

# Global Mobile Network Experience Awards 2023

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OPENSIGNAL



# Key Findings

## **SK telecom users have the best overall multiplayer gaming experience**

SK telecom is the outright Global Winner for Games Experience with an impressive score of 86.3 points on a 100-point scale, placing it in the Excellent (85 or above) category. Its two national rivals, LG U+ and KT, tie for second place with scores of 84.7–85.5 points. SK telecom's score is 26 points above the global average of 60.3 points.

## **The Global Winner for Download Speed Experience is SK telecom**

Our SK telecom users see average overall download speeds of 131.7Mbps – making it the sole Global Winner for Download Speed Experience. SK telecom wins by an impressive margin, given second-placed KT's score of 105.7Mbps – the only other operator to score above 100Mbps. The average download speeds seen by our SK telecom users are 4.2 times the global average of 31.5Mbps.

## **3 Denmark comes top for Upload Speed Experience**

Our 3 users in Denmark observe the fastest average overall upload speeds globally – an impressive 22.9Mbps – around 4.5Mbps faster than Swisscom and TDC Denmark's statistically tied scores of 18.2–18.6Mbps. The operator with the largest percentage improvement in its Upload Speed Experience between H2 2021 and H2 2022 is Ufone Pakistan with a spectacular rise of 77.2%.

## **Telia Finland and Telia Estonia jointly win Excellent Consistent Quality**

Telia Finland is the sole Global Winner for Core Consistent Quality and in Excellent Consistent Quality it shares the award with Telia Estonia. This is the first time that either category has appeared in the Global Awards. The two operators win Excellent Consistent Quality with statistically tied scores of 90.8–91.1%. For Core Consistent Quality, Telia Finland wins outright with a score of 97.2%, narrowly ahead of TDC Denmark's and Elisa Finland's identical scores of 97%.

## **Operators from Denmark, Estonia, Japan, Lithuania and South Korea are Global Winners for Voice App Experience**

Nine operators jointly win: 3 Denmark, Telia and BITÉ from Lithuania, all three South Korean operators (LG U+, KT, SK telecom), Japan's au and NTT docomo, along with Estonia's Telia. These operators have statistically tied scores for Voice App Experience.

## **Asia Pacific operators perform strongly on year-on-year improvement**

Of the 83 operators that are a Global Rising Star in at least one category, 33.7% (28) hail from Asia Pacific, followed by 25.3% from Africa and the Middle East, 20.5% from Europe, and 19.3% from South and Central America. In total, 41.4% of all Global Rising Star awards are won by Asia Pacific operators.

## **Ufone Pakistan is a Global Rising Star in all five categories**

When we look at the percentage improvement in our users' mobile experience over the last year, Pakistan's Ufone has achieved an impressive feat; it is the only operator in the global top 30 in every category. Six operators are Global Rising Stars across four categories: Banglalink, WOM Colombia, Orange Egypt, Celcom and Yes in Malaysia, and Globe in the Philippines.

## **LG U+ users spend the most time using 4G or 5G**

Our LG U+ users in South Korea spend 99.7% of their time connected to 4G or 5G, making the operator the Global Winner for Time on 4G/5G. India's Jio and Japan's au follow closely behind with statistically tied scores of 99.3–99.4%. The average Time on 4G/5G score across global operators is 88.9% – which LG U+ exceeds by 10.8 percentage points. Meanwhile, the operator with the largest year-on-year percentage increase in Time on 4G/5G is Iraq's Asiacell with a rise of 23.6%.



## **11 operators share first place for Video Experience**

The contest for Video Experience is so fierce that 11 operators are Global Winners with statistically tied scores of 66.7–71.1 points on a 100-point scale, far above the global average of 49.4 points. The Global Winners are: StarHub, Denmark's 3 and TDC, The Netherlands' KPN and T-Mobile, SK telecom, Norway's Telenor and Telia, Telemach Croatia, Telia Lithuania, and Telia Estonia.

# Opensignal Global Awards 2023

## The Global Winners and Leaders



 Video Experience	<b>StarHub</b> Singapore <b>3</b> Denmark <b>TDC</b> Denmark <b>KPN</b> Netherlands	<b>T-Mobile</b> Netherlands <b>SK telecom</b> South Korea <b>Telenor</b> Norway <b>Telia</b> Norway	<b>Telemach</b> Croatia <b>Telia</b> Lithuania <b>Telia</b> Estonia					
 Games Experience	<b>SK telecom</b> South Korea			<b>LG U+</b> South Korea <b>KT</b> South Korea <b>StarHub</b> Singapore	<b>SoftBank</b> Japan <b>TDC</b> Denmark <b>au</b> Japan	<b>KPN</b> Netherlands <b>3</b> Denmark <b>Telekom</b> Slovakia	<b>Orange</b> Slovakia <b>3</b> Hong Kong <b>T-Mobile</b> Netherlands	<b>Telenor</b> Denmark <b>Telia</b> Lithuania
 Voice App Experience	<b>3</b> Denmark <b>Telia</b> Lithuania <b>KT</b> South Korea	<b>SK telecom</b> South Korea <b>LG U+</b> South Korea <b>NTT docomo</b> Japan	<b>au</b> Japan <b>BITÉ</b> Lithuania <b>Telia</b> Estonia	<b>SoftBank</b> Japan <b>StarHub</b> Singapore <b>T-Mobile</b> Netherlands	<b>TDC</b> Denmark <b>Telenor</b> Denmark <b>KPN</b> Netherlands	<b>Telia</b> Denmark <b>Orange</b> Slovakia	<b>Telekom</b> Hungary <b>Telenor</b> Norway	<b>Tele2</b> Sweden <b>LMT</b> Latvia
 Download Speed Experience	<b>SK telecom</b> South Korea			<b>KT</b> South Korea <b>LG U+</b> South Korea	<b>Telenor</b> Norway <b>T-Mobile</b> Puerto Rico	<b>KPN</b> Netherlands <b>3</b> Denmark	<b>T-Mobile</b> Netherlands <b>StarHub</b> Singapore	<b>Telia</b> Norway
 Upload Speed Experience	<b>3</b> Denmark			<b>Swisscom</b> Switzerland <b>TDC</b> Denmark <b>Rakuten</b> Japan	<b>LG U+</b> South Korea <b>T-Mobile</b> Netherlands	<b>SK telecom</b> South Korea <b>Telenor</b> Norway	<b>KPN</b> Netherlands <b>Salt</b> Switzerland	<b>Telia</b> Norway <b>Telia</b> Lithuania
 Time on 4G/5G	<b>LG U+</b> South Korea			<b>Jio</b> India <b>au</b> Japan	<b>SK telecom</b> South Korea <b>AT&amp;T</b> USA	<b>Liberty</b> Puerto Rico <b>SIMBA</b> Singapore	<b>NTT docomo</b> Japan <b>KT</b> South Korea	<b>Airtel</b> India <b>ice</b> Norway
 Excellent Consistent Quality	<b>Telia</b> Finland <b>Telia</b> Estonia			<b>Elisa</b> Finland <b>TDC</b> Denmark	<b>DNA</b> Finland <b>Telenor</b> Norway	<b>KPN</b> Netherlands <b>SK telecom</b> South Korea	<b>T-Mobile</b> Netherlands <b>3</b> Sweden	<b>ice</b> Norway
 Core Consistent Quality	<b>Telia</b> Finland			<b>TDC</b> Denmark <b>Elisa</b> Finland	<b>Telia</b> Estonia <b>3</b> Sweden	<b>Telenor</b> Denmark <b>Telekom</b> Slovakia	<b>Tele2</b> Sweden <b>Telia</b> Denmark	<b>DNA</b> Finland <b>Orange</b> Slovakia

# Opensignal Global Awards 2023

## Global Rising Stars

(most improved year-on-year)



