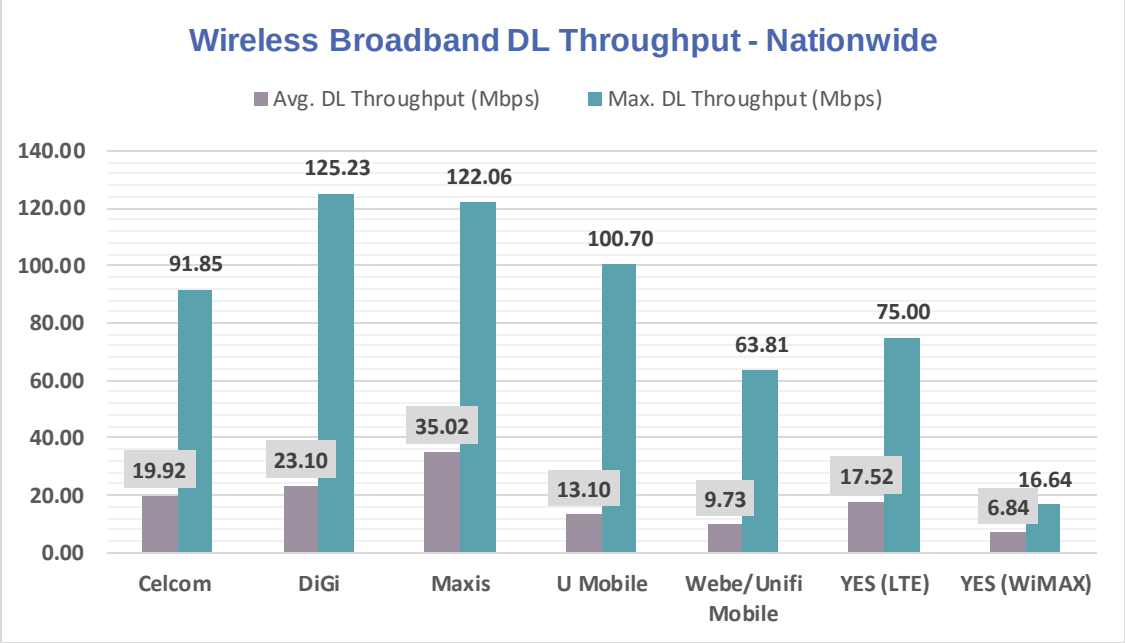
**Note: Aside from measuring wireless mobile broadband, MCMC also conducted measurement on WiMAX fixed wireless broadband provided by YES (WiMAX).*

Based on the average speed shown above, Maxis recorded the highest average download speed nationwide with 35.02Mbps. Figure 2 explains in detail in graph form for the average and maximum download throughput achieved for each service provider nationwide.

Note:

1) The current MS was prepared in 2015 that addresses a 2 phase regulatory implementation. Throughput was set at 650kbps for the period 2016 to 2017. The minimum throughput metrics was then set at 1Mbps for 2018 onwards. The MS was enforced in 2016. These settings were made due to:
    a. Prior 2017 (re-farming period) most networks were on 3G, hence throughput set at 650kbps at 65% of the time
    b. In 2017, frequency re-farming activities were carried out by operators to vastly deploy LTE coverage
    c. 2018, the threshold was raised to 1Mbps 80% of the time and the areas tested included complaint areas throughout Malaysia as well as remote towns anticipating much wider LTE coverage. With minimum 1Mbps, video quality streaming in 480p are able to be played smoothly without buffering.
2) MCMC will constantly review the minimum threshold and already have plans to raise the bar for 2020 and beyond to much higher speeds with wider LTE-CA deployments. The minimum threshold to be set will ensure smooth HD (720p) video quality delivery.

Figure 2: Mobile broadband average and maximum download throughput achieved – Nationwide:

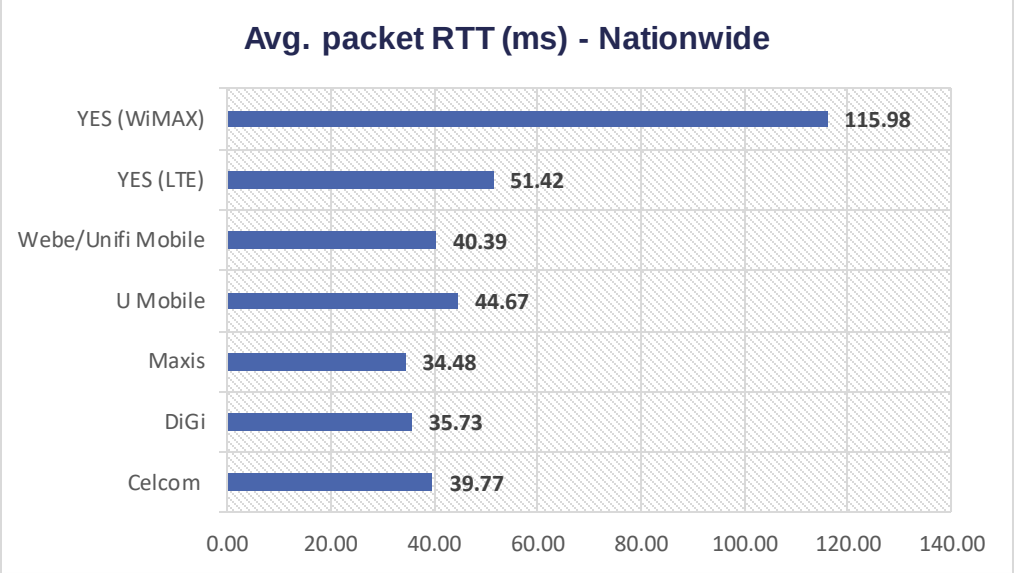


Note: Peak speed locations

Service Provider	MaxDL throughput (Mbps)	Location
Celcom	91.85	Pasar Awam Port Klang, Selangor
Digi	125.23	Kempadang Utama, Kuantan, Pahang
Maxis	122.06	Desa Pinggiran Bayu, Negeri Sembilan
U Mobile	100.7	Jalan Perindustrian Paloh, Perak
Webe/Unifi Mobile	63.81	Taman Mutiara Melaka,Batu Berendam, Melaka
YES (LTE)	75	Muzium Sultan Alam Shah, Shah Alam, Selangor
YES (WiMAX)	16.64	Presint 8, Putrajaya

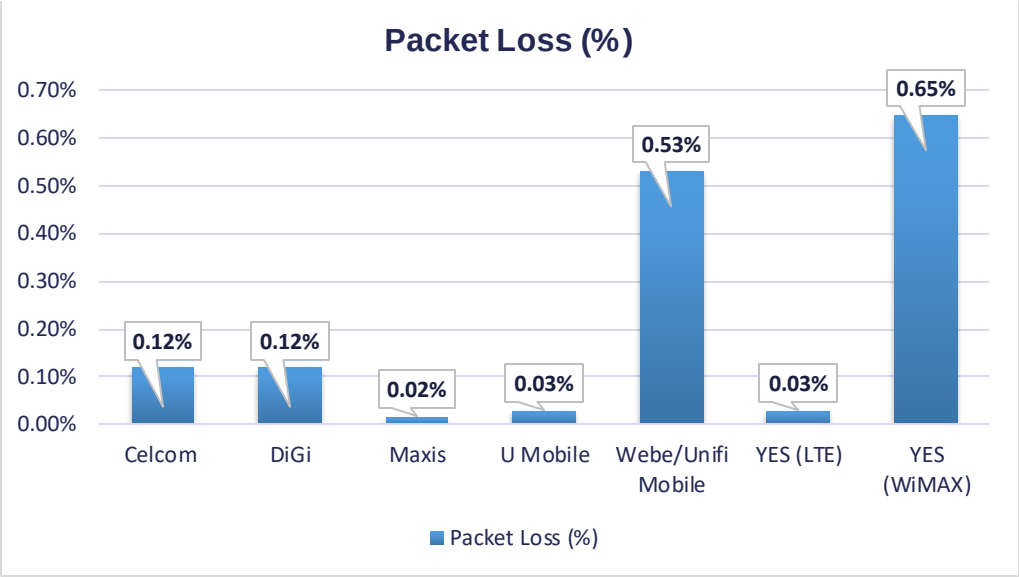
Meanwhile, the performance measurement on network latency is to assess other internet activities that require minimal delay such as data calls, video games, Skype or FaceTime. Based on the measurement results of round-trip time (RTT) between the tested locations nationwide and MyIX, Maxis had the quickest response time with an average of 34.48 ms. The nationwide average network latency is shown in Figure 3 below:

Figure 3: Mobile broadband average network latency (RTT) – Nationwide:



Another aspect of the network performance was the ability of the network to successfully transfer packets from the user end towards the destination host. In a shared network environment, packet loss may occur due to network congestion during heavy utilization. When different traffic vying for the limited shared resources, packets inevitably will be dropped or delivered out of order. Packet loss may also occur due to network design routing and the effects of radio resource environment during the transfer of the packets. Figure 4 describes the outcome of the test on packet loss nationwide.

Figure 4: Mobile broadband packet loss percentage – Nationwide:



Summary for Wireless Broadband – Nationwide

Figure 5: Summary result for wireless broadband – Nationwide:

Criteria	Best overall average download speed nationwide	Best peak download speed achieved	Best network latency nationwide	Lowest packet loss nationwide
Winner	maxis	digi	maxis	maxis
	35.02 Mbps	125.23 Mbps	34.48 ms	0.02%

- Maxis maintained their performance from previous years, excelling in both network throughput and network latency for the year 2018.
- The average download speed of fixed wireless broadband using WiMAX technology, provided by YES (WiMAX) lags behind the speed offered by other mobile broadband providers that utilizes LTE technology.

State by State Results

This section describes the aggregated measurement results of download throughput, network latency and packet loss in each state.

Central Region

- Measurements were conducted in Q1 2018 (Jan - Mar). States covered are Selangor, WP Kuala Lumpur, Putrajaya and Negeri Sembilan.

Figure 6: Average DL throughput by State in Central Region

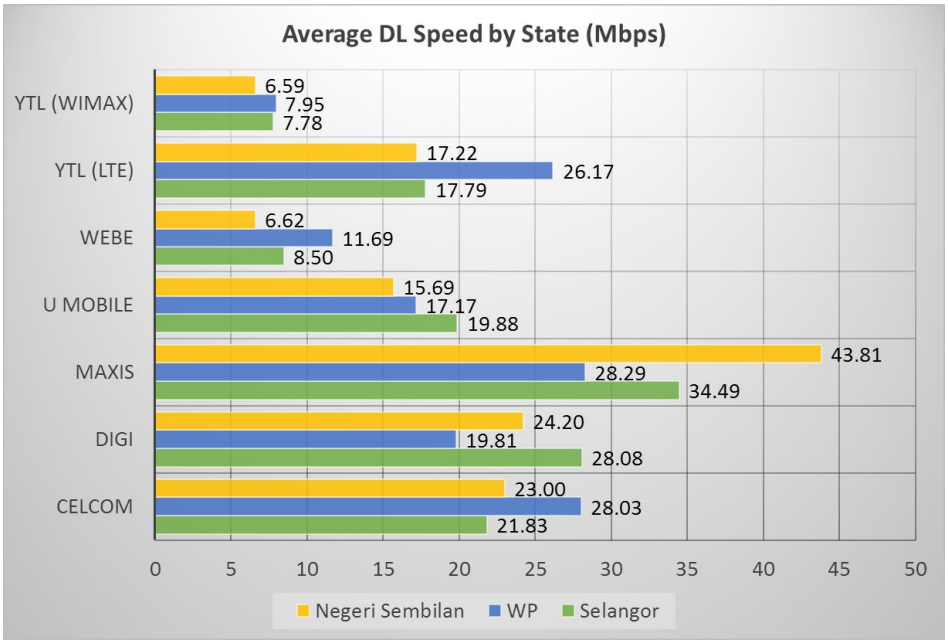


Figure 7: Average Ping RTT by State in Central Region

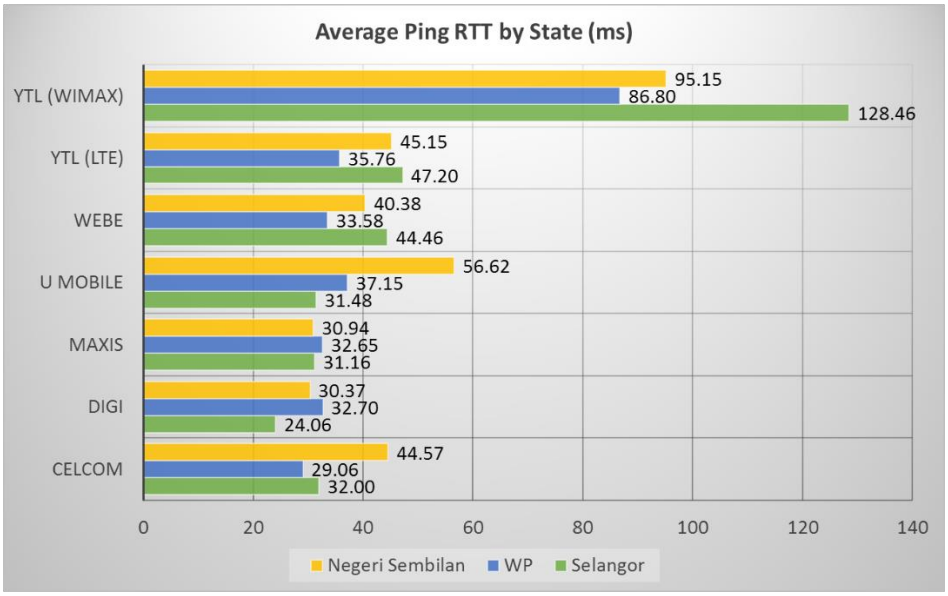
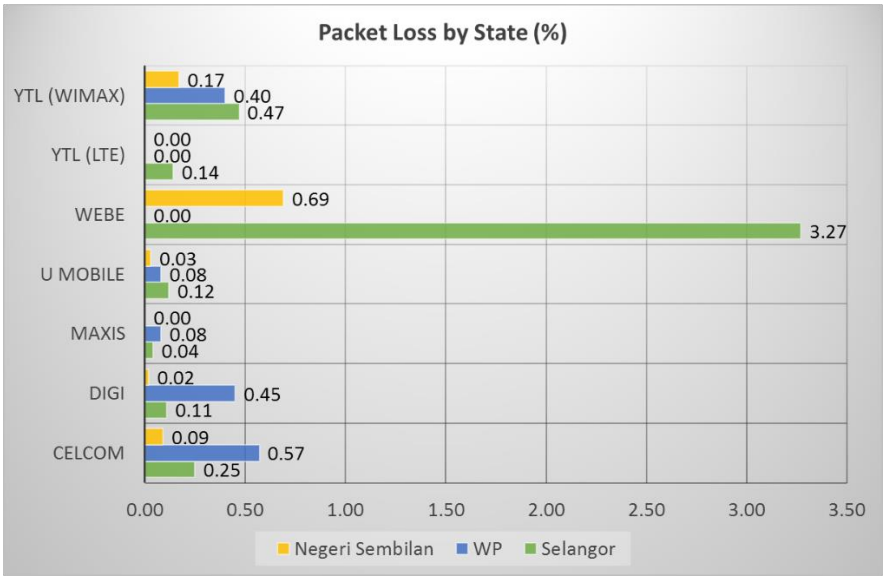


Figure 8: Packet Loss by State in Central Region



Summary for Wireless Broadband results – Central Region

	Selangor	WP Kuala Lumpur & Putrajaya	Negeri Sembilan
Best average DL throughput	**Maxis**	**Maxis**	**Maxis**
Best average Ping RTT	**Digi**	**Celcom**	**Digi**

Northern Region

- Measurements were conducted in Q2 2018 (Apr – Jun). States covered are Penang, Perak and Kedah-Perlis.