 <p>Games Experience</p>	<p><b>Orange</b> Morocco</p> <p><b>inwi</b> Morocco</p> <p><b>Tigo</b> Paraguay</p> <p><b>Dialog</b> Sri Lanka</p> <p><b>Maroc Telecom</b> Morocco</p> <p><b>Omantel</b> Oman</p>	<p><b>Zong</b> Pakistan</p> <p><b>Movistar</b> Chile</p> <p><b>Claro</b> Chile</p> <p><b>Globe</b> Philippines</p> <p><b>Orange</b> Egypt</p> <p><b>Movistar</b> El Salvador</p>	<p><b>WOM</b> Colombia</p> <p><b>Etisalat</b> Egypt</p> <p><b>Ooredoo</b> Tunisia</p> <p><b>Turkcell</b> Turkey</p> <p><b>Yes</b> Malaysia</p> <p><b>XL</b> Indonesia</p>	<p><b>Ufone</b> Pakistan</p> <p><b>3</b> Hong Kong</p> <p><b>DITO</b> Philippines</p> <p><b>Kölb</b> Costa Rica</p> <p><b>Pelephone</b> Israel</p> <p><b>Celcom</b> Malaysia</p>	<p><b>Ooredoo</b> Oman</p> <p><b>Personal</b> Paraguay</p> <p><b>cs</b> Hong Kong</p> <p><b>Mobitel</b> Sri Lanka</p> <p><b>stc</b> Saudi Arabia</p> <p><b>stc</b> Bahrain</p>
 <p>Voice App Experience</p>	<p><b>inwi</b> Morocco</p> <p><b>Orange</b> Egypt</p> <p><b>Grameenphone</b> Bangladesh</p> <p><b>WOM</b> Colombia</p> <p><b>Orange</b> Morocco</p> <p><b>Robi</b> Bangladesh</p> <p><b>Dialog</b> Sri Lanka</p>	<p><b>Globe</b> Philippines</p> <p><b>Ufone</b> Pakistan</p> <p><b>Zong</b> Pakistan</p> <p><b>Airtel</b> Sri Lanka</p> <p><b>Banglalink</b> Bangladesh</p> <p><b>Mobitel</b> Sri Lanka</p> <p><b>Hutch</b> Sri Lanka</p>	<p><b>Etisalat</b> Egypt</p> <p><b>Jazz</b> Pakistan</p> <p><b>Movistar</b> El Salvador</p> <p><b>DITO</b> Philippines</p> <p><b>Zain</b> Saudi Arabia</p> <p><b>Claro</b> Chile</p>	<p><b>XL</b> Indonesia</p> <p><b>Maroc Telecom</b> Morocco</p> <p><b>Yes</b> Malaysia</p> <p><b>TrueMove H</b> Thailand</p> <p><b>Turkcell</b> Turkey</p> <p><b>Entel</b> Peru</p>	<p><b>Djezzy</b> Algeria</p> <p><b>TeleTalk</b> Bangladesh</p> <p><b>Movistar</b> Chile</p> <p><b>cs</b> Hong Kong</p> <p><b>Celcom</b> Malaysia</p> <p><b>Telekom</b> Romania</p>
 <p>Download Speed Experience</p>	<p><b>T-Mobile</b> Puerto Rico</p> <p><b>Celcom</b> Malaysia</p> <p><b>Yes</b> Malaysia</p> <p><b>GT</b> Taiwan</p> <p><b>Banglalink</b> Bangladesh</p> <p><b>stc</b> Bahrain</p>	<p><b>Grameenphone</b> Bangladesh</p> <p><b>DITO</b> Philippines</p> <p><b>A1</b> Bulgaria</p> <p><b>Movistar</b> Chile</p> <p><b>3</b> Denmark</p> <p><b>WOM</b> Chile</p>	<p><b>Tigo</b> Honduras</p> <p><b>T-Mobile</b> USA</p> <p><b>Maxis</b> Malaysia</p> <p><b>Bitel</b> Peru</p> <p><b>3</b> Sweden</p> <p><b>Partner</b> Israel</p>	<p><b>Ooredoo</b> Algeria</p> <p><b>3</b> UK</p> <p><b>Cellcard</b> Cambodia</p> <p><b>Digi</b> Malaysia</p> <p><b>Hot Mobile</b> Israel</p> <p><b>Celcom</b> Israel</p>	<p><b>Ufone</b> Pakistan</p> <p><b>Claro</b> Puerto Rico</p> <p><b>Zong</b> Pakistan</p> <p><b>Pelephone</b> Israel</p> <p><b>Chunghwa</b> Taiwan</p> <p><b>Telemach</b> Croatia</p>
 <p>Upload Speed Experience</p>	<p><b>Ufone</b> Pakistan</p> <p><b>Grameenphone</b> Bangladesh</p> <p><b>Robi</b> Bangladesh</p> <p><b>Banglalink</b> Bangladesh</p> <p><b>Hutch</b> Sri Lanka</p> <p><b>Claro</b> El Salvador</p>	<p><b>4ka</b> Slovakia</p> <p><b>Globe</b> Philippines</p> <p><b>Celcom</b> Malaysia</p> <p><b>Orange</b> Morocco</p> <p><b>Tigo</b> Honduras</p> <p><b>Yes</b> Malaysia</p>	<p><b>Mobitel</b> Sri Lanka</p> <p><b>Ooredoo</b> Algeria</p> <p><b>WOM</b> Colombia</p> <p><b>Orange</b> Egypt</p> <p><b>Digi Mobil</b> Romania</p> <p><b>GT</b> Taiwan</p>	<p><b>China Unicom</b> China</p> <p><b>3</b> Sweden</p> <p><b>China Telecom</b> China</p> <p><b>Partner</b> Israel</p> <p><b>Celcom</b> Israel</p> <p><b>Claro</b> Colombia</p>	<p><b>A1</b> Bulgaria</p> <p><b>mts</b> Serbia</p> <p><b>Mobilis</b> Algeria</p> <p><b>Unifi</b> Malaysia</p> <p><b>Magenta</b> Austria</p> <p><b>Asiacell</b> Iraq</p>
 <p>Time on 4G/5G</p>	<p><b>Asiacell</b> Iraq</p> <p><b>Ufone</b> Pakistan</p> <p><b>Digicel</b> El Salvador</p> <p><b>Zain</b> Iraq</p> <p><b>Vodafone</b> Ireland</p> <p><b>3</b> Ireland</p>	<p><b>Telekom</b> Romania</p> <p><b>Cellcom</b> Israel</p> <p><b>Yettel</b> Serbia</p> <p><b>Telemach</b> Croatia</p> <p><b>Partner</b> Israel</p> <p><b>Digi</b> Malaysia</p>	<p><b>Dialog</b> Pakistan</p> <p><b>Claro</b> Chile</p> <p><b>Hutch</b> Sri Lanka</p> <p><b>WOM</b> Colombia</p> <p><b>Airtel</b> Sri Lanka</p> <p><b>Claro</b> Colombia</p>	<p><b>Jazz</b> Pakistan</p> <p><b>Globe</b> Philippines</p> <p><b>3</b> UK</p> <p><b>U Mobile</b> Malaysia</p> <p><b>TIM</b> Italy</p> <p><b>Orange</b> Egypt</p>	<p><b>Salt</b> Switzerland</p> <p><b>Movistar</b> El Salvador</p> <p><b>A1</b> Croatia</p> <p><b>Banglalink</b> Bangladesh</p> <p><b>A1</b> Bulgaria</p> <p><b>Free Mobile</b> France</p>



# Users' mobile experience continues to improve

In the fourth Global Awards report, Opensignal once again compares operators from around the world – recognizing those on which our users had the best mobile experience and celebrating the mobile industry's achievements. In addition, we again highlight the operators on which our users have seen the greatest improvement in their mobile experience – these operators are the Global Rising Stars.

This is the first time that we have also analyzed the consistency of our users' experience across global operators. We have added two new award categories: Excellent Consistent Quality and Core Consistent Quality. These assess what proportion of users' tests met the recommended performance thresholds for common applications. For Excellent Consistent Quality, this includes watching HD video, completing group video conference calls and playing games; Core Consistent Quality looks at less demanding applications such as SD video, voice calls and web browsing.

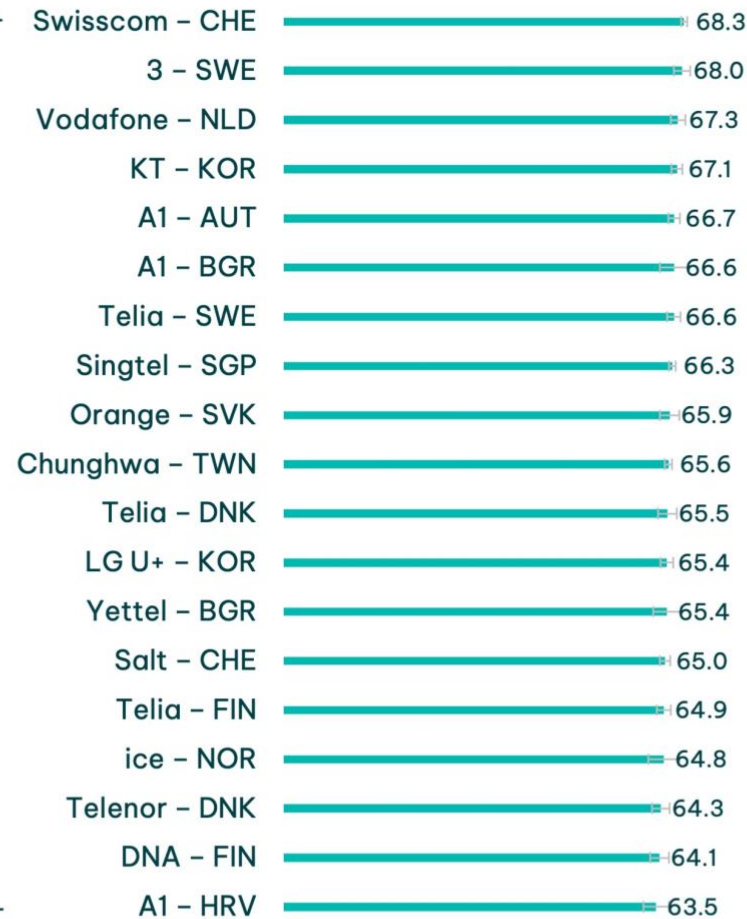
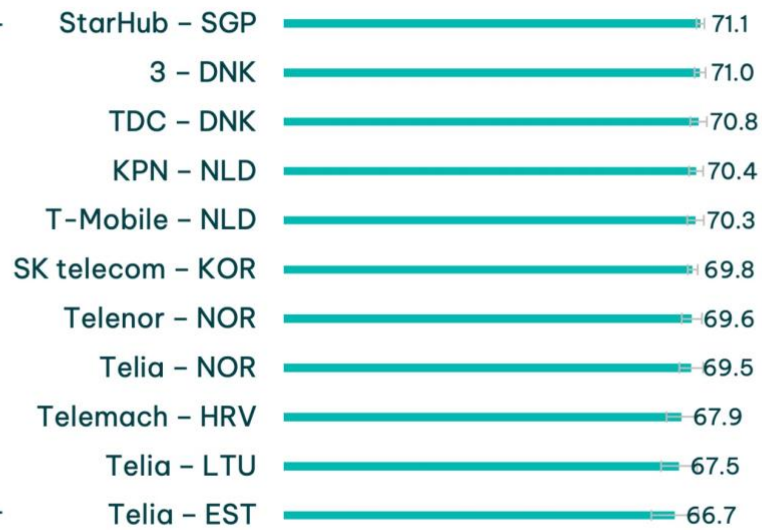
Unlike Opensignal's [5G Global Awards](#), this report looks at the overall mobile experience of our users across all mobile network technologies. This means that these results are significantly different. But 5G has become an increasingly important driver of users' overall experience. In markets where operators have launched 5G services, both the overall experiential scores – Video Experience, Games Experience and Voice App Experience – and the speed awards are heavily influenced by the boost that 5G gives to users' experience over older 3G and 4G technologies. The more time that users spend connected to 5G the more influence 5G has on the overall experience of users.

Using eight key measures of the mobile network experience, we have analyzed the data provided by our users over the first 180 days of the second half of 2022 and determined the Global Winner(s) using [confidence intervals](#) in the same way we do with all Opensignal reports. If the confidence intervals overlap then the result is a statistical tie and we declare two or more operators to be joint winners. Otherwise, an operator takes home the award as an outright winner.

We have also used confidence intervals to determine the Global Leaders and the Global High Performers, which are composed of the top 10 and top 30 scoring operators, respectively (excluding Global Winners). The exact number of operators in these categories can vary due to statistical ties between operators' scores. The use of confidence intervals means that in some cases operators with the same scores place in different categories.



## Video Experience – Global



Average – Global 49.4

(Only highest ranked operators listed on chart)



OPEN SIGNAL

0 20 40 60 80 100

Video Experience score

Data collection period 1 July – 27 December 2022 | © Opensignal Limited

Opensignal's Video Experience quantifies the quality of video streamed to mobile devices by measuring real-world video streams over an operator's network. The videos tested include a mixture of resolutions and are streamed directly from the world's largest video content providers.

There is an 11-way statistical tie for first place and, as a result, StarHub, 3 Denmark, TDC Denmark, KPN Netherlands, T-Mobile Netherlands, SK telecom, Telenor Norway, Telia Norway, Telemach Croatia, Telia Lithuania and Telia Estonia are all Global Winners for Video Experience. Their scores of 66.7–71.1 points on a 100-point scale compare favorably with the global average of 49.4 points. Because there are so many Global Winners, there are no Global Leaders in this category on this occasion.

Of the 11 Global Winners, nine hail from Europe, with Singapore's StarHub and South Korea's SK telecom coming from the Asia Pacific region. StarHub has the highest score for Video Experience in South East Asia (71.1 points).

Looking at the Global High Performers, a similar pattern plays out as there are 15 from Europe – including A1 Austria, Orange Slovakia and Swisscom – with four from Asia Pacific making up the remainder (KT, Singtel, Chunghwa and LG U+).

While it is not a Global High Performer for Video Experience, Ooredoo Maldives has the highest score in South Asia (57.4 points). Over in Puerto Rico, T-Mobile has the highest score for Video Experience in South and Central America (61 points) and by an impressive margin as the regional runners-up – all three of Uruguay's national operators along with Argentina's Personal – have statistically tied scores of 50.8–52.1 points.



## Games Experience – Global



SK telecom – KOR 86.3

LG U+ – KOR 85.5

KT – KOR 84.7

StarHub – SGP 82.7

SoftBank – JPN 81.3

TDC – DNK 80.4

au – JPN 80.2

KPN – NLD 79.8

3 – DNK 79.8

Telekom – SVK 79.5

Orange – SVK 79.2

3 – HKG 79.2

T-Mobile – NLD 79.1

Telenor – DNK 79.0

Telia – LTU 78.7



Singtel – SGP 79.2

csl – HKG 78.9

Vodafone – NLD 78.9

Rakuten – JPN 78.2

M1 – SGP 78.1

Telekom – HUN 78.1

T-Mobile – CZE 78.0

NTT docomo – JPN 78.0

Telia – DNK 77.8

Taiwan Mobile – TWN 77.7

Vodafone – CZE 77.2

Swisscom – CHE 77.1

ice – NOR 76.9

Telekom Slovenije – SVN 76.5

O2 – CZE 76.4

Magenta – AUT 76.4

Yettel – HUN 76.3

O2 – SVK 76.2

FarEasTone – TWN 76.2

Telia – EST 76.1

Orange – BEL 75.8



Average – Global 60.3

(Only highest ranked operators listed on chart)



OPEN SIGNAL

0 20 40 60 80 100

Games Experience score

Data collection period 1 July – 27 December 2022 | © Opensignal Limited



Opensignal's Games Experience is a measure of how mobile users experience real-time multiplayer mobile gaming on an operator's network. Measured on a scale of 0–100, it analyzes how our users' multiplayer mobile gaming experience is affected by mobile network conditions including latency, packet loss and jitter.

In contrast to Video Experience, there is just one Global Winner for Games Experience: SK telecom. The South Korean operator wins outright with a score of 86.3 points on a 100-point scale, placing it in the Excellent (85 or above) category. This means that the vast majority of our SK telecom users deem their network experience acceptable. Nearly all respondents feel like they have control over the game and they receive immediate feedback on their actions. There is not a noticeable delay in almost all cases.