Figure 9: Average DL throughput by State in Northern Region

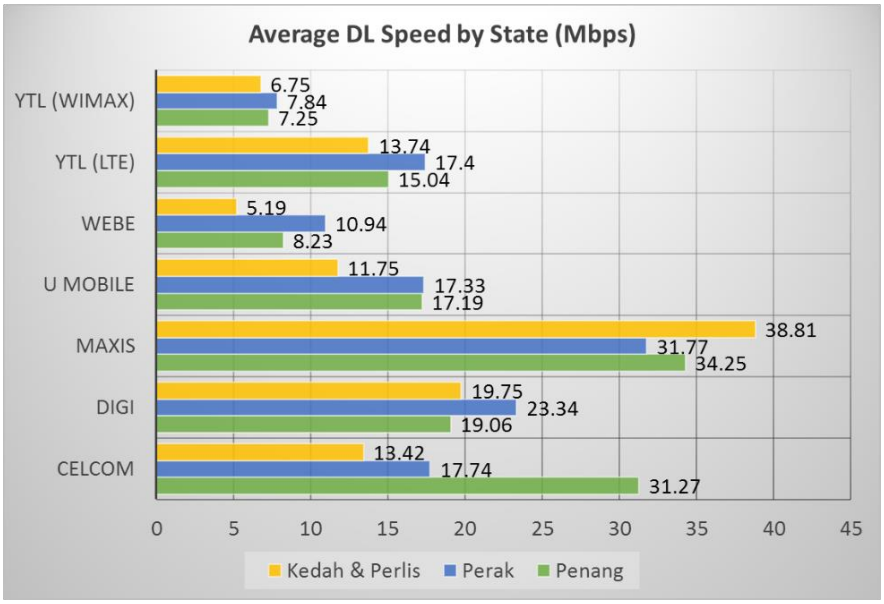


Figure 10: Average Ping RTT by State in Northern Region

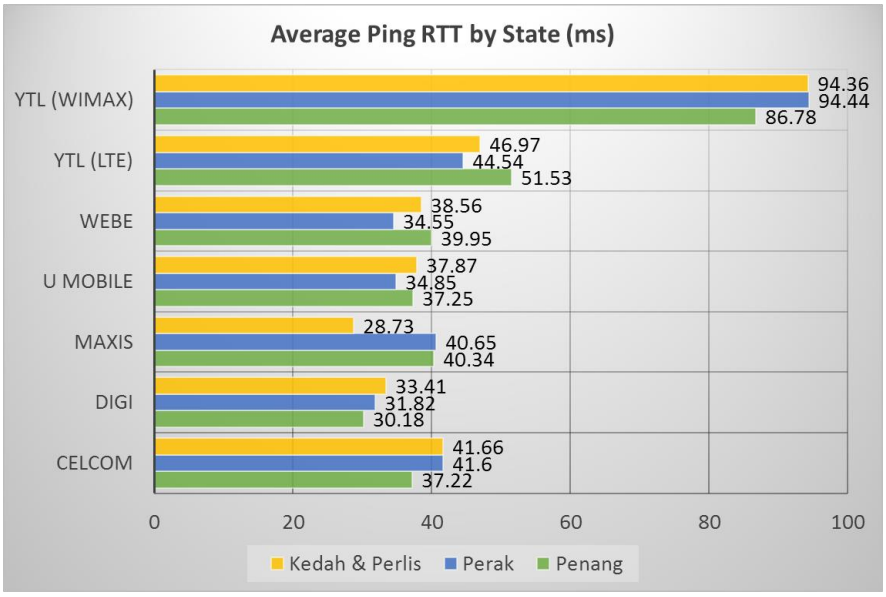
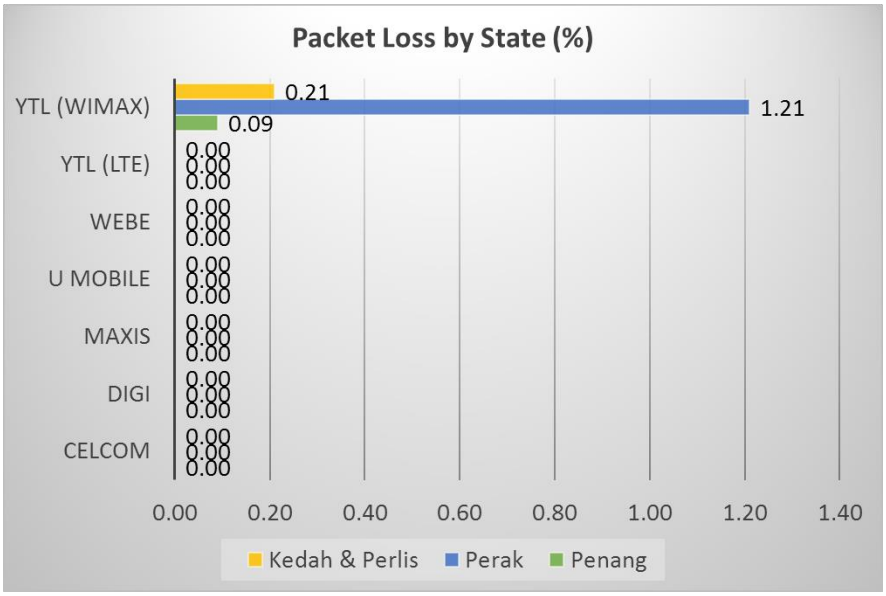


Figure 11: Packet Loss by State in Northern Region



Summary for Wireless Broadband results – Northern Region

	Kedah & Perlis	Perak	Penang
Best average DL throughput	**Maxis**	**Maxis**	**Maxis**
Best average Ping RTT	**Maxis**	**Digi**	**Digi**

Eastern Region

- Measurements were conducted in Q3 2018 (Jul – Sep). States covered are Pahang, Terengganu and Kelantan.

Figure 12: Average DL throughput by State in Eastern Region

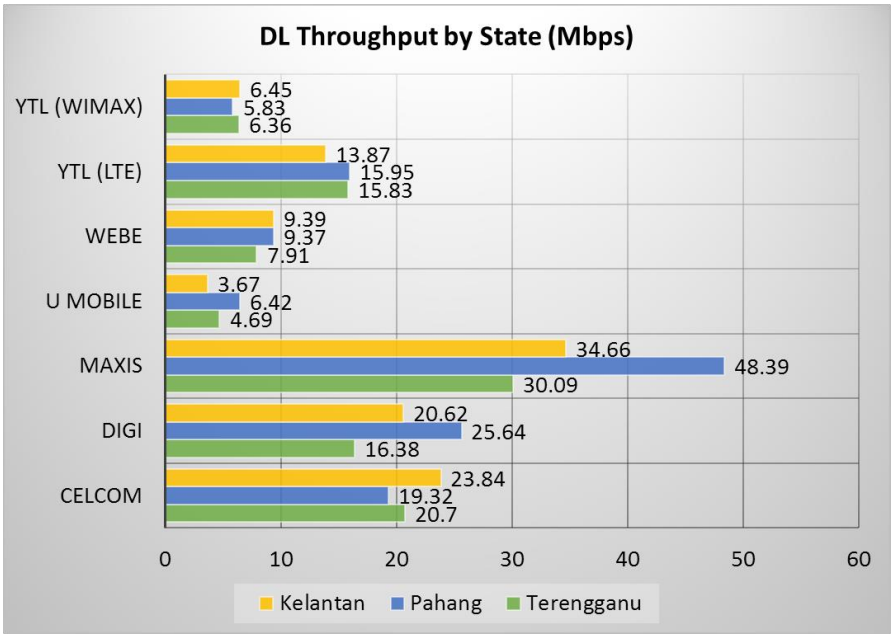


Figure 13: Average Ping RTT by State in Eastern Region

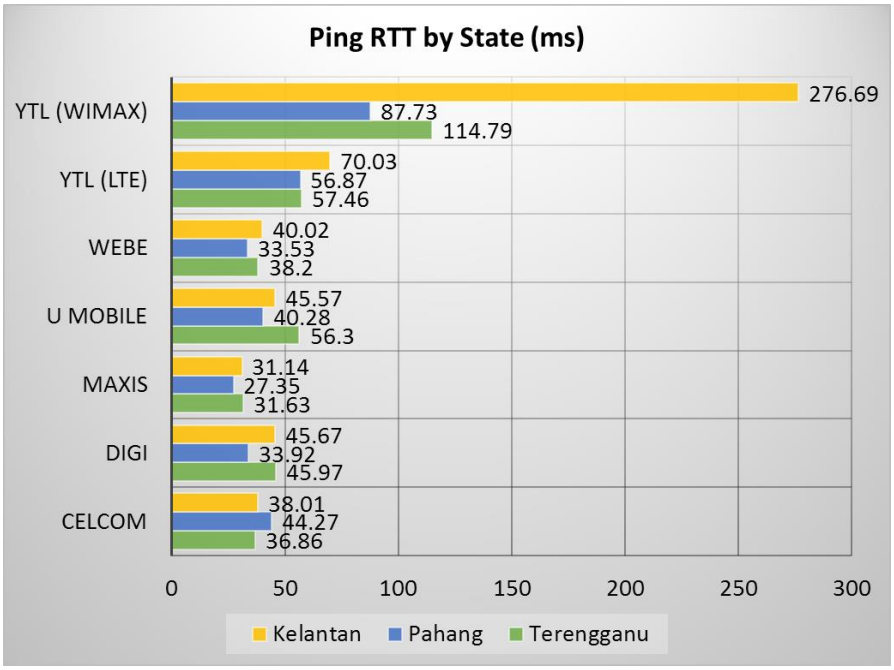
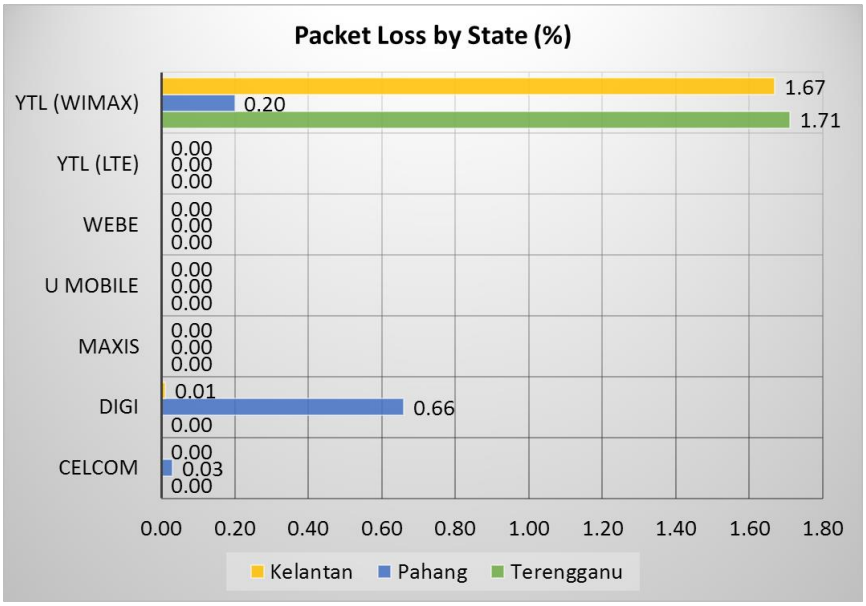


Figure 14: Packet Loss by State in Eastern Region



Summary for Wireless Broadband results – Eastern Region

	Kelantan	Pahang	Terengganu
Best average DL throughput	**Maxis**	**Maxis**	**Maxis**
Best average Ping RTT	**Maxis**	**Maxis**	**Maxis**

Southern Region

- Measurements were conducted in Q4 2018 (Oct - Nov). States covered are Melaka and Johor.

Figure 15: Average DL throughput by State in Southern Region

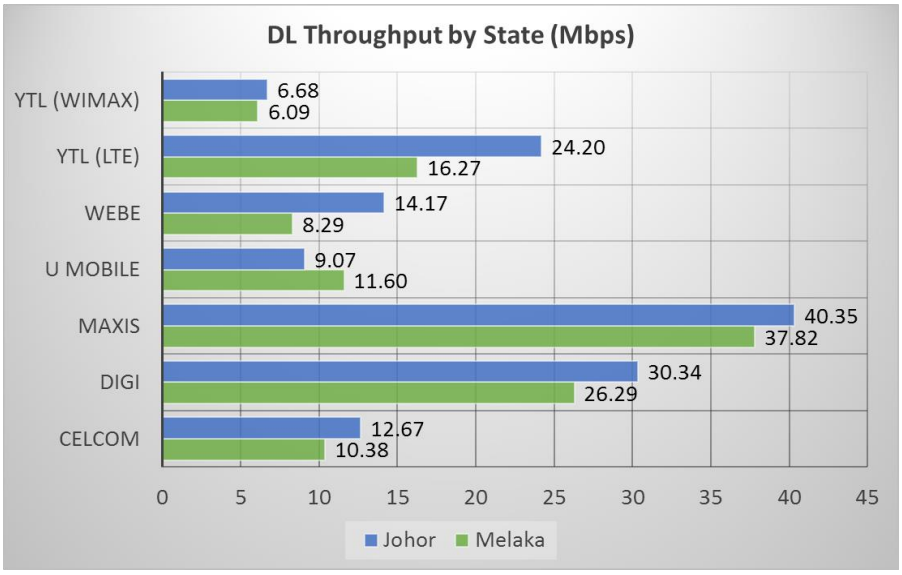


Figure 16: Average Ping RTT by State in Southern Region

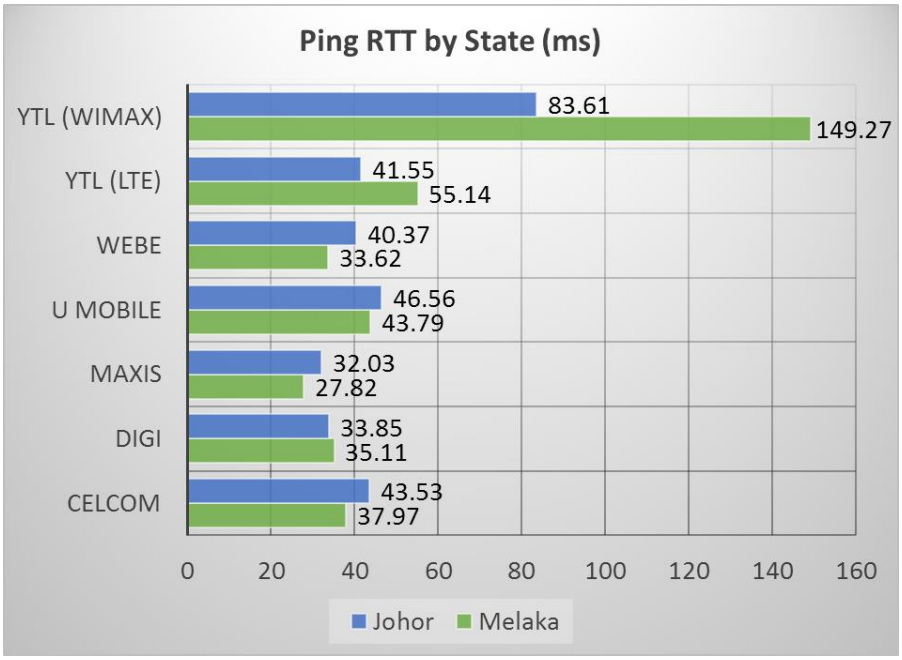
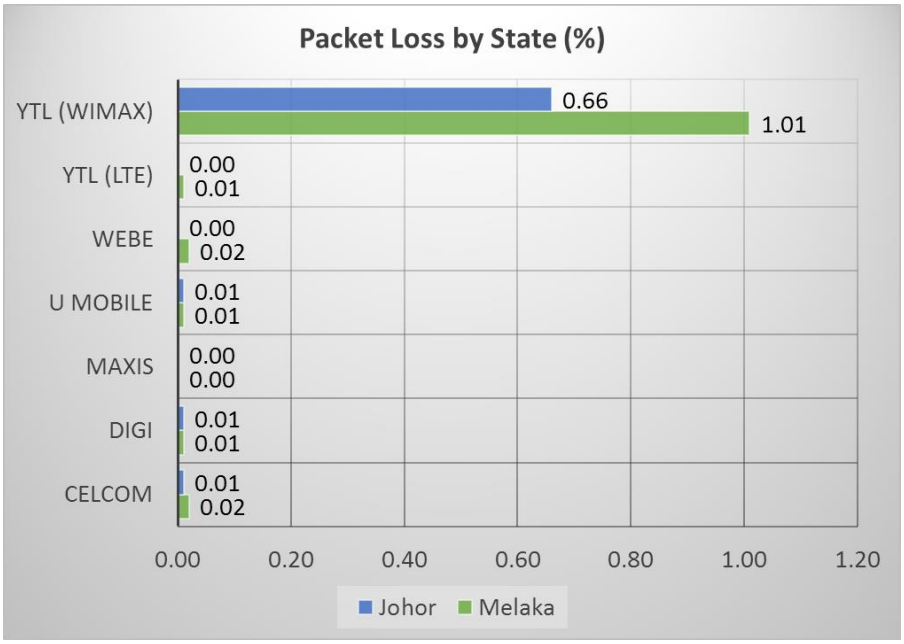


Figure 17: Packet Loss by State in Southern Region



Summary for Wireless Broadband results – Southern Region

	Melaka	Johor
Best average DL throughput	**Maxis**	**Maxis**
Best average Ping RTT	**Maxis**	**Maxis**

Sabah and Sarawak Region

- Measurements were conducted in September for Sarawak and in November for Sabah. No WiMAX service provided by YTL in Sarawak.