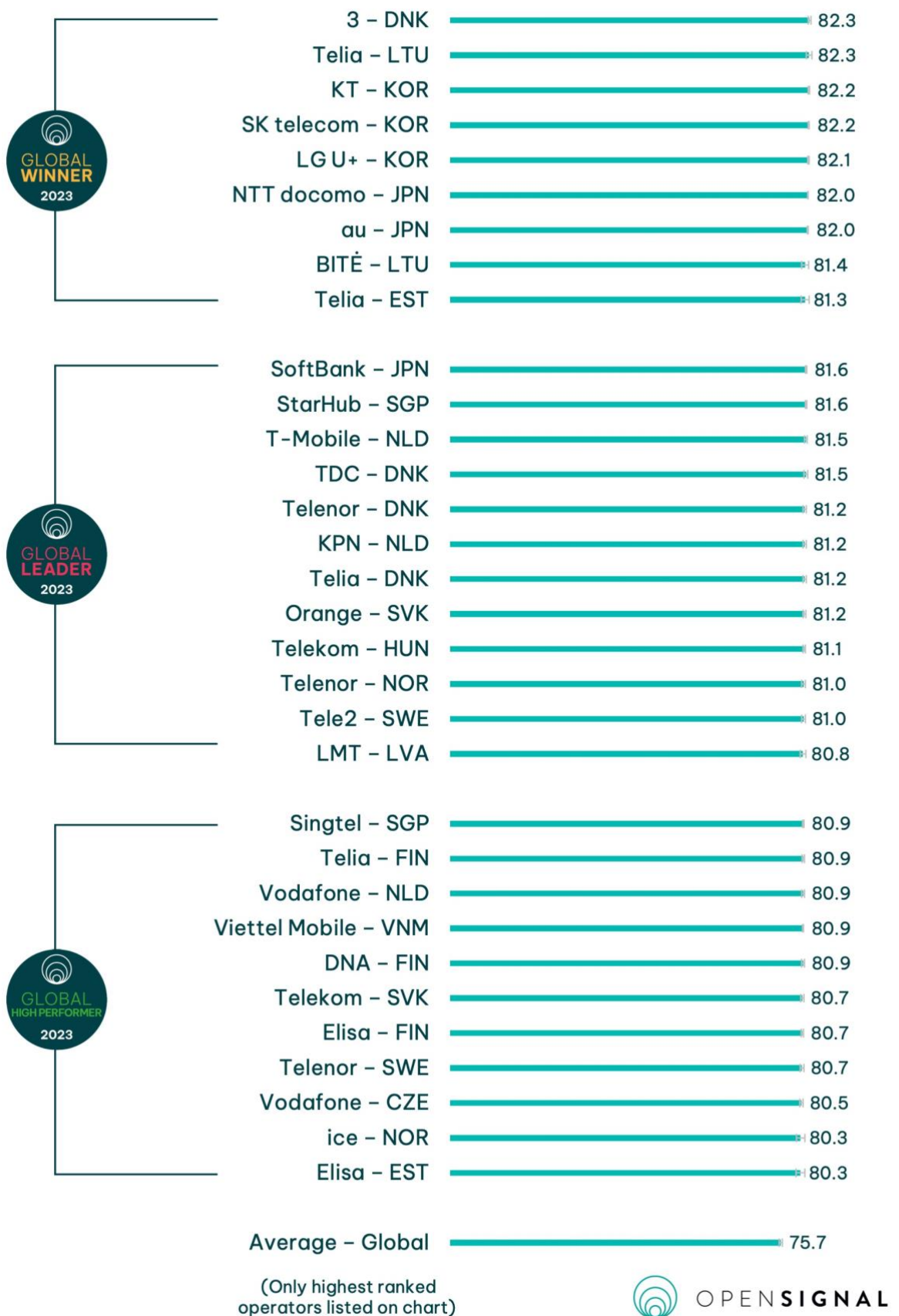
South Korea's other national operators, LG U+ and KT, tie for second place with statistically tied scores of 84.7–85.5 points. SK telecom's score is 26 points above the global average of 60.3 points, which places in the Poor category (40–65).

Eight out of 14 Global Leaders hail from Europe with the remaining six coming from the Asia Pacific region. The European Global Leaders consist of Telekom and Orange in Slovakia, three out of four Danish operators (3, TDC and Telenor), KPN and T-Mobile from the Netherlands, and Telia Lithuania. The Global Leaders hailing from Asia Pacific are: LG U+, KT, StarHub, Japan's SoftBank and au, along with 3 Hong Kong.

As with Video Experience, our Ooredoo Maldives users observe the best Games Experience in South Asia, given its score of 67.3 points, while StarHub has the highest score in South East Asia (82.7 points). In North America, Telus comes top for Games Experience, with its score of 68.3 points, giving it around a 1.2 point lead over T-Mobile U.S. and Bell, which statistically tie for second place. Over in South and Central America, our users have their best Games Experience on Movistar Uruguay's network, due to its score of 69.1 points, comfortably ahead of its national rival Claro's 65.6 points.



## Voice App Experience – Global



Data collection period 1 July – 27 December 2022 | © Opensignal Limited

Opensignal's Voice App Experience measures the quality of experience for over-the-top (OTT) voice services using a model derived from the International Telecommunication Union (ITU) approach for quantifying overall voice call quality and a series of calibrated technical parameters. Examples of these mobile voice apps include WhatsApp, Skype, LINE, WeChat, Viber and Facebook Messenger.

Nine operators are Global Winners for Voice App Experience, due to their statistically tied scores of 81.3–82.3 points on a 100-point scale. They are 3 Denmark, Telia and BITÉ from Lithuania, all three South Korean operators (LG U+, KT, SK telecom), Japan's au and NTT docomo, as well as Estonia's Telia. Their scores compare favorably with the global average of 75.7 points.

Five Global Winners hail from the Asia Pacific region, while the remaining four are European. However, 10 out of 12 Global Leaders come from Europe, with Japan's SoftBank and Singapore's StarHub making up the remainder. Similarly, nine out of 11 Global High Performers for Voice App Experience are based in Europe, including Orange Slovakia, with Singtel and Vietnam's Viettel Mobile hailing from the Asia Pacific region.

All of Denmark's national operators are either Global Winners (3 Denmark) or Global Leaders (TDC, Telenor and Telia) for Voice App Experience.

Global High Performers for Voice App Experience include Singapore's Singtel, Telekom Slovakia, and all three of Finland's national operators (DNA, Elisa and Telia).

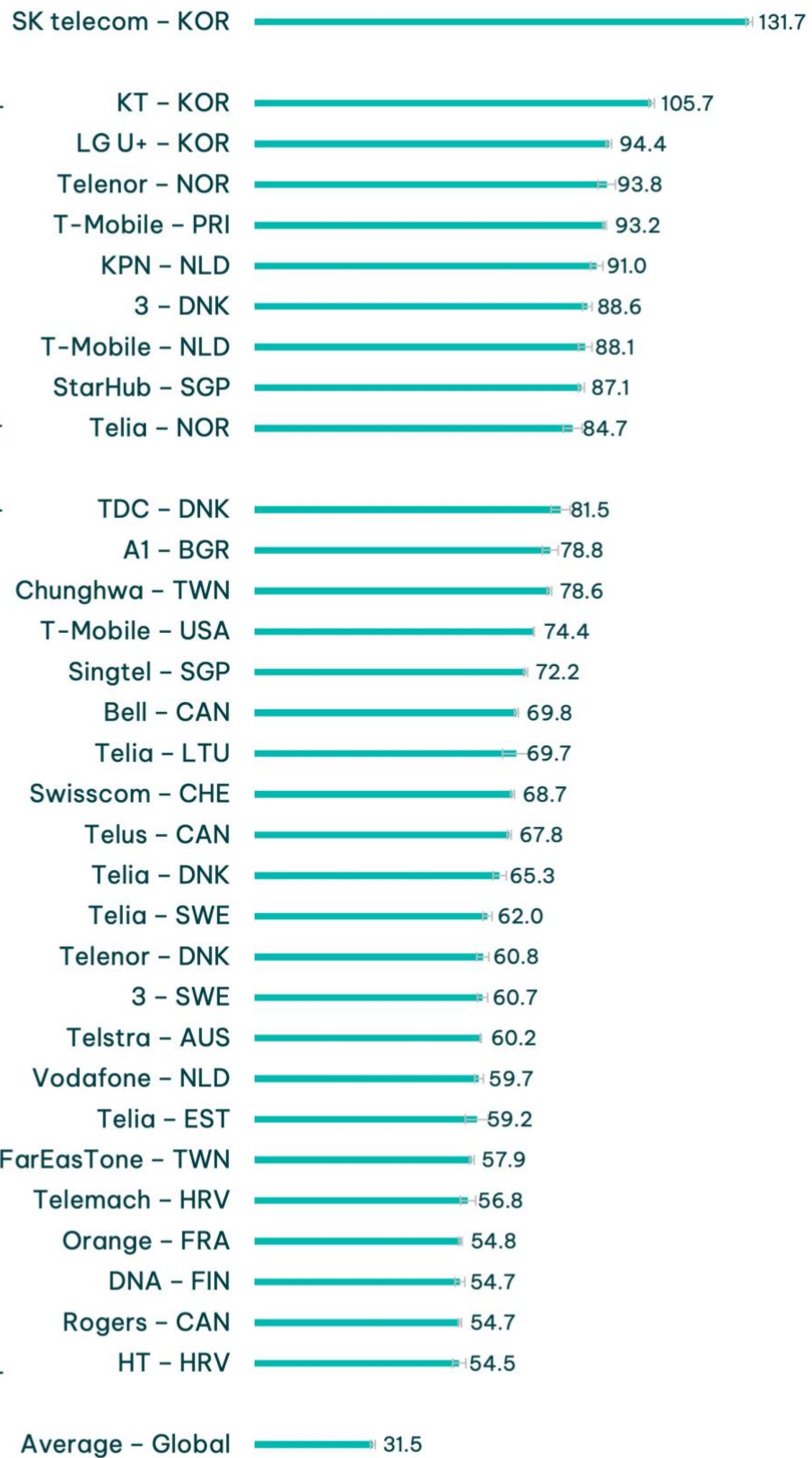
All the Global Winners, Global Leaders and Global High Performers place in the Good (80–87) category. This means many of our users on their networks are satisfied. Minor quality impairments are experienced by some users. Sometimes the background is not quite clear, it can be either hazy or not loud enough. Clicking sounds or distortion are very rarely present.