Figure 18: Average DL throughput in Sabah and Sarawak

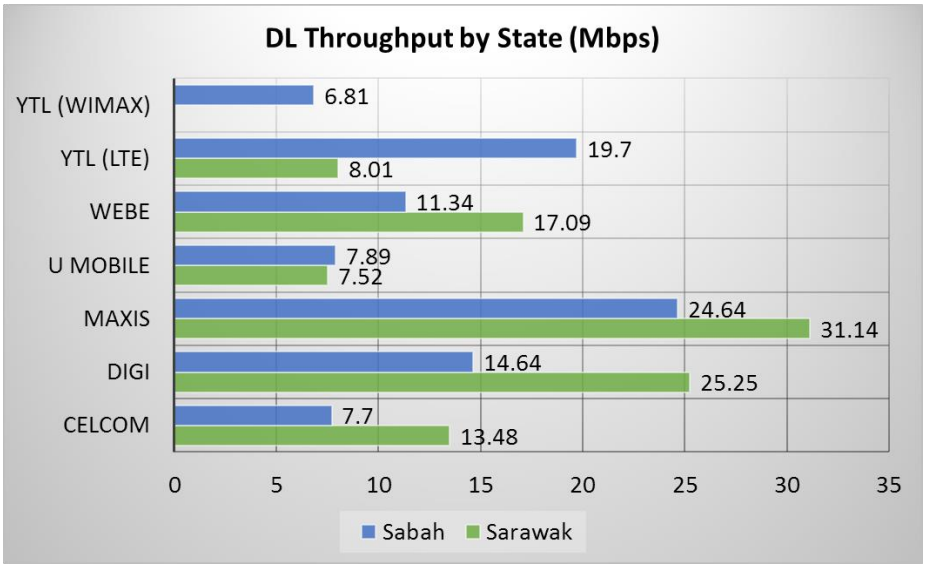


Figure 19: Average Ping RTT in Sabah and Sarawak

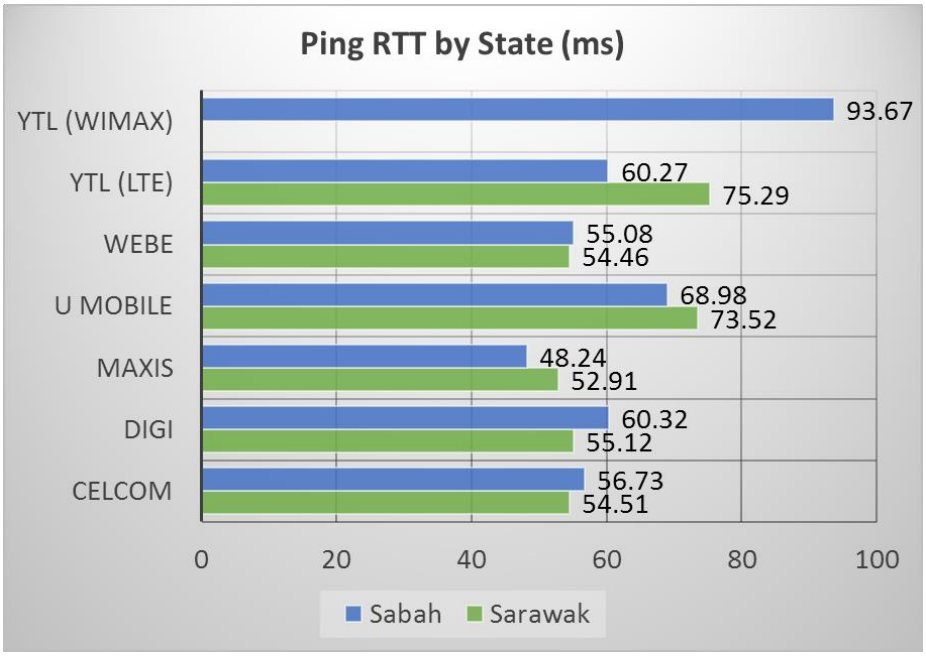
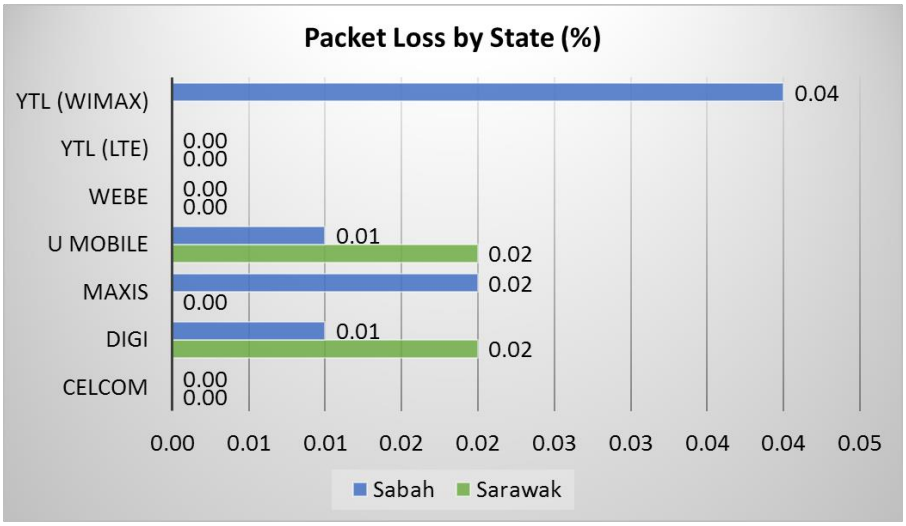


Figure 20: Packet Loss in Sabah and Sarawak



Summary for Wireless Broadband results – Sabah and Sarawak

	Sabah	Sarawak
Best average DL throughput	**Maxis**	**Maxis**
Best average Ping RTT	**Maxis**	**Maxis**

Wired Broadband Access

Nationwide overall performance

Results for wired broadband performance are illustrated by figures shown below. Wired broadband measurements are segregated between two different last mile technology; fibre connections and Digital Subscriber Line (DSL) connections. The requirements stated in MSQoS for Wired Broadband include throughput, network latency and packet loss as shown below:

- Fibre download and upload throughput must be ≥ 90% of subscribed speed for at least 90% of the time.
- DSL download and upload throughput must be ≥ 70% of subscribed speed for at least 90% of the time.
- Both DSL and Fibre ping RTT must be ≤ 85 ms for at least 95% of the time and packet loss ≤ 1%

Figure 21 shows the headline result for the key metrics aggregated level across Malaysia for wired broadband access measured from January to December 2018.

Figure 21: Key metrics scorecard for wired broadband – Nationwide:

Service Provider	Fibre				DSL			
	Percentage of Time			Packet Loss %	Percentage of Time			Packet Loss %
	UL Speed ≥ 90% subscribed speed	DL Speed ≥ 90% subscribed speed	Ping RTT ≤ 85 ms		UL Speed ≥ 70% subscribed speed	DL Speed ≥ 70% subscribed speed	Ping RTT ≤ 85 ms	
Maxis	95.63%	97.68%	98.34%	0.34%	100.00%	100.00%	99.08%	0.00%
Time	95.63%	96.20%	100.00%	0.00%	N/A			
TM	98.92%	95.12%	97.36%	0.69%	100.00%	99.98%	**88.62%**	0.47%

The response time or network latency, wired broadband connections produce better results compared to wireless broadband access as the connections are more stable without having to go through the RF environment. Figure 22 describes in a graph form the performance of the average RTT for each wired broadband SPs for the measurement conducted nationwide.

Figure 22: Wired broadband average network latency/Round-trip Time (RTT) – Nationwide:

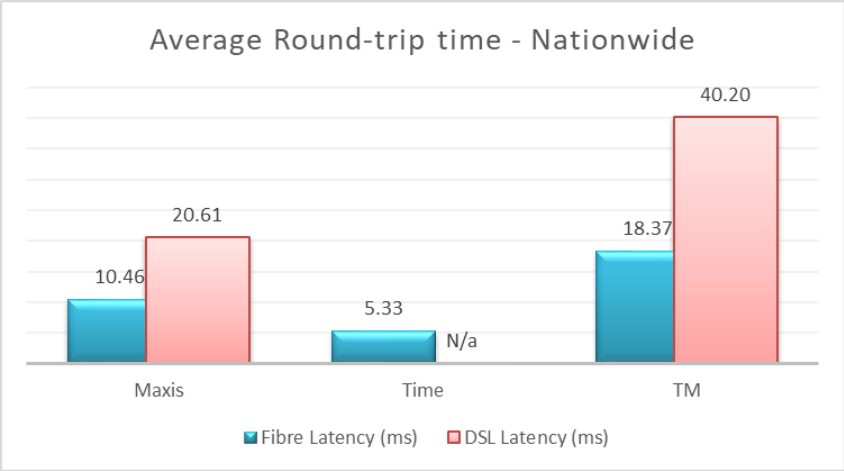
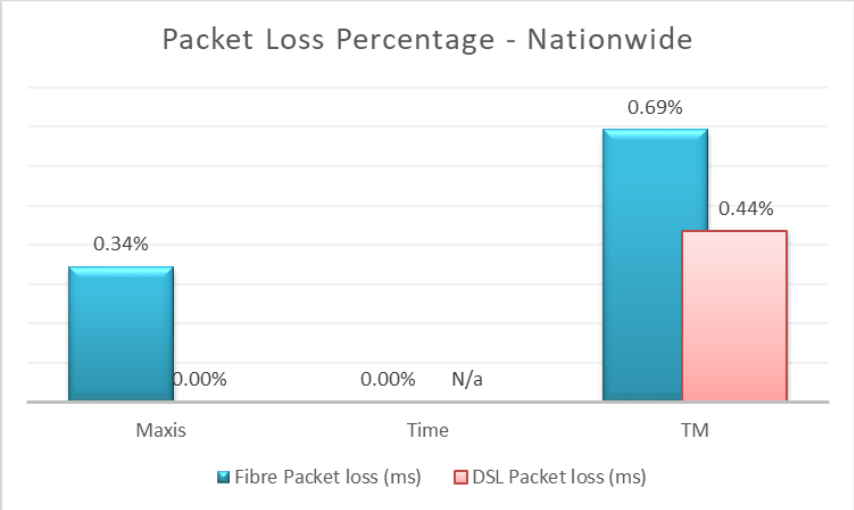


Figure 23 describes the packet loss percentage for each wired broadband SPs based on measurement conducted nationwide for both fibre and DSL technology.

Figure 23: Wired broadband packet loss percentage – Nationwide:



Regional results

Section below describes the aggregated measurement results of throughput, network latency and packet loss in each region.

Results gathered in 2018 shows that there are improvements in DSL technology for throughput parameter. Majority of DSL technology measurements were gathered from TM consumers. The improvement of the throughput results may have been linked to the initiative taken by TM to address Streamyx (DSL) poor throughput performance.