In contrast, the global average of 75.7 points indicates an Acceptable (74–80) Voice App Experience. This means that some users are satisfied. Some users experience perceptible call quality impairments. Clicking sounds of short duration or distortion are heard, and/or the volume may not be sufficiently loud. However, listeners are generally able to comprehend without repetition.

StarHub has the highest Voice App Experience score in South East Asia – 81.6 points on a 100-point scale. In South and Central America, Movistar Uruguay has the highest regional score (79.4 points). In North America, T-Mobile U.S. comes top regionally with a score of 76.9 points, narrowly ahead of Telus and Verizon's statistically tied scores of 76.5–76.6 points.



## Download Speed Experience – Global



(Only highest ranked operators listed on chart)



OPEN SIGNAL

0 20 40 60 80 100 120 140 (Mbps)

Data collection period 1 July – 27 December 2022 | © Opensignal Limited

SK telecom is the only Global winner for Download Speed Experience, as our users on its network observe average overall download speeds of 131.7Mbps. In addition, it is one of only two operators in the world on which our users reported speeds in excess of 100Mbps – the other being fellow South Korean operator KT, which places second with a score of 105.7Mbps.

However, four operators have scores in the low 90s and it will be interesting to see if any of them can join the exclusive 100Mbps club in 2023 as the 5G experience improves and drives up the overall experience. SK telecom wins with a lead of 26Mbps over the next closest operator, and a score that is 4.2 times higher than the global average of 31.5Mbps.

Looking at the nine Global Leaders, five hail from Europe: Norway's Telenor and Telia, KPN and T-Mobile in the Netherlands and Danish 3. Three Global Leaders are from the Asia Pacific region – South Korea's KT and LG U+, along with Singapore's StarHub.

Four of the 22 Global High Performers hail from North America – T-Mobile U.S. and all three Canadian national operators – Bell, Telus and Rogers. Of the four, T-Mobile has the fastest average overall download speeds in North America – 74.4Mbps, beating the runner-up Bell by 4.6Mbps. Other Global High Performers for Download Speed Experience include Taiwan's Chunghwa and FarEasTone, Singtel, Swisscom, TDC Denmark and Telemach Croatia.

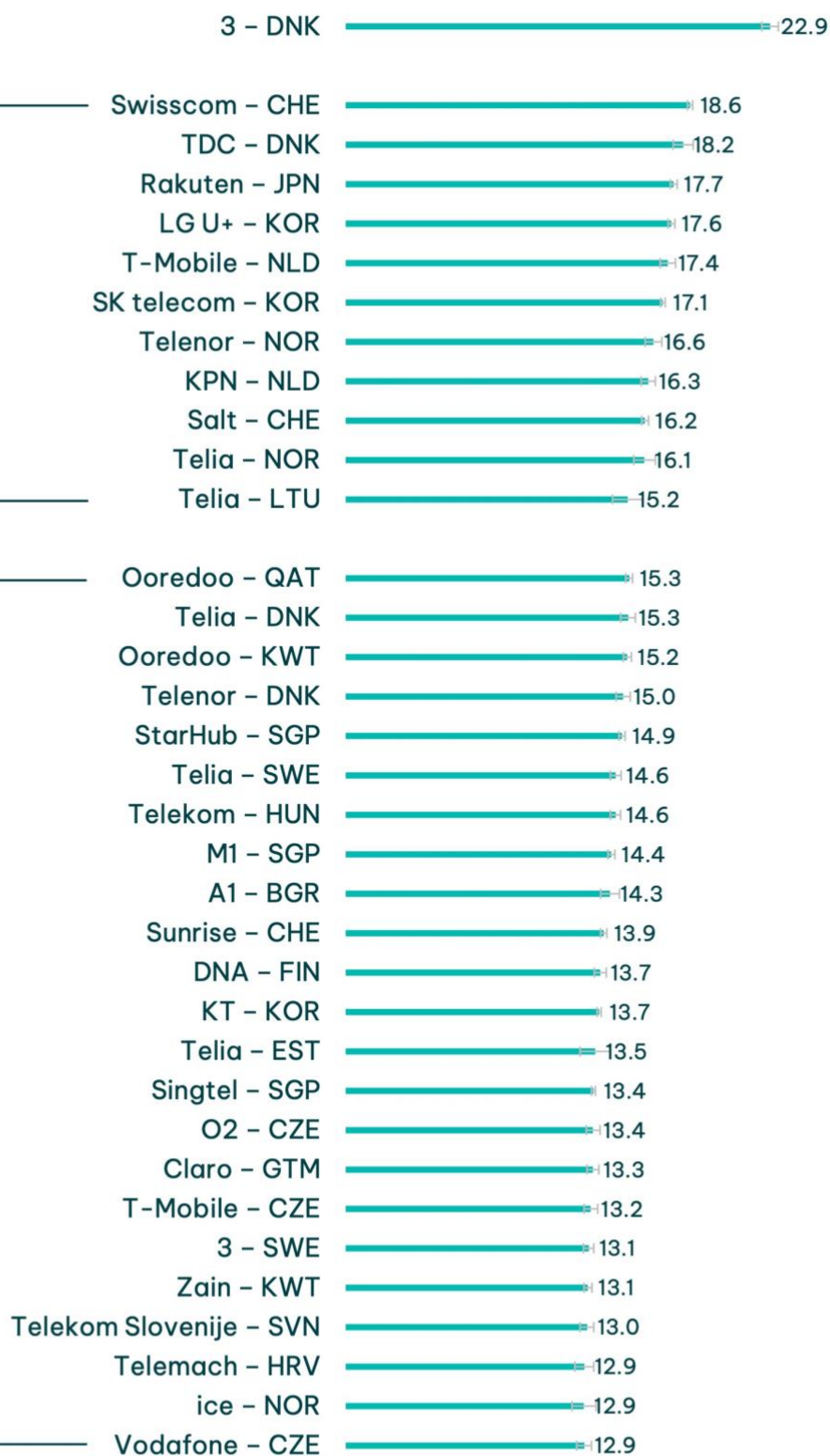
Our users in South East Asia observe their fastest download speeds on StarHub's network, given its score of 87.1 points. In Europe, the regional top spot is shared by KPN Netherlands and Telenor Norway, given their statistically tied scores of 91–93.8Mbps.

Our users in Africa and the Middle East observe their fastest download speeds on Ooredoo Qatar's network, due to its score of 53.2Mbps, 4.4Mbps ahead of the regional runner-up Etisalat in the UAE.





## Upload Speed Experience – Global



Average - Global 8.6

(Only highest ranked operators listed on chart)



OPEN SIGNAL

0 10 20 30 (Mbps)

Data collection period 1 July – 27 December 2022 | © Opensignal Limited

(Mbps)

Traditionally much of the focus on the mobile experience has been on download speeds. However, upload speeds are becoming increasingly important given the rise of social media and cloud services which encourage users to upload photos, videos and other bandwidth-intensive content.

The fastest global overall average upload speeds are seen by our users in Denmark on 3's network, who clocked up an impressive 22.9Mbps – around 4.5Mbps faster than Swisscom's and TDC Denmark's statistically tied scores of 18.2-18.6Mbps. 3 Denmark is therefore the sole Global Winner for Upload Speed Experience. The operator's score is 2.7 times higher than the global average of 8.6Mbps.

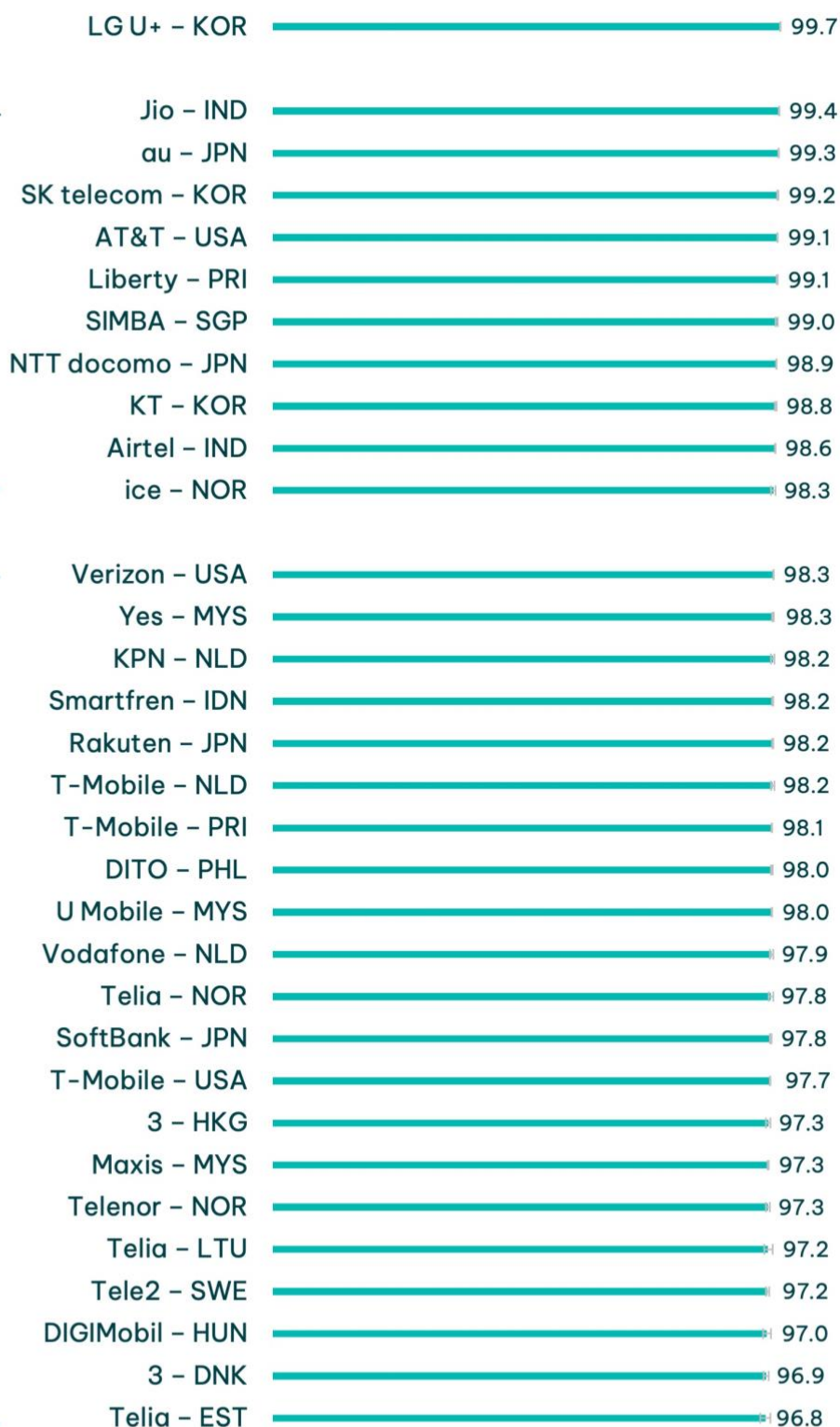
Turning to the Global Leaders, they include two out of three national operators for the following markets: South Korea (LG U+ and SK telecom), Norway (Telenor and Telia), Switzerland (Swisscom and Salt) and the Netherlands (KPN and T-Mobile). There are two exceptions to this rule: Rakuten, which is the only Japanese operator to be recognized as a Global Leader for Upload Speed Experience, and Telia Lithuania. Rakuten and LG U+ are statistically tied for the fastest average upload speeds in the Asia Pacific region, with scores of 17.6-17.7Mbps.

European operators continue to dominate the rankings for Upload Speed Experience when we look at the Global High Performers. 15 out of 23 come from Europe – including Telemach Croatia – while the next largest contingent hails from the Asia Pacific (four operators), followed by Africa and the Middle East (three operators). Only one operator from the Americas is recognized for its average upload speeds at the global level: Claro Guatemala, with 13.3Mbps – the highest score recorded in this region this time around. When we look specifically at North America, Canadian Rogers comes top with 10.7Mbps.

Singapore's StarHub and Ooredoo in the Maldives come top for Upload Speed Experience in South East Asia and South Asia respectively, with scores of 14.9Mbps and 7.6Mbps.



## Time on 4G/5G – Global



Average – Global 88.9

(Only highest ranked operators listed on chart)



OPEN SIGNAL

0 20 40 60 80 100 (% time)

Data collection period 1 July – 27 December 2022 | © Opensignal Limited

Time on 4G/5G is the percentage of time our users spend with a 4G or better connection. It is an important measure of the mobile experience as users can only enjoy the superior experience they typically observe with 4G or 5G over older generations of mobile technology when they have an active 4G or 5G connection. In addition, the majority of the 5G networks in use today use 5G non-standalone access technology. As this requires 5G users to be connected to 4G when using 5G and users on 5G can benefit from carrier aggregation with 4G bands, 4G is still an important part of the mobile experience, even for 5G users.

LG U+ is the sole Global Winner for Time on 4G/5G, as our users on its network connect to 4G or 5G for an impressive 99.7% of their time. Jio and au follow closely behind the Global Winner with statistically tied scores of 99.3-99.4%. The average Time on 4G/5G score across all operators analyzed was 88.9% – which LG U+ exceeds by 10.8 percentage points.