Figure 24: Throughput performance for fibre broadband by region

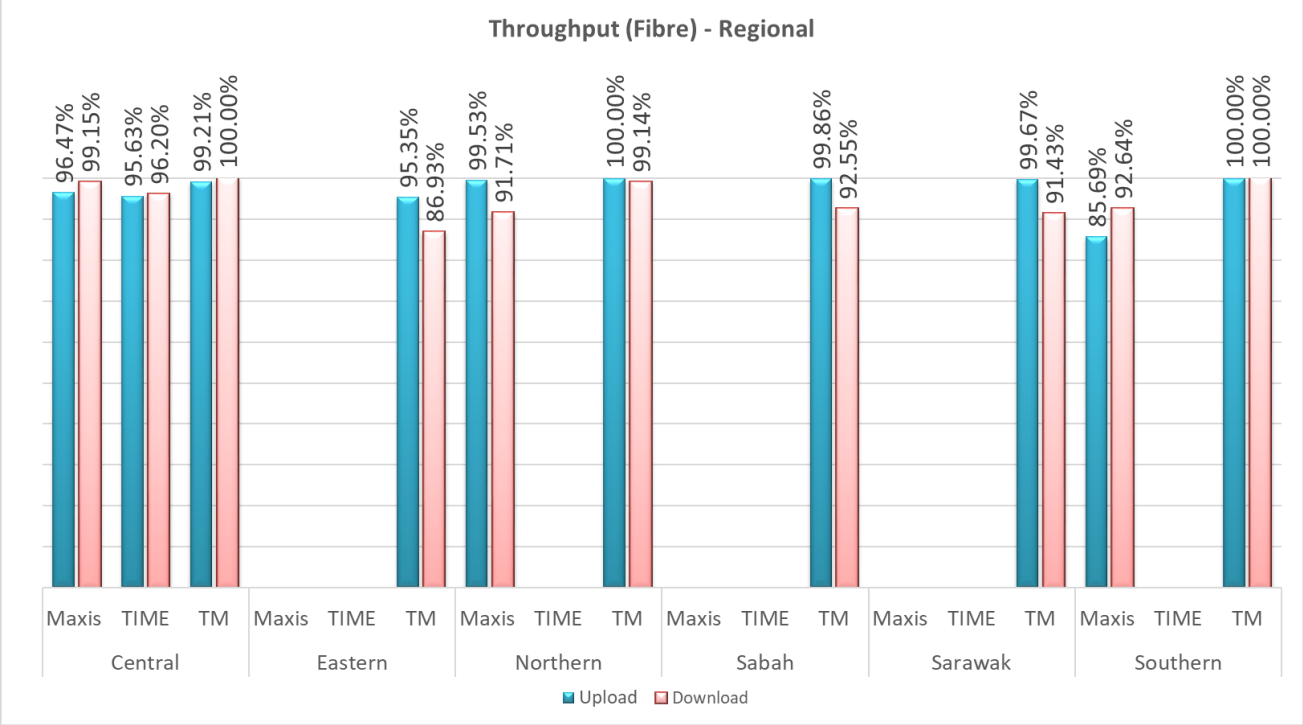


Figure 25: Throughput performance for DSL broadband by region

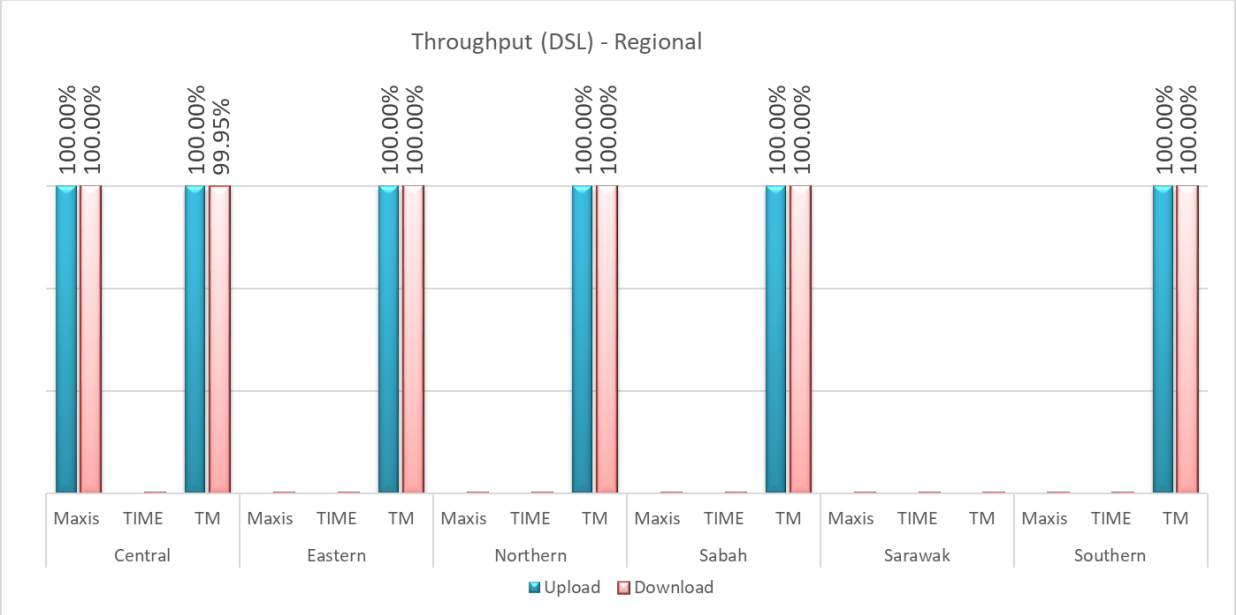


Figure 26: Ping RTT performance for fibre broadband by region

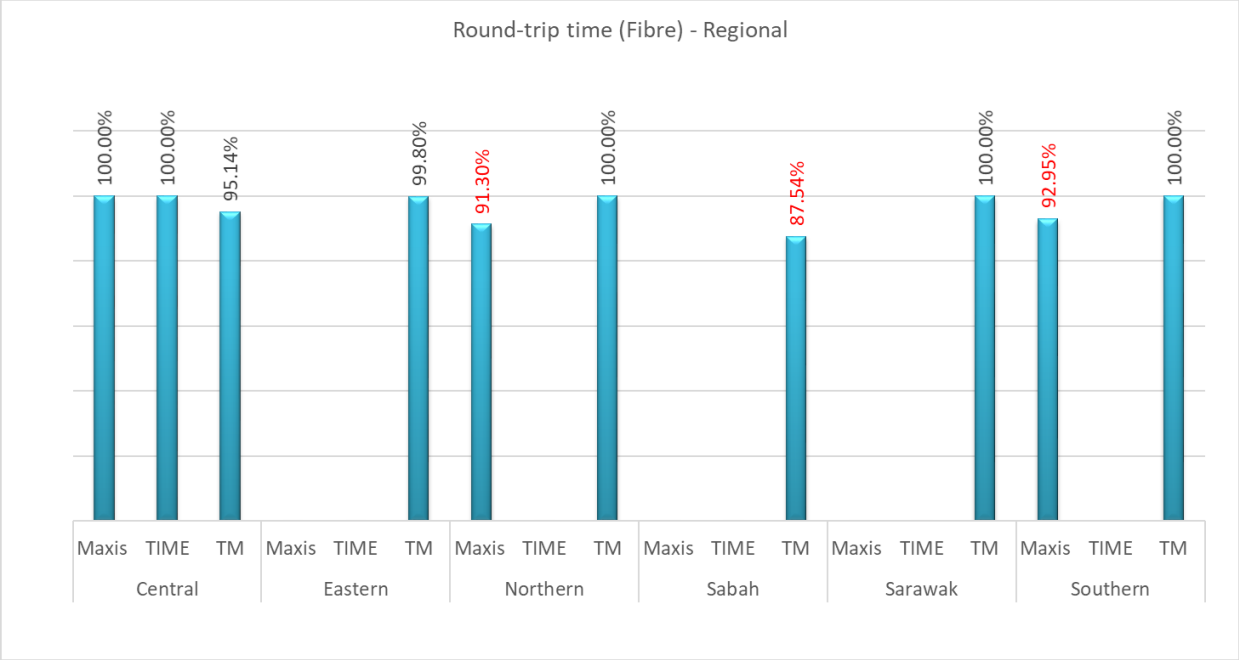


Figure 27: Ping RTT performance for DSL broadband by region

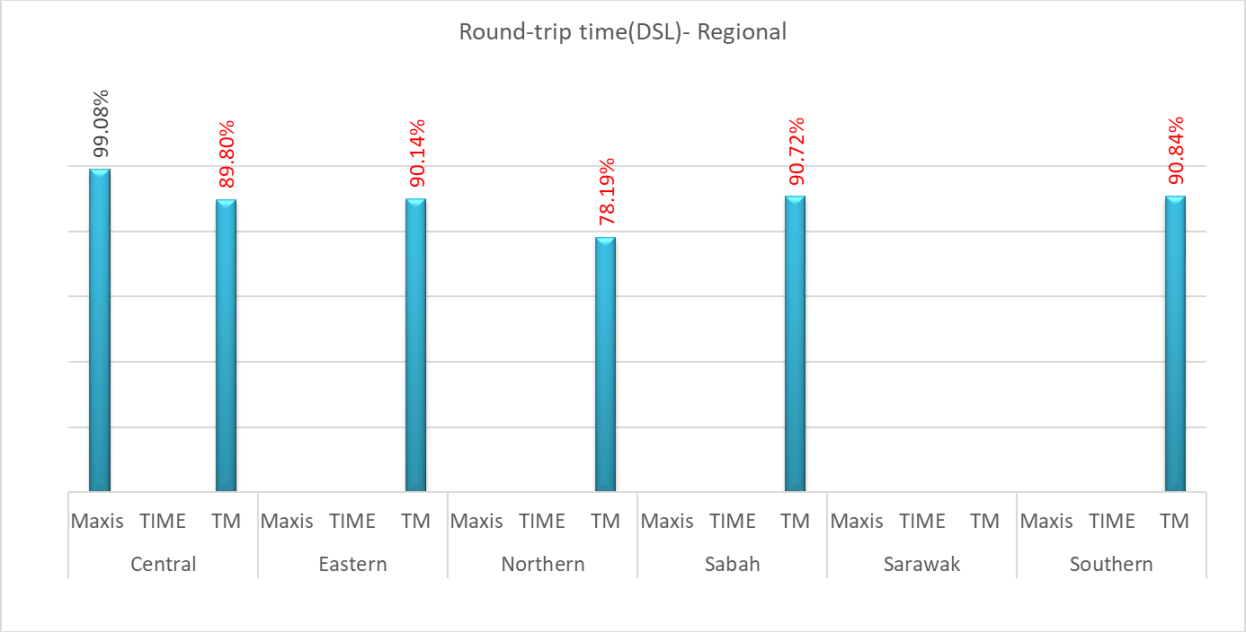


Figure 28: Packet Loss performance for fibre broadband by region

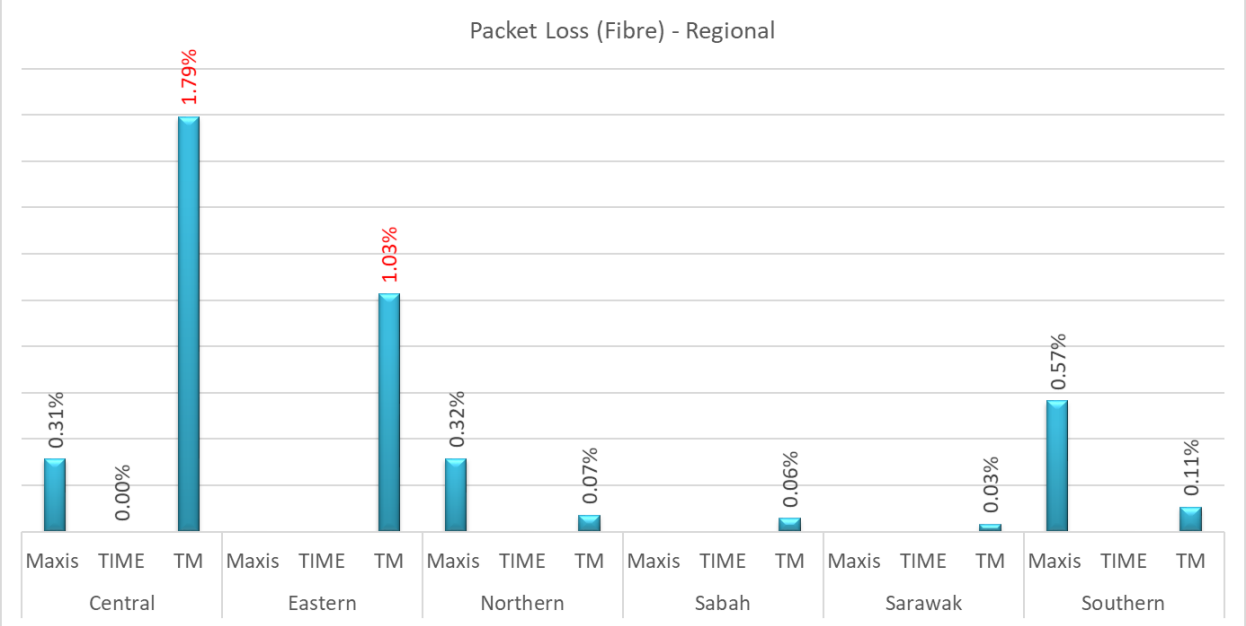
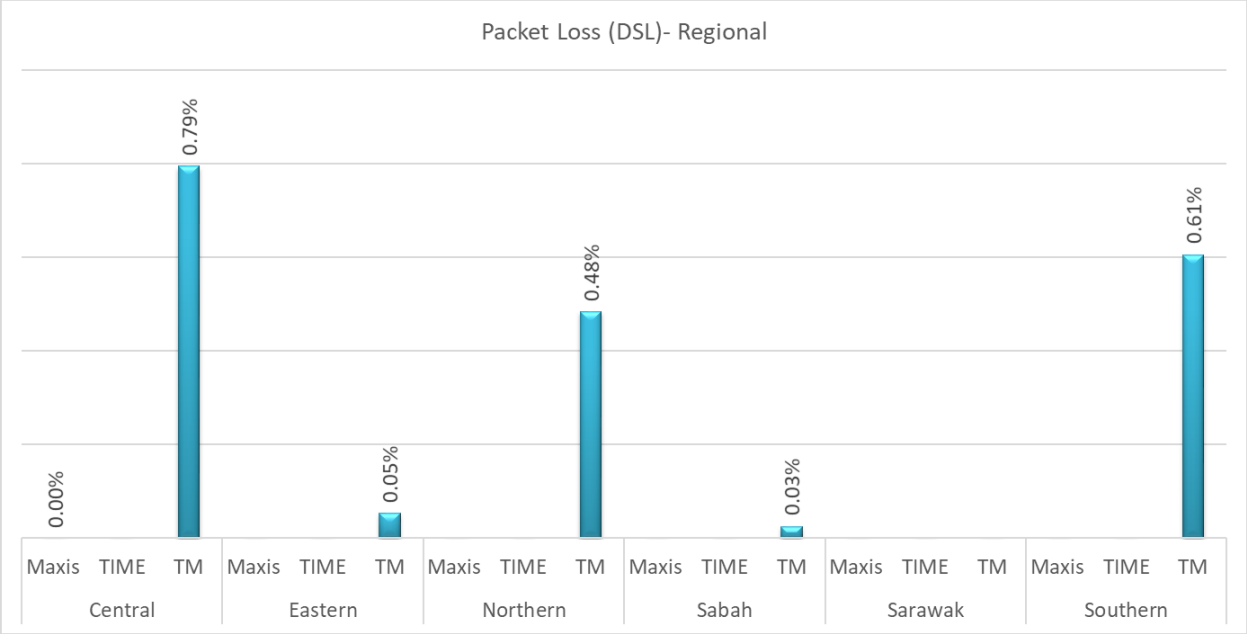


Figure 29: Packet Loss performance for DSL broadband by region



Performance by subscribed speed

This section describes the aggregated measurement results of throughput test, network latency and packet loss based on user subscription.