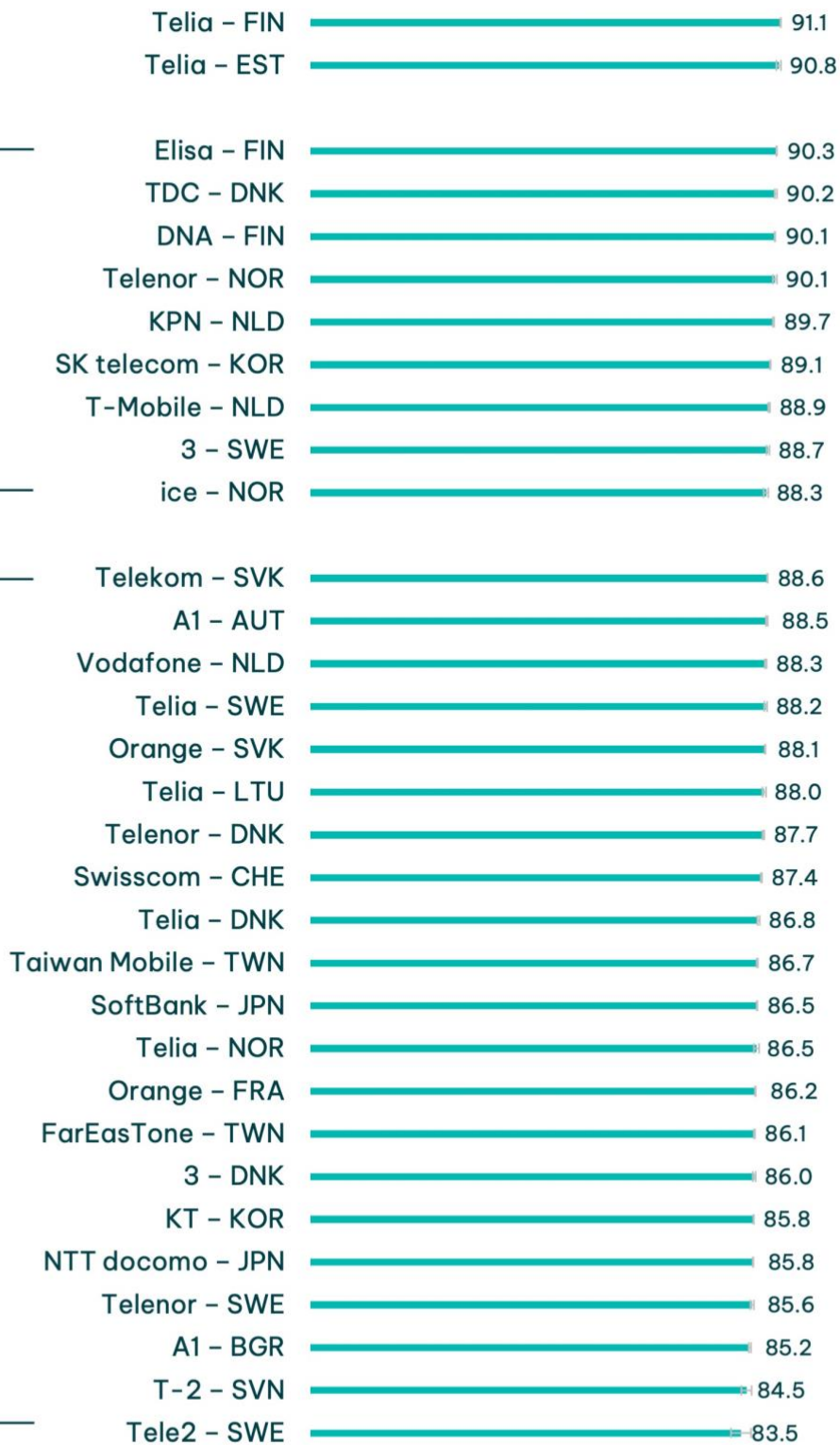
As might be expected, operators which have never operated legacy 2G and 3G networks perform strongly in terms of this measure of the mobile experience; Jio and Singapore's SIMBA place as Global Leaders, while Japan's Rakuten and DITO in the Philippines are Global High Performers. Our Jio users spend the most time connected to 4G or 5G in South Asia (99.4%).

Seven out of 10 Global Leaders for Time on 4G/5G hail from the Asia Pacific region. AT&T U.S and Liberty Puerto Rico are the only Global Leaders from the Americas for Time on 4G/5G and they are the top operators for this metric in North America, and South and Central America, respectively.

While there is only one European Global Leader (ice Norway), Europe is better represented when we look at Global High Performers. 10 Global High Performers out of 21 come from Europe, compared to eight for Asia Pacific and the remaining three hailing from the Americas.



## Excellent Consistent Quality – Global



Average - Global 65.4

(Only highest ranked operators listed on chart)



OPEN SIGNAL

0 20 40 60 80 100

(% of tests)

Data collection period 1 July – 27 December 2022 | © Opensignal Limited



Opensignal's Consistent Quality metrics (Excellent Consistent Quality and Core Consistent Quality) measure how often users' experience on a network was sufficient to support common applications' requirements. They measure download speed, upload speed, latency, jitter, packet loss, time to first byte and the percentage of tests attempted which did not succeed due to a connectivity issue on either the download or server response component.

Excellent Consistent Quality is the percentage of users' tests that met the minimum recommended thresholds for users to watch HD video, complete group video conference calls and play games.

This methodology is very different from Opensignal's experiential metrics (Video Experience, Games Experience and Voice App Experience), which use MOS (mean opinion score) models to place users' experience, based on a number of technical measurements, onto a 100-point scale and use the mean values for each operator calculated across all our users on its network.

Telia Finland and Telia Estonia are joint Global Winners for Excellent Consistent Quality, due to their statistically tied scores of 90.8-91.1% – compared to the global average of 65.4%.

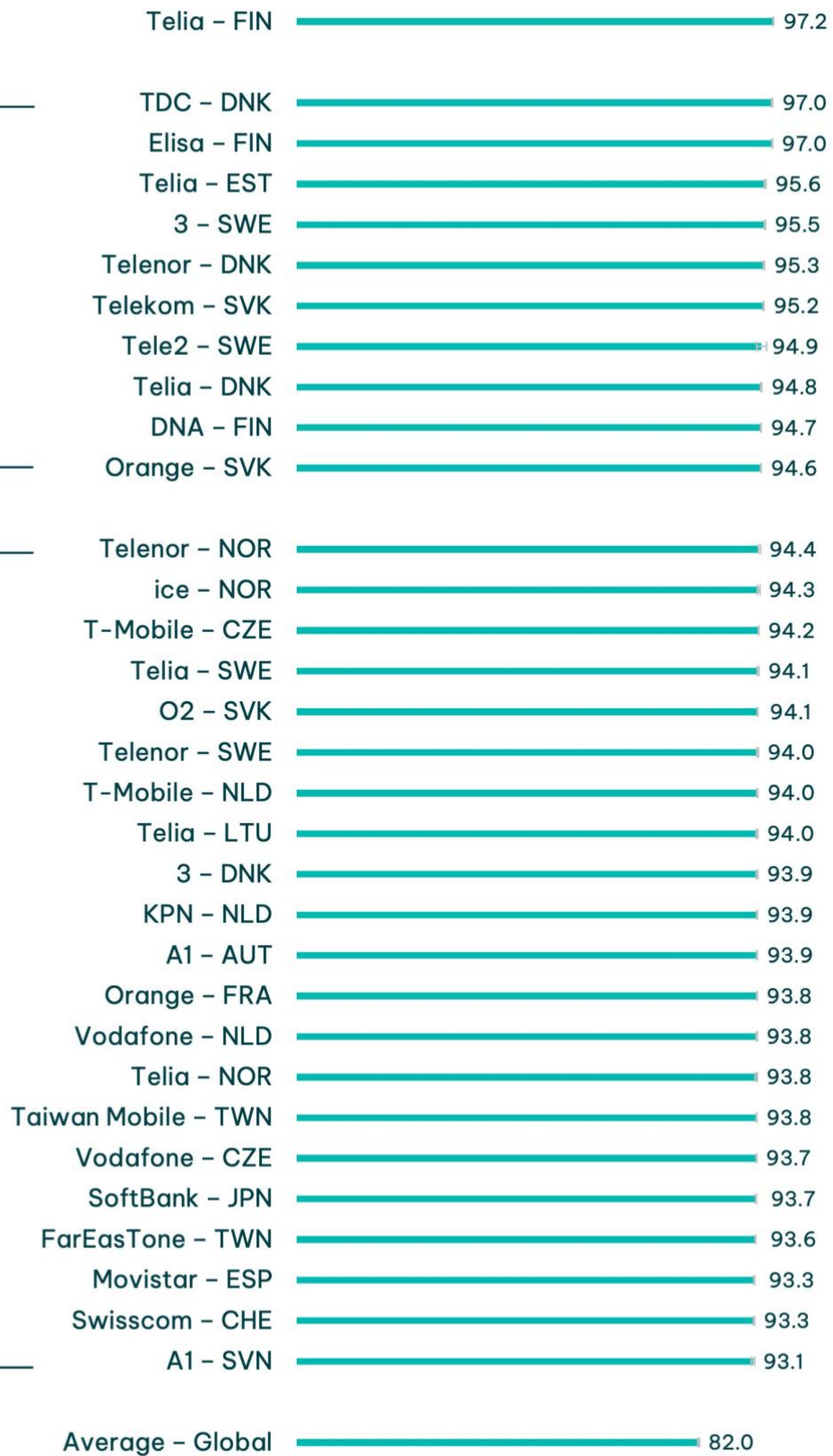
Both of Telia Finland's national rivals, Elisa and DNA, are Global Leaders. SK telecom is the only operator from outside Europe to be recognized as a Global Leader for Excellent Consistent Quality and it has the highest score in the Asia Pacific region (89.1%).