Figure 30: Throughput performance for fibre broadband by subscription

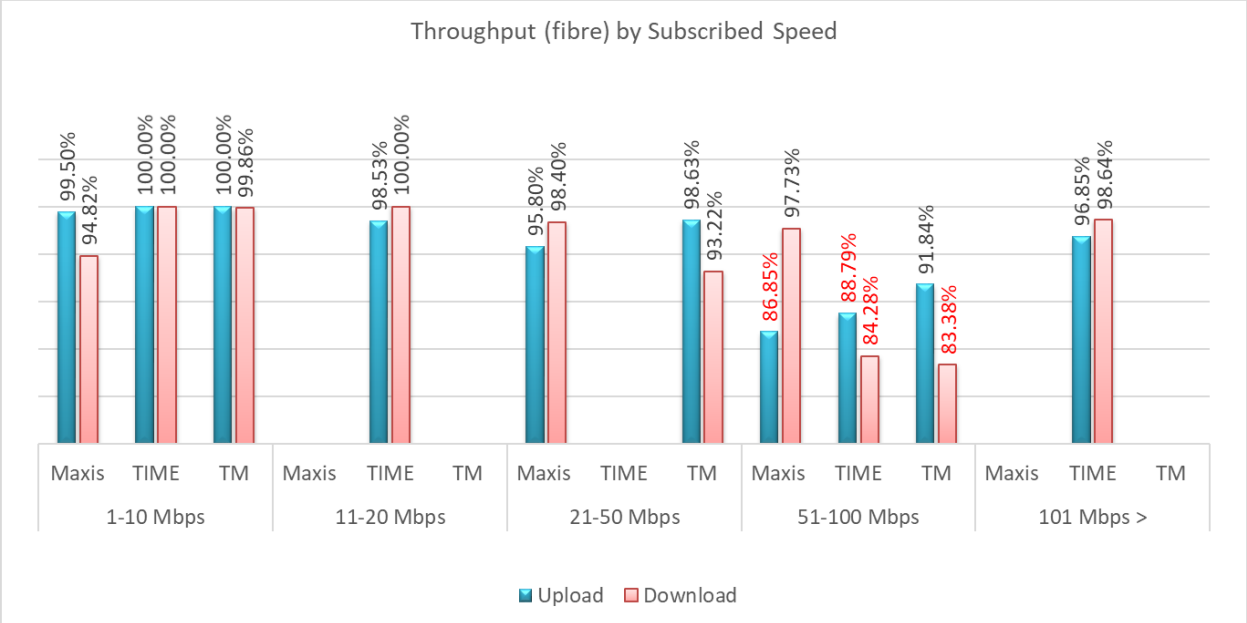


Figure 31: Throughput performance for DSL broadband by subscription

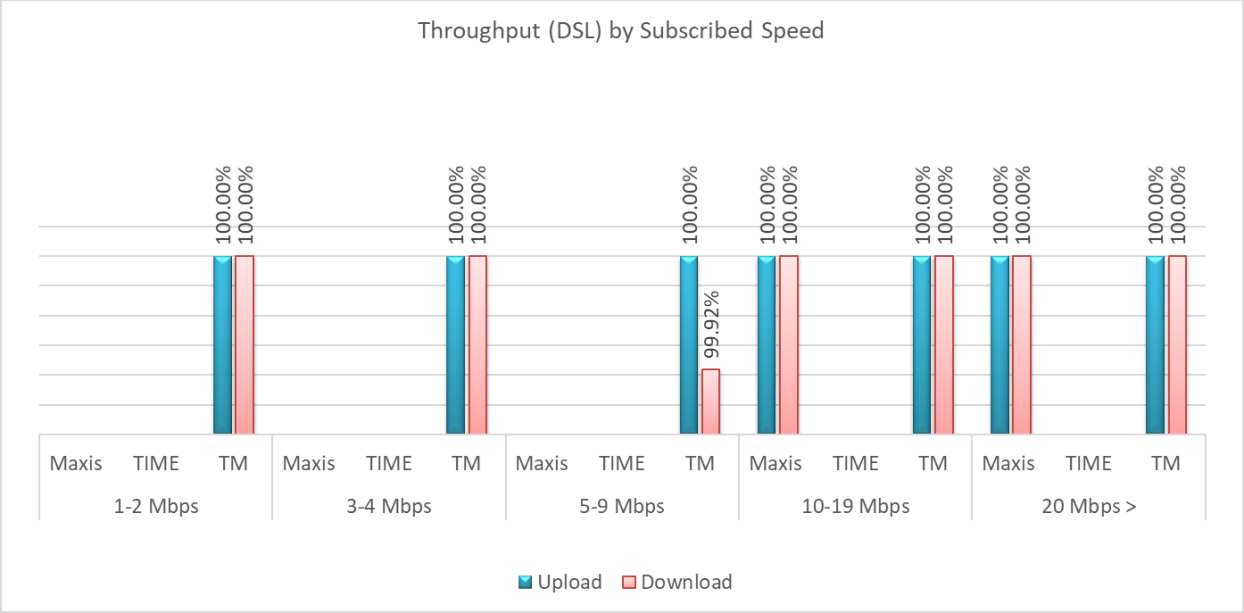


Figure 32: Ping RTT performance for Fibre broadband by subscription

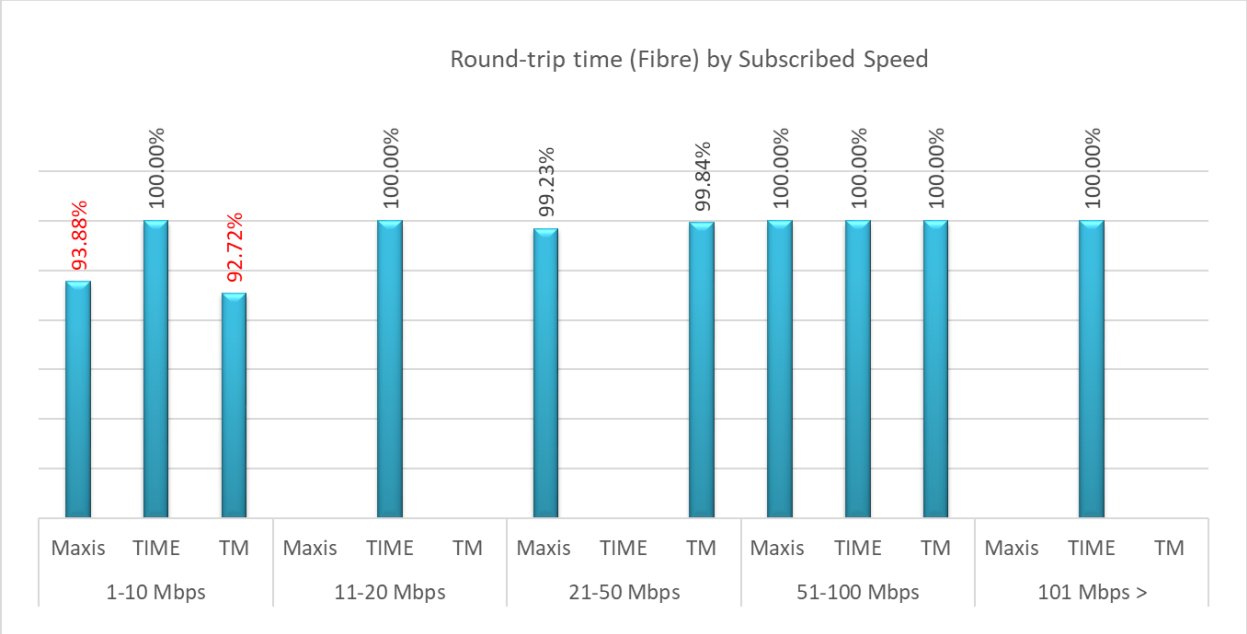


Figure 33: Ping RTT performance for DSL broadband by subscription

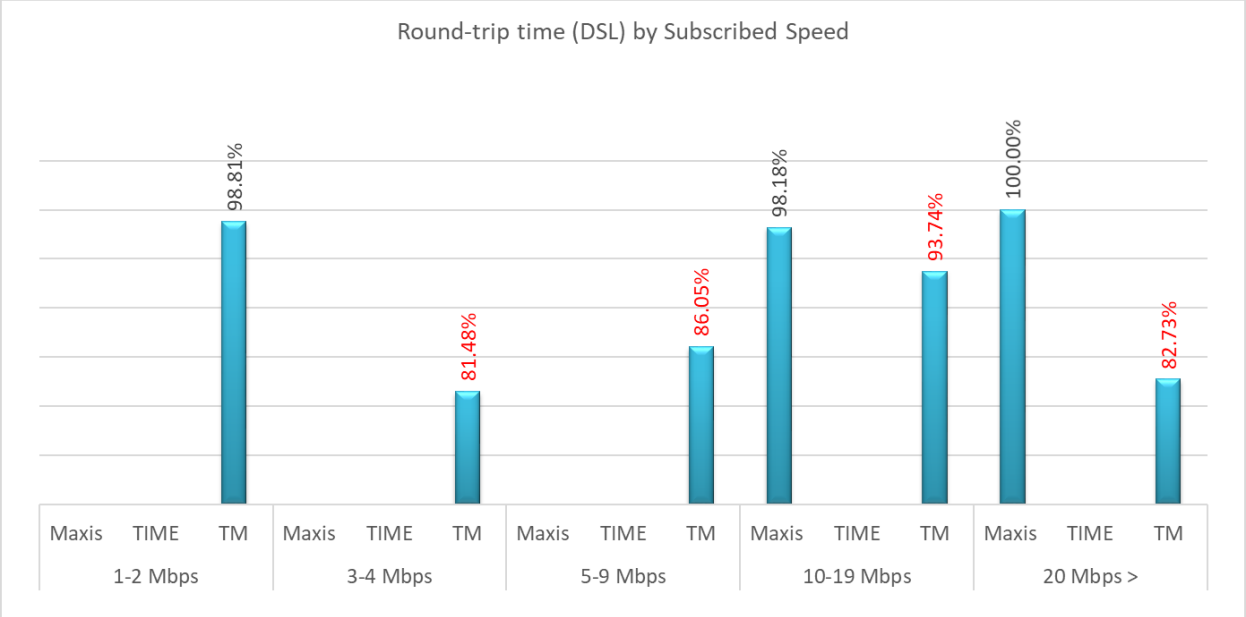


Figure 34: Packet Loss performance for Fibre broadband by subscription

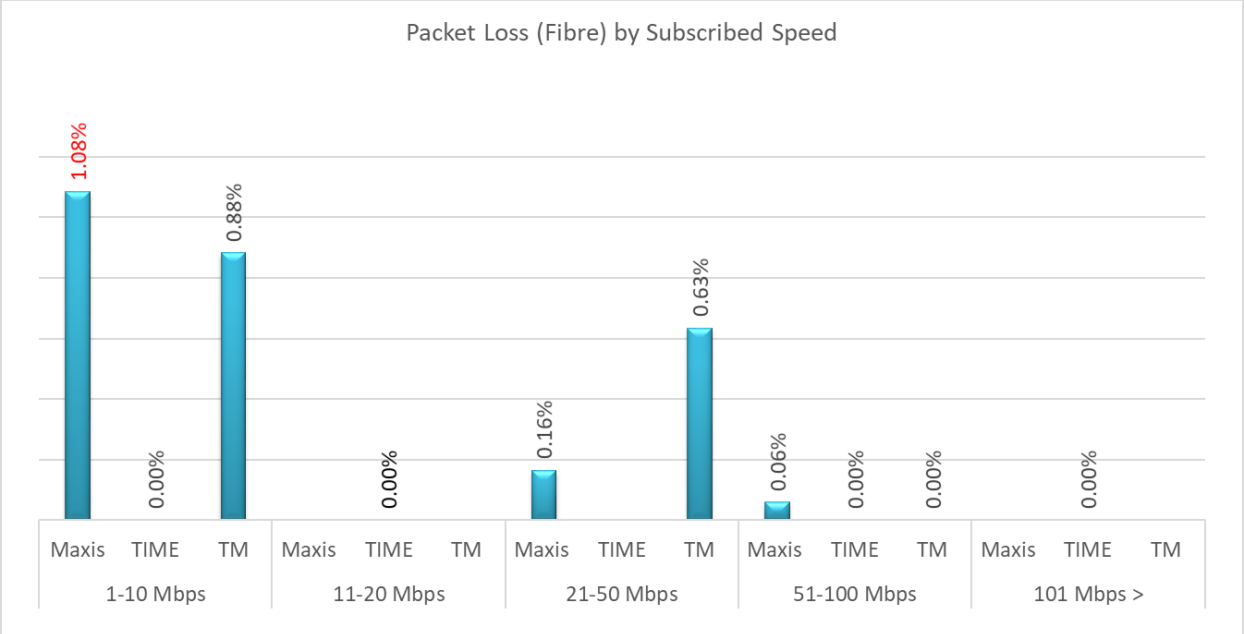
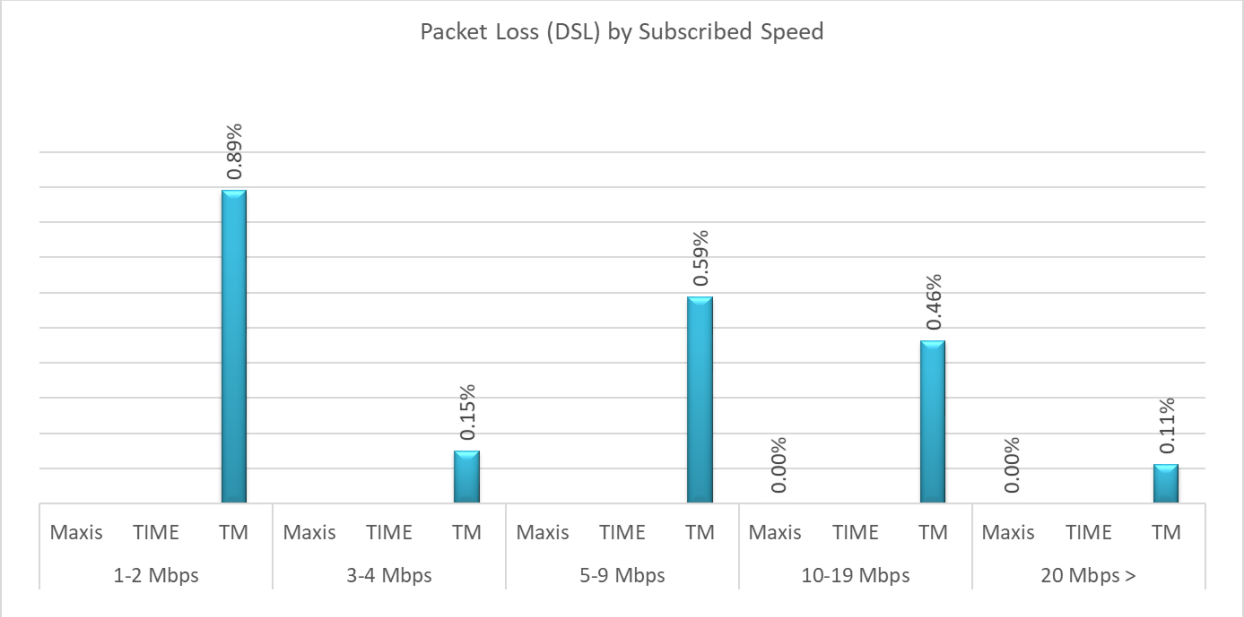


Figure 35: Packet Loss performance for DSL broadband by subscription



Results based on number of test locations

Below is the summary of total test location in compliance with the mandatory standards for both Fibre and DSL broadband.

Figure 36: Compliance of Wired broadband per test location

Service Provider	Total location tested	Total location complied		
		Throughput	Latency	Packet Loss
TM	112	105	94	97
Maxis	61	56	58	56
TIME	27	25	27	27
Overall	**200**	**186**	**179**	**180**

TM failed to comply on the latency parameters under DSL technology.

Public Cellular Services

Results for Public Cellular Services (PCS) are divided into two categories, (i) Identified route and (ii) Nationwide route. Identified route consist of a route in Putrajaya, Cyberjaya, MEX highway, KLIA to Subang Airport via ELITE and Subang Airport to Jalan Duta via NKE while Nationwide route consist of route other than the Identified route.

The headline results shown here are for the key metrics aggregated level across Malaysia for PCS measured from January to December 2018.

Identified Route Result

Figure 37 shows the overall results for Identified Route based on MSQoS for Public Cellular Services (PCS) requirements on Dropped Call Rate (DCR) and Call Setup Success Rate (CSSR).

Figure 37: Overall result of Public Cellular Service for Identified Route Assessment

	celcom	digi	maxis	mobile
Dropped Call Rate (≤ 2%)	0.47%	1.15%	0.52%	0.79%
Call Setup Success Rate (≥ 95%)	99.90%	99.64%	99.95%	99.79%

Figure 38: H1 and H2 DCR of Identified Route

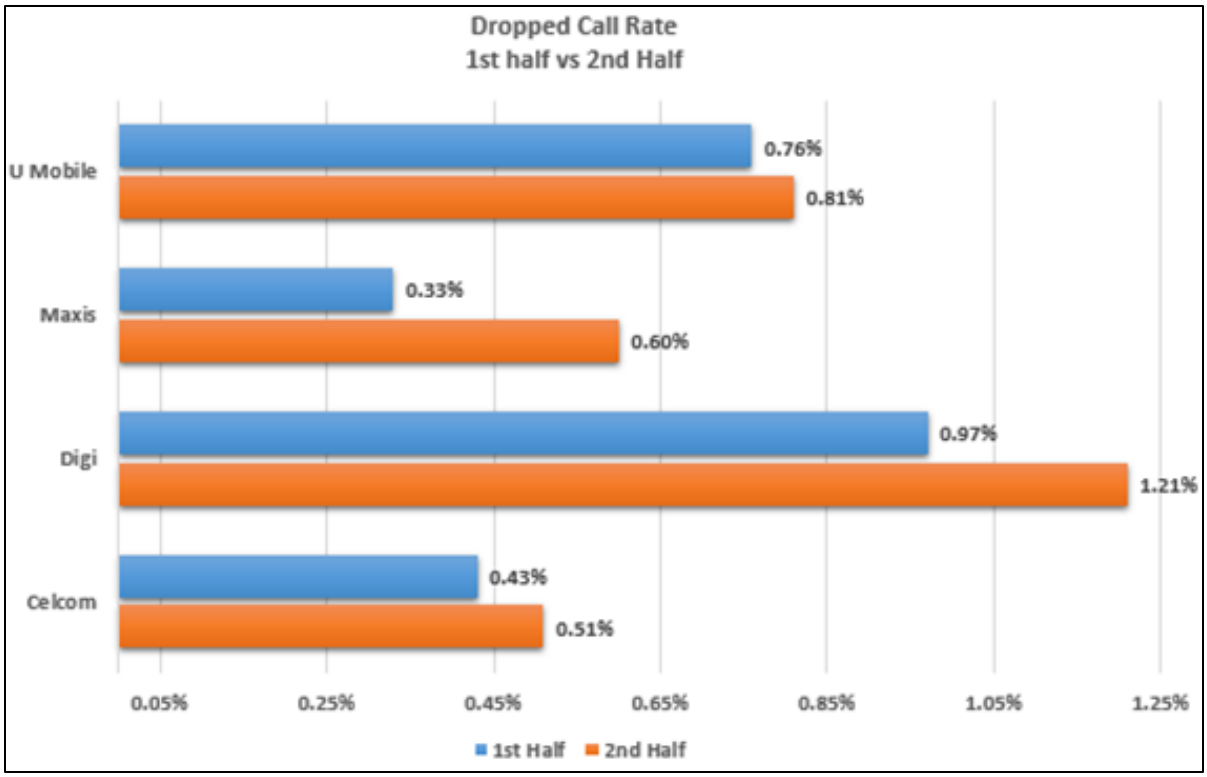
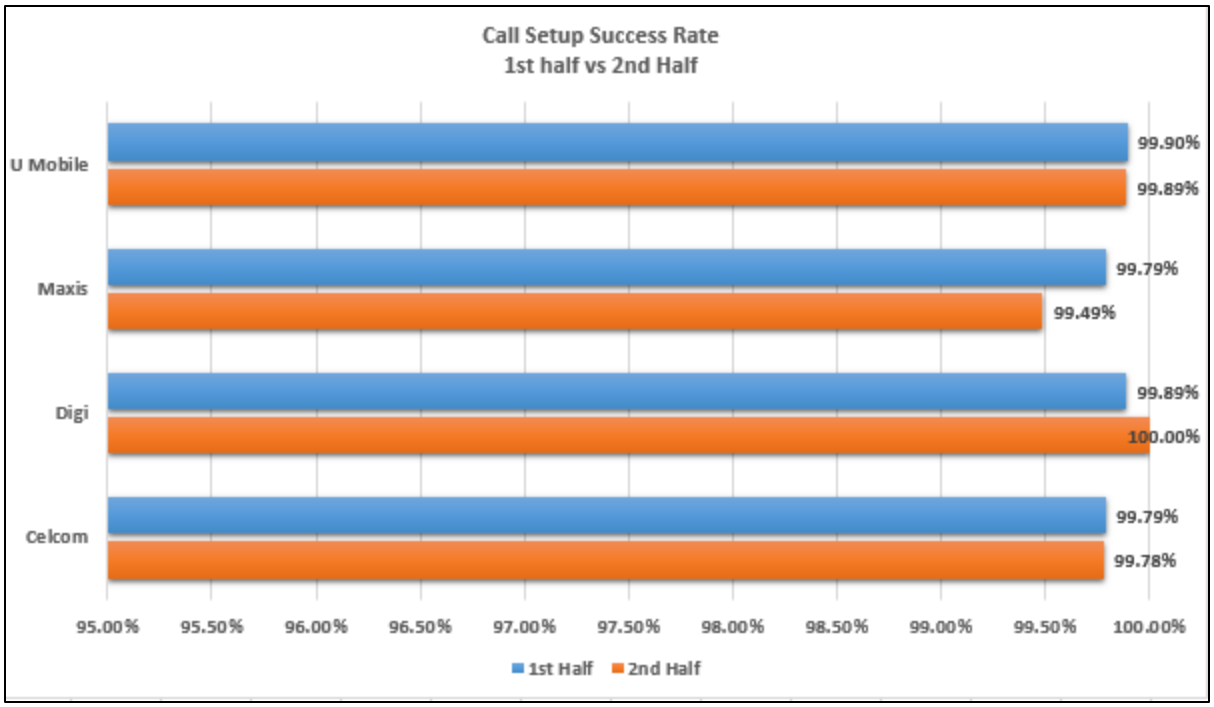


Figure 39: H1 and H2 CSSR of Identified Route



Nationwide Result

Figure 40 shows the overall results for Nationwide Route based on MSQoS for Public Cellular Services (PCS) on Dropped Call Rate (DCR) and Call Setup Success Rate (CSSR).

Figure 40: Overall result of Public Cellular Service for Nationwide Assessment

	celcom	digi	maxis	U mobile
Dropped Call Rate (≤ 3%)	1.20%	1.70%	1.76%	1.85%
Call Setup Success Rate (≥ 95%)	99.37%	99.37%	99.33%	98.59%

All service providers met the Mandatory Standards requirements on Dropped Call Rate (DCR) and Call Setup Success Rate (CSSR) Nationwide.

Figure 41: H1 and H2 of DCR Nationwide

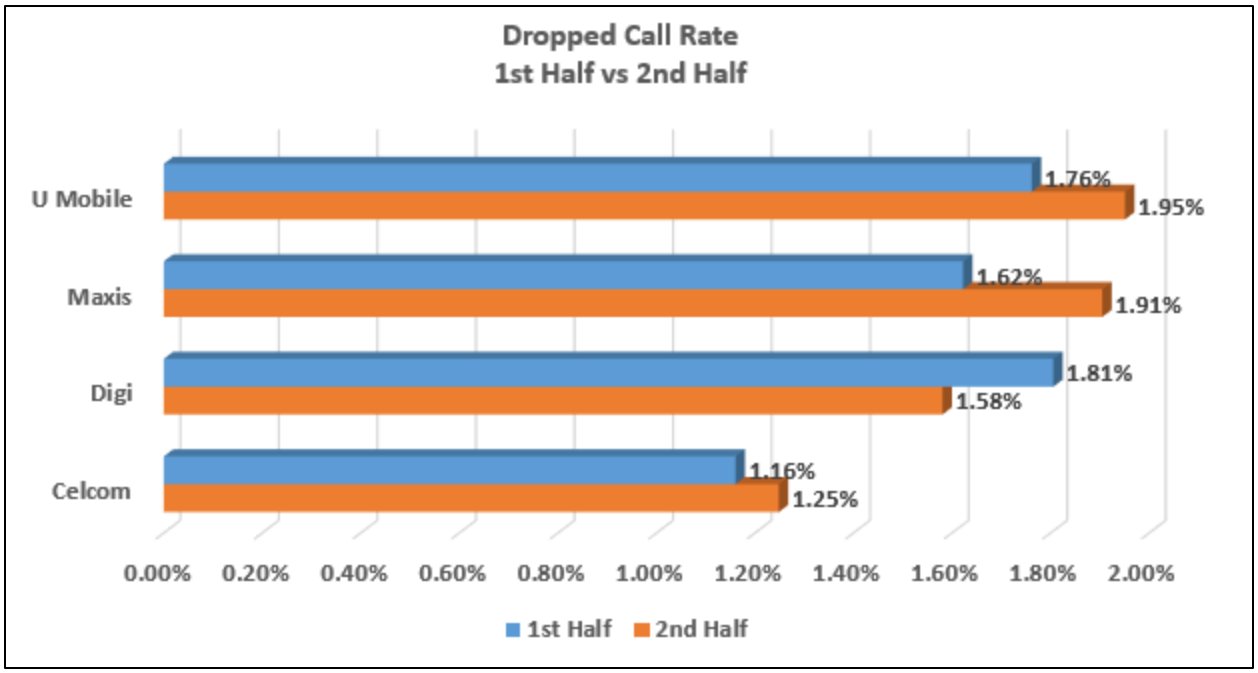
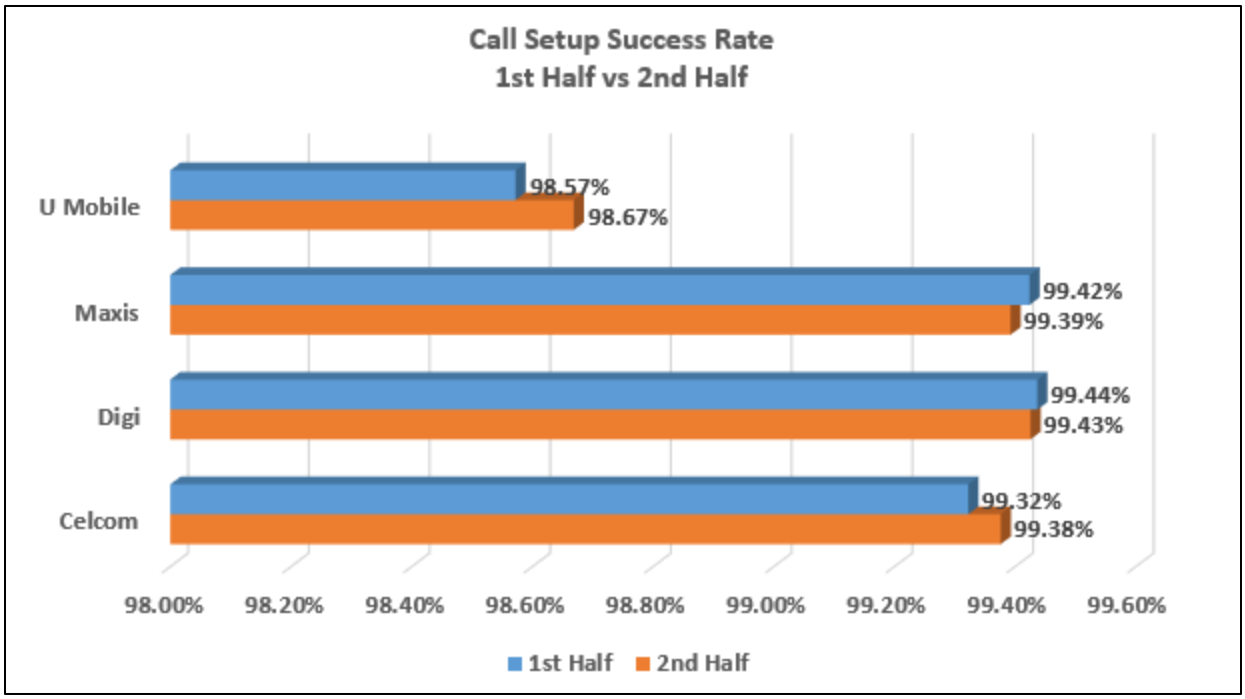


Figure 42: H1 and H2 of CSSR Nationwide



Individual States Performances

Below show Dropped Call Rate (DCR) and Call Setup Success Rate (CSSR) according to states.

Central Region

Figure 43: Overall results in Central Region

State	Service Provider	DCR	CSSR
Selangor	Celcom	0.50%	99.93%
	Digi	0.87%	99.80%
	Maxis	0.53%	99.93%
	Umobile	1.15%	99.21%
Negeri Sembilan	Celcom	1.63%	99.64%
	Digi	3.07%	98.22%
	Maxis	3.32%	99.02%
	Umobile	2.75%	98.94%
Kuala Lumpur	Celcom	1.24%	99.42%
	Digi	1.67%	99.68%
	Maxis	0.33%	99.49%
	Umobile	1.16%	100.00%

Figure 44: DCR in Central Region

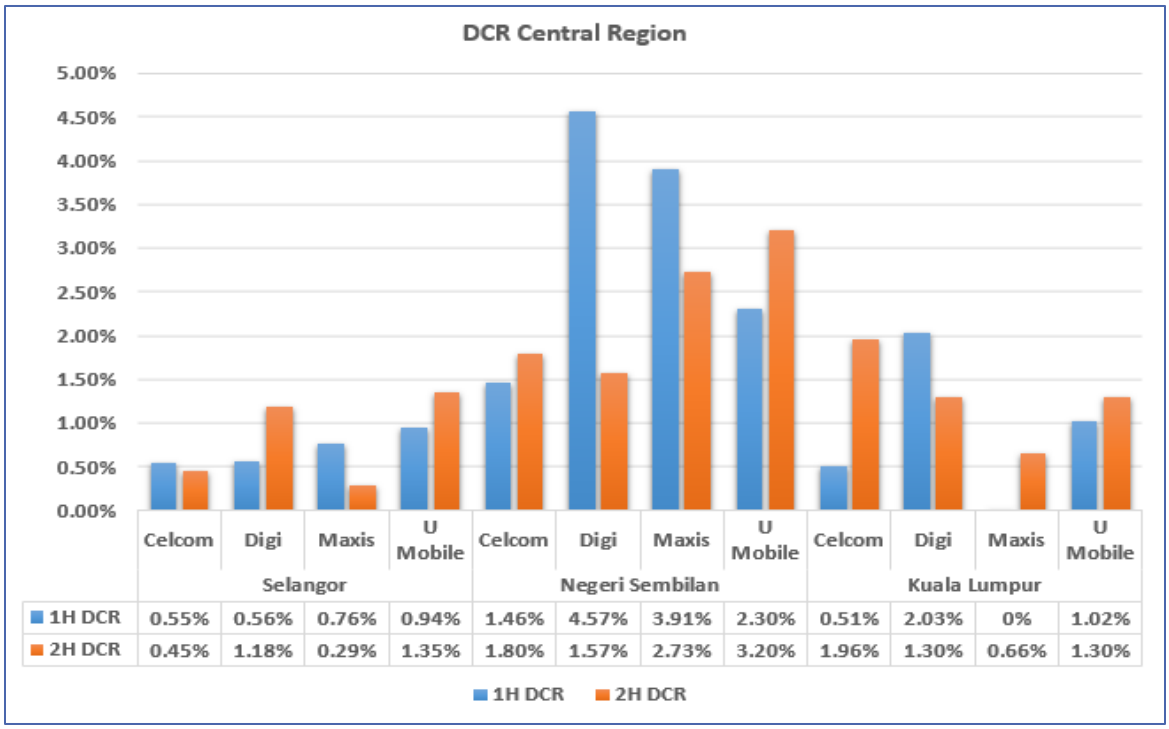
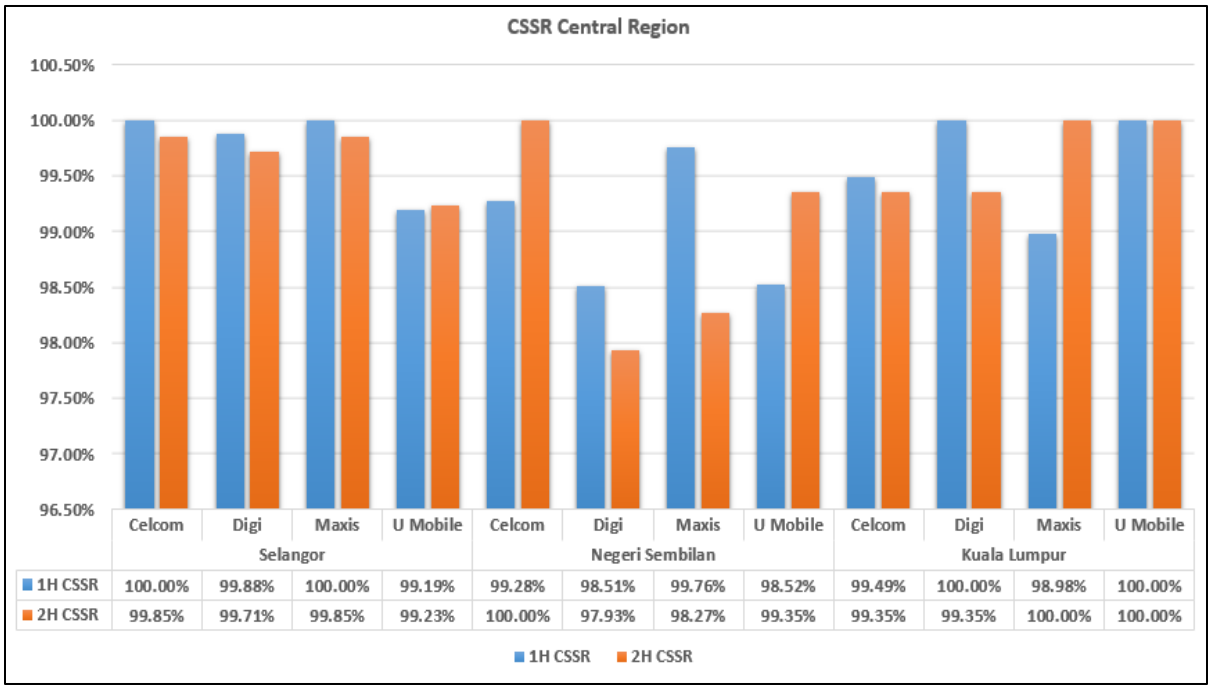


Figure 45: CSSR in Central Region



Northern Region

Figure 46: Overall results of Northern Region

		DCR	CSSR
Kedah	Celcom	0.98%	99.72%
	Digi	3.75%	98.94%
	Maxis	2.43%	98.57%
	U Mobile	2.97%	98.61%
Pulau Pinang	Celcom	0.79%	99.43%
	Digi	0.68%	99.44%
	Maxis	1.62%	99.53%
	U Mobile	0.96%	99.15%
Perlis	Celcom	1.68%	98.35%
	Digi	0.42%	98.76%
	Maxis	1.24%	100.00%
	U Mobile	3.39%	97.52%
Perak	Celcom	0.69%	99.14%
	Digi	1.56%	99.66%
	Maxis	2.20%	98.96%
	U Mobile	1.93%	98.42%

Figure 47: DCR in Northern Region

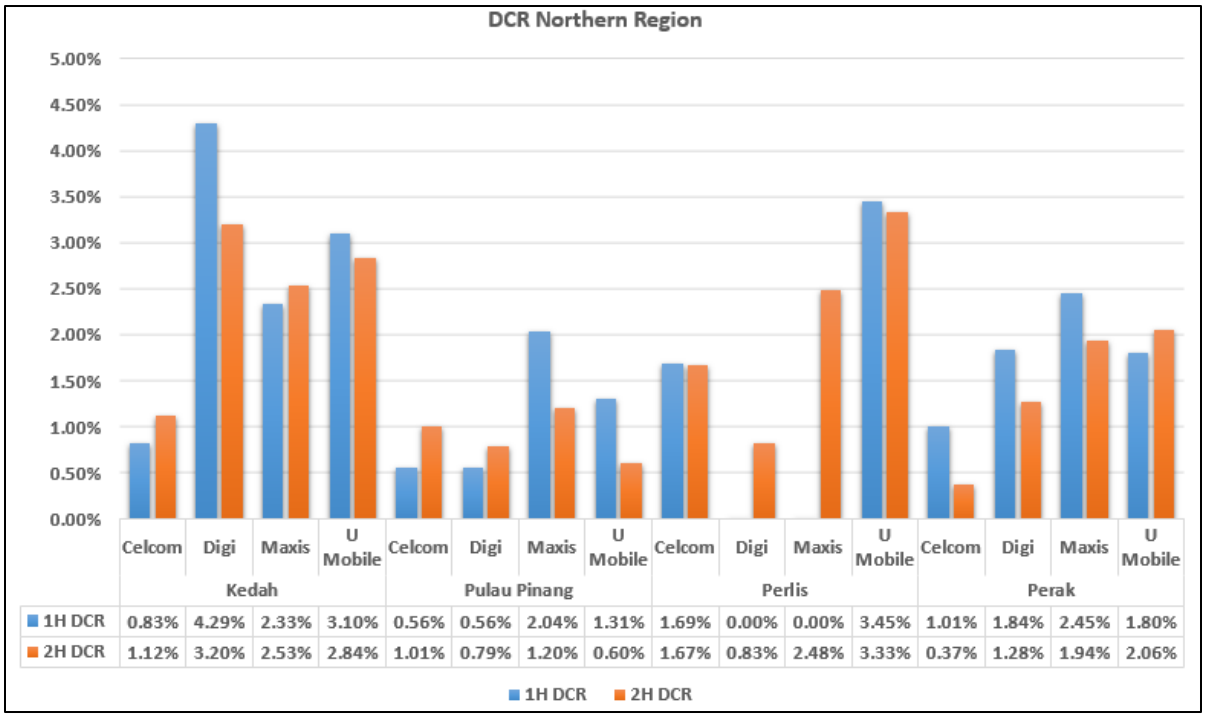
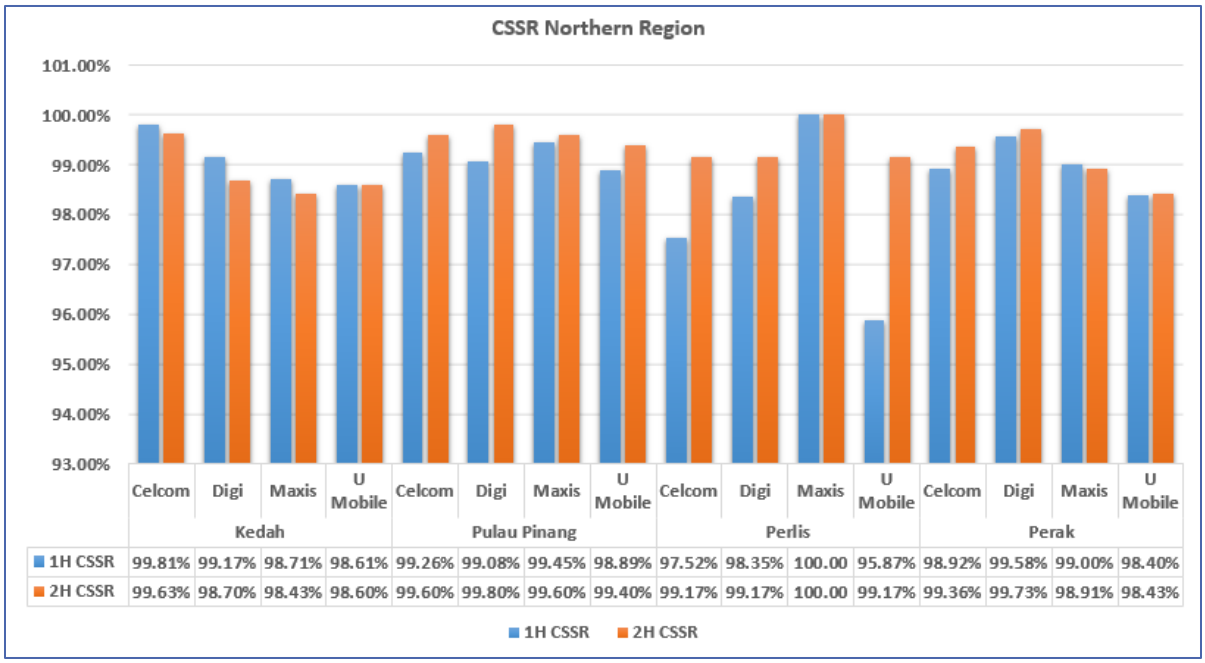


Figure 48: CSSR in Northern Region



Eastern Region

Figure 49: Overall results in Eastern Region

State	Service Provider	DCR	CSSR
Kelantan	Celcom	1.85%	99.39%
	Digi	1.26%	99.56%
	Maxis	1.08%	99.62%
	Umobile	1.56%	98.94%
Pahang	Celcom	0.58%	99.66%
	Digi	1.65%	99.31%
	Maxis	1.91%	99.66%
	Umobile	1.86%	98.63%
Terengganu	Celcom	2.04%	99.04%
	Digi	2.78%	98.98%
	Maxis	3.71%	99.47%
	Umobile	2.02%	98.71%

Figure 50: DCR in Eastern Region

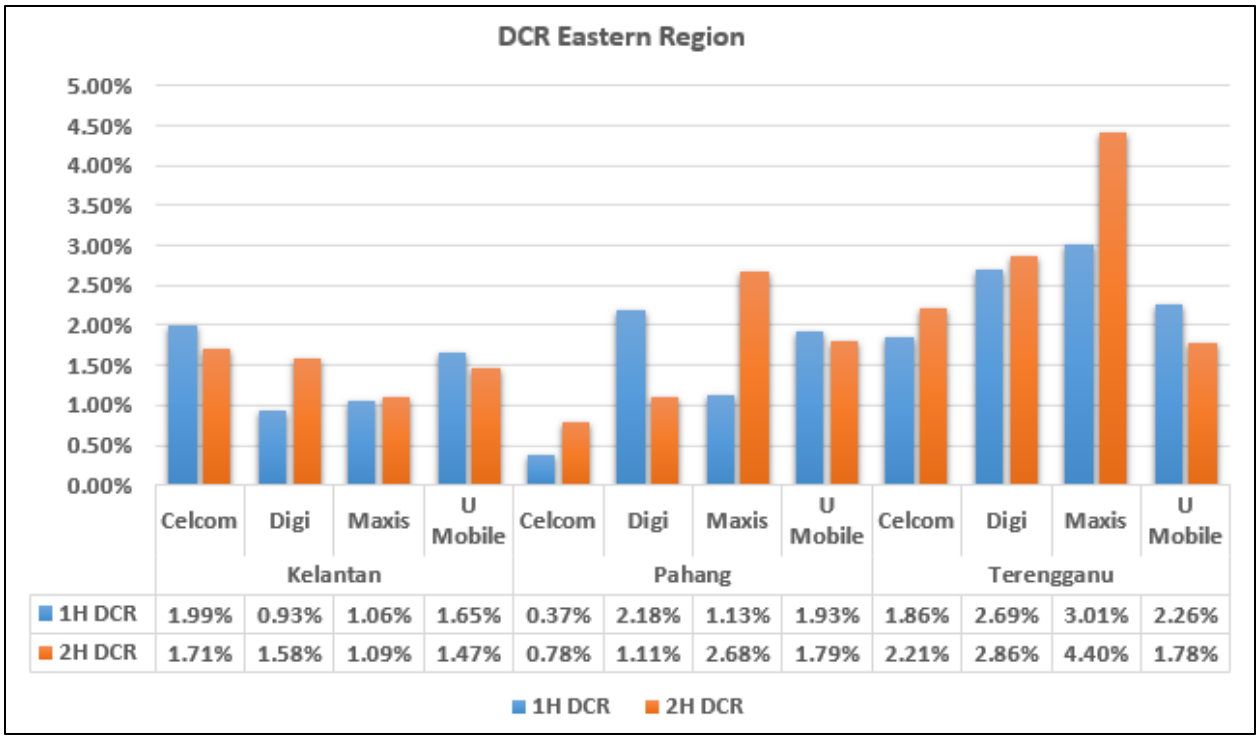
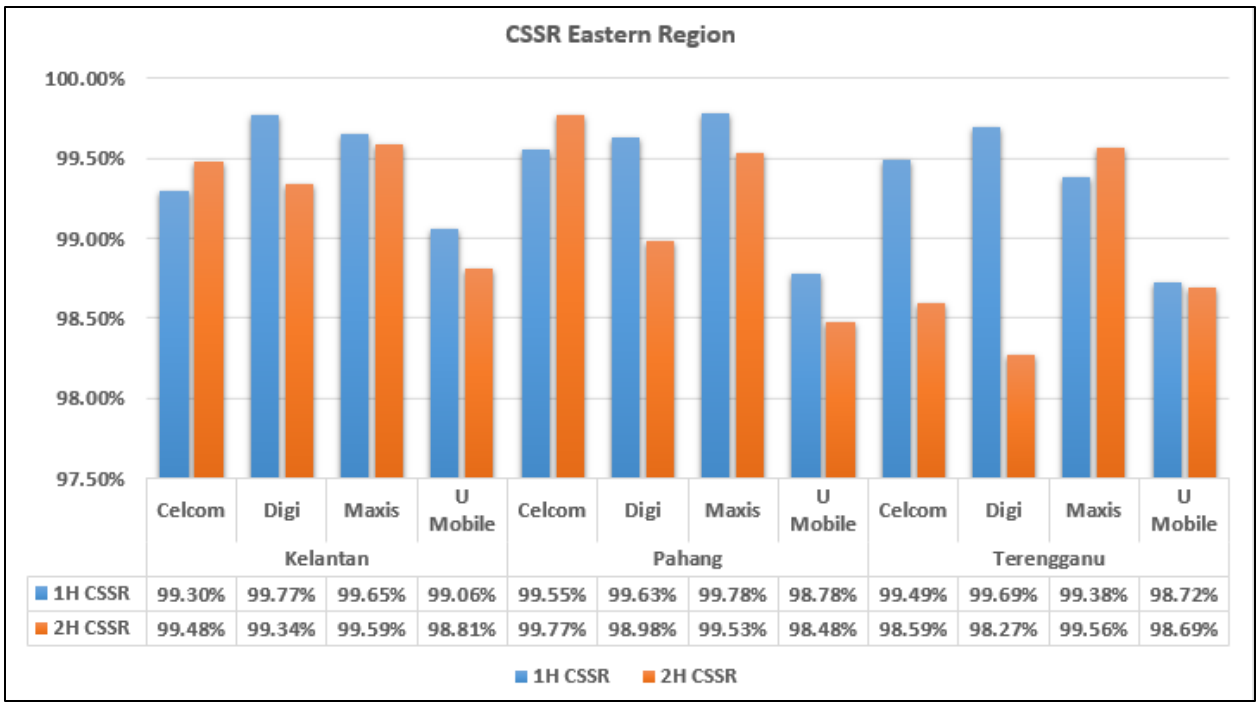


Figure 51: CSSR in Eastern Region



Southern Region

Figure 52: Overall results in Southern Region

State	Service Provider	DCR	CSSR
Johor	Celcom	0.74%	99.61%
	Digi	1.26%	99.54%
	Maxis	1.20%	99.60%
	U Mobile	0.67%	99.41%
Melaka	Celcom	1.39%	99.14%
	Digi	0.86%	99.83%
	Maxis	1.05%	98.97%
	U Mobile	2.41%	99.15%

Figure 53: DCR in Southern Region

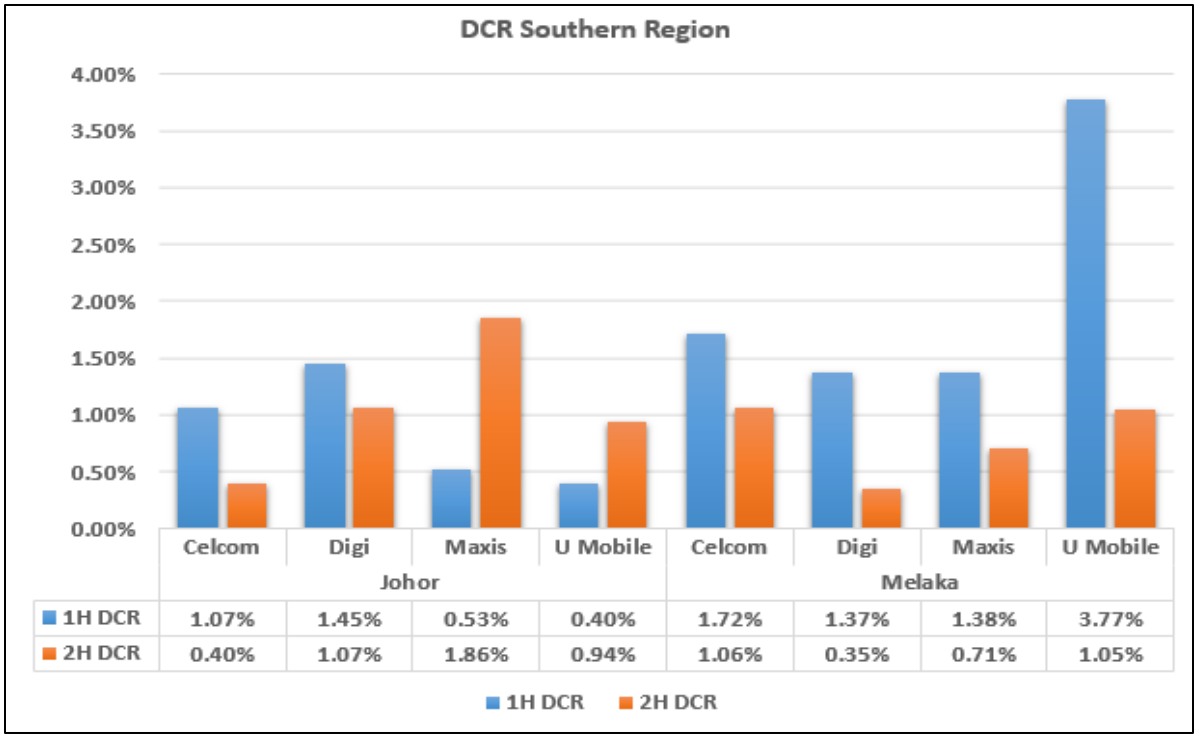
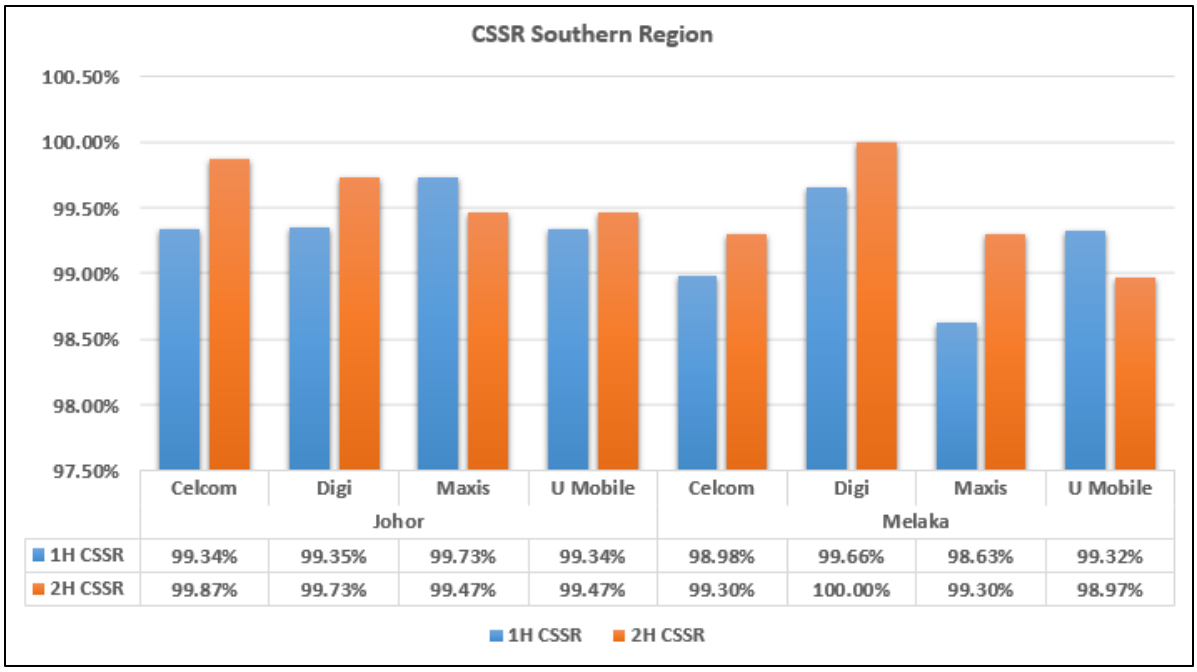


Figure 54: CSSR in Southern Region



Sarawak

Figure 55: Overall results of Sarawak state

State	Service Provider	DCR	CSSR
Sarawak	Celcom	0.65%	99.49%
	Digi	0.21%	99.75%
	Maxis	0.34%	99.83%
	Umobile	1.49%	98.95%

Figure 56: DCR of Sarawak state

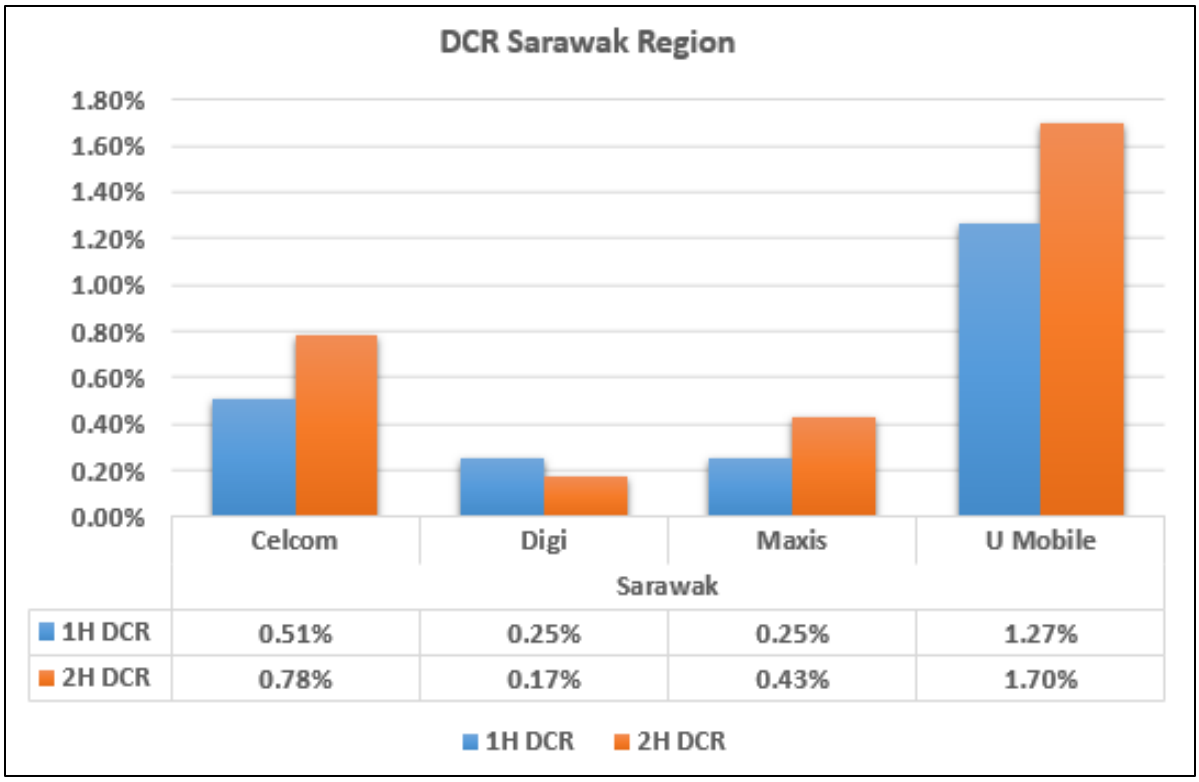
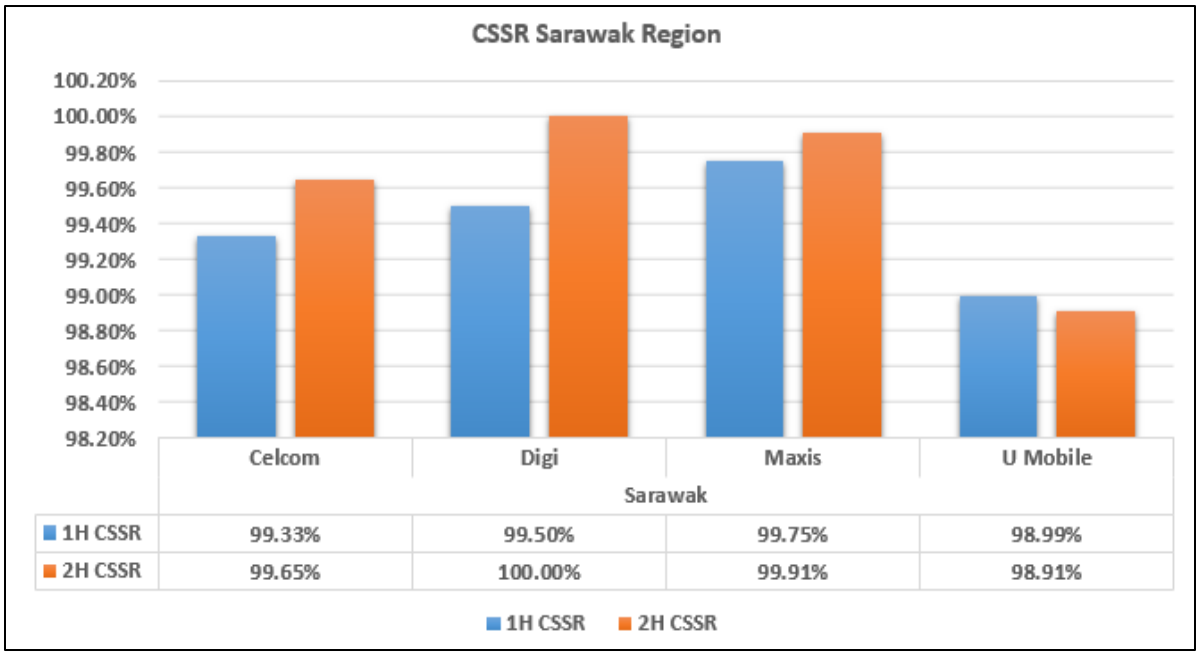


Figure 57: CSSR of Sarawak state



Sabah

Figure 58: Overall results of Sabah state

State	Service Provider	DCR	CSSR
Sabah	Celcom	2.13%	98.92%
	Digi	1.86%	99.19%
	Maxis	1.99%	99.03%
	Umobile	1.90%	97.58%

Figure 59: DCR in Sabah

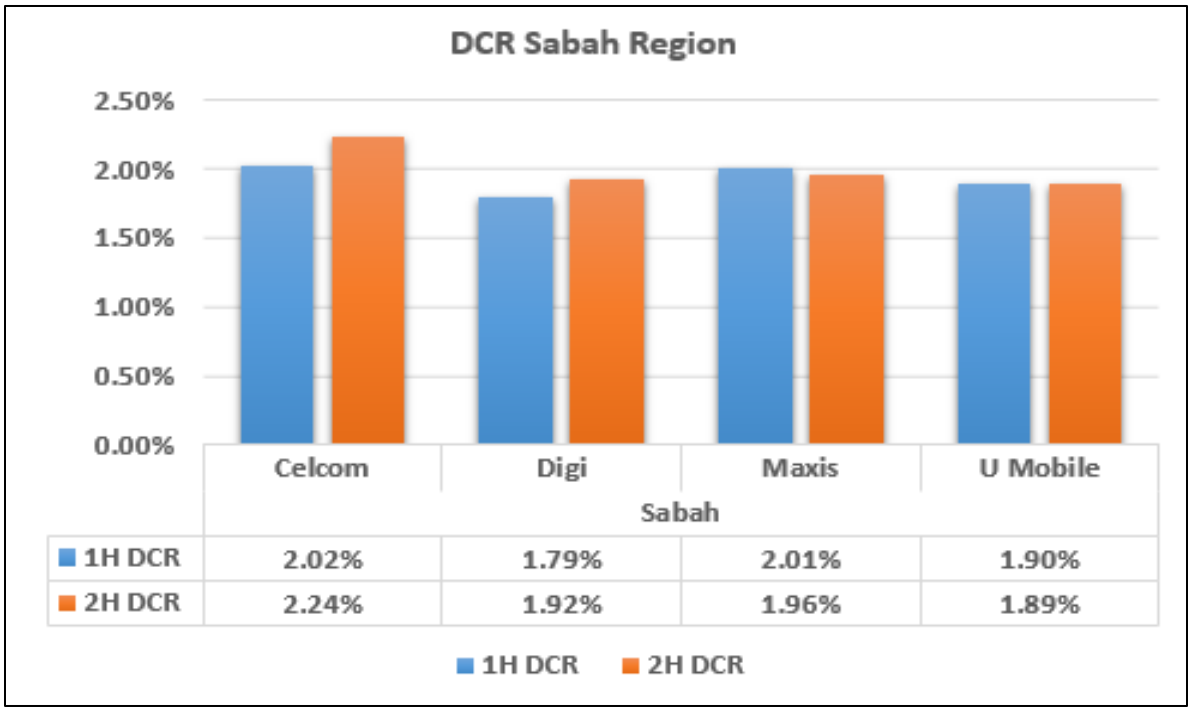
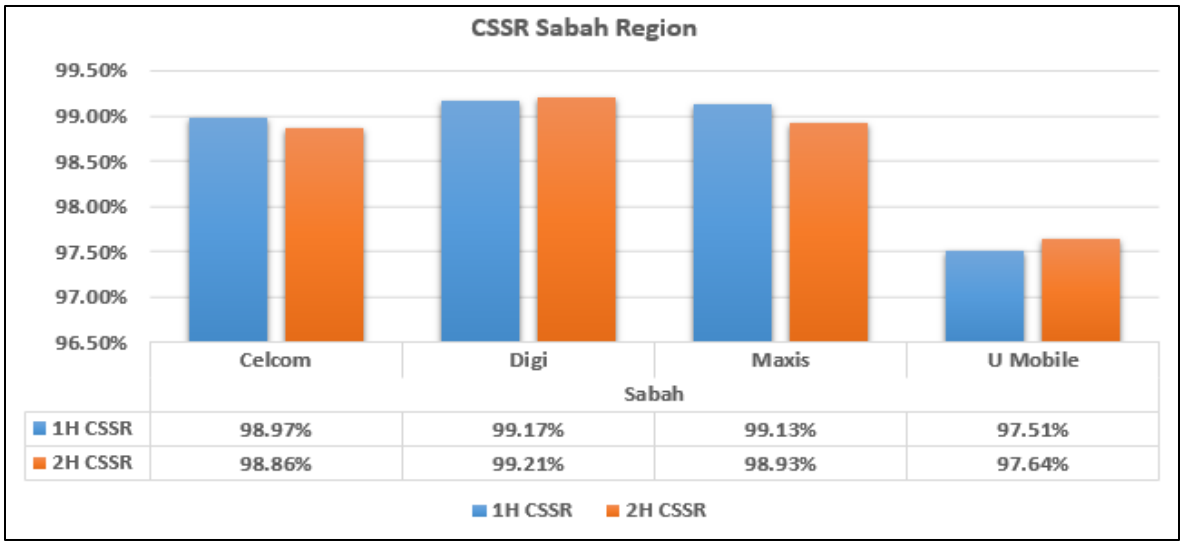


Figure 60: CSSR in Sabah



Summary

Wireless Broadband Access

- Maxis dominated the wireless broadband performance based on the overall nationwide measurement results. Maxis network ranked top for overall average DL throughput, network latency and also recorded the lowest packet loss nationwide.
- Digi achieved the highest peak DL speeds at 125Mbps.
- Areas deployed LTE-A network, better DL throughput was made possible to end users with smartphones supporting the technology.
- However, DL speed is not everything in the internet world. Network latency, device performance, server capacity of the content provider, peering network availability and user behavior will also have great impact to the quality of experience to the end users.
- Table below shows improvement in terms of average download speeds compared to the 2017 measurement, although it must be noted that the test locations may differ from the previous year:

Service Provider	2017	2018	Improvement
Celcom	18.28 Mbps	19.92 Mbps	+8.97%
Digi	15.57 Mbps	23.10 Mbps	+48.36%
Maxis	25.6 Mbps	35.02 Mbps	+36.80%
U Mobile	7.86 Mbps	13.10 Mbps	+66.67%
Webe	7.30 Mbps	9.73 Mbps	+33.29%
YTL (LTE)	N/A	17.52 Mbps	N/A

- Due to the completion of frequency re-farming ending year 2017, significant improvement can be seen in 2018 by all SPs, with U Mobile demonstrating notable improvement in terms of average download speed. U Mobile have been aggressively rolling out LTE networks nationwide post re-farming.

Wired Broadband Access

- Looking at the regional results, further improvements are expected. In the Southern region, Maxis was below target (85.69%) on upload throughput while TM at 86.93% for download throughput in Eastern region using fibre broadband access in both cases.
- Fibre technology is far more reliable compared to DSL technology for broadband. However, in 2018, TM seems to be taking steps to overcome the Streamyx (DSL broadband) impairments in terms of throughput as seen from the measurement results.
- Unfortunately, DSL technology using copper proves difficulty in complying with Ping RTT requirements in providing internet access as it deteriorates over distance. More so, overtime copper quality degrades, hence causing attenuation to the signal, leading to data transmission error.
- In the year 2018, all three (3) fixed operators introduced “Free upgrade packages” to existing subscribers in response to the government initiative of “double the speed, half the price” package. Most of home users now have access to 100Mbps, 300Mbps and even

1Gbps internet access. However, the higher packages can only be materialized by upgrading their modems and routers to support the higher internet speeds.

Public Cellular Services

- Service providers show commendable performance in providing voice call services to the subscriber based on overall results.
- Service providers recorded a Dropped Call Rate between 0.47% - 1.15% in Identified route and 1.20% - 1.85% in nationwide route. Meanwhile for Call Setup Success Rate all service providers were able to achieve more than 99% of call connectivity.
- PCS mainly VOICE, is still measured as there are quite a number of users who are still relying on normal phones and does not possess smartphones with any of the above applications for voice calls.