European operators continue to dominate when we turn to the Global High Performers. Out of the 21 operators that place in this category, only five are from another region – all being from the Asia Pacific region. They are: Taiwan Mobile, SoftBank, FarEasTone, KT and NTT docomo. European Global High Performers for Excellent Consistent Quality include Telekom and Orange from Slovakia, A1 Austria, Vodafone Netherlands and Telia Sweden.

Singapore's StarHub comes top in South East Asia with a score of 83.3%, while out of all the operators analyzed in Africa and the Middle East, Turkcell has the highest score for Excellent Consistent Quality – 77.5%. Turning to the Americas, T-Mobile Puerto Rico has the highest score in South and Central America with 76.8%, while in North America, T-Mobile U.S. and Canada's Telus tie for regional first place with statistically tied scores of 80.8-80.9%.



## Core Consistent Quality – Global



(Only highest ranked operators listed on chart)



OPEN SIGNAL

0 20 40 60 80 100  
(% of tests)

Data collection period 1 July – 27 December 2022 | © Opensignal Limited

Core Consistent Quality is the percentage of users' tests that met the minimum recommended performance thresholds for lower-performance applications including SD video, voice calls and web browsing.

Given high inflation, Core Consistent Quality is becoming increasingly relevant. This is because it helps our users understand how often they can rely on their cellular connections to carry out simple common tasks. This is key when users are looking for an operator that can meet their basic requirements at a competitive price.

There is only one Global Winner for Core Consistent Quality: Telia Finland with a score of 97.2% – far ahead of the global average of 82%. However, it wins by a slender margin, given TDC Denmark and Elisa Finland's identical scores of 97%. Telia Finland is also one of two joint Global Winners for Excellent Consistent Quality, alongside Telia Estonia. Finland's other two national operators, DNA and Elisa, are Global Leaders for Core Consistent Quality, along with three out of four Danish operators (TDC, Telia and Telenor), Swedish 3 and Tele2, Slovakia's Orange and Telekom, and Telia Estonia.

European Global High Performers include all three of Norway's national operators (ice, Telenor and Telia), A1 Austria and Swisscom – the only operator from Switzerland to be recognized for Core Consistent Quality.

Only three out of 21 Global High Performers for Core Consistent Quality hail from outside Europe: Taiwan Mobile, SoftBank and FarEasTone. Taiwan Mobile and SoftBank are statistically tied for the regional top spot in Asia Pacific with scores of 93.7–93.8%, while StarHub has the highest score in South East Asia (92.3%). Out of all the operators analyzed in Africa and the Middle East, Turkcell takes regional first place with 90.7% – the same position it has for Excellent Consistent Quality.

In South and Central America, T-Mobile Puerto Rico comes top with 88.6%, giving it a slender lead over Movistar Uruguay's 88.3%. Finally, T-Mobile U.S. has the highest score for Core Consistent Quality in North America – 91.6% ahead of second-placed Telus' 90.7%.

# Opensignal's 2023 Global Rising Stars

We now take a look at the Global Rising Stars: the top 30 operators around the world on which our users have seen the greatest percentage improvement in mobile network experience in the last year. We compare their experience between the second half of 2022 and the same period in 2021.

We have Global Rising Stars awards for five key measures of the real-world mobile network experience: Games Experience, Voice App Experience, Download Speed Experience, Upload Speed Experience and Time on 4G/5G.

Global Rising Stars celebrate the recent achievements of those operators that have made rapid progress in improving the experience of their users in a short period of time. By contrast, Opensignal's Global Winner awards highlight the fruits of many years of cumulative effort and investment in comparing the current state of users' mobile experience on different operators.

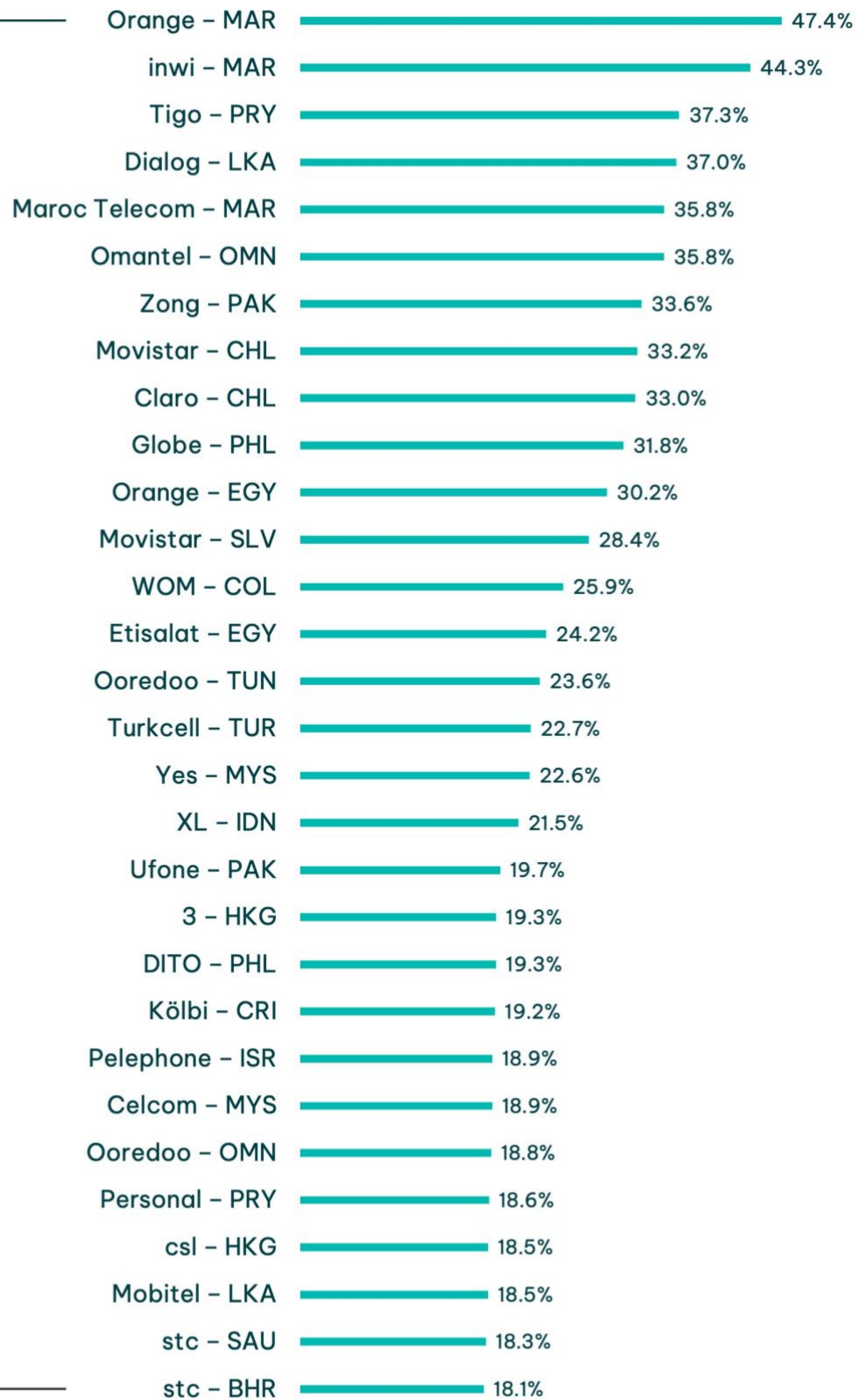
Some operators have significantly improved the mobile experience of users across most of the metrics we've analyzed. Ufone Pakistan has managed the remarkable feat of being a Global Rising Star across all five categories, while a further six operators are Global Rising Stars across four categories: Banglalink, WOM Colombia, Orange Egypt, Celcom and Yes in Malaysia and Globe in the Philippines. Globe is a Global Rising Star for Games Experience, Voice App Experience, Upload Speed Experience and Time on 4G/5G. The Philippines' new operator, DITO, is a Global Rising Star for Games Experience, Voice App Experience and Download Speed Experience.

T-Mobile is the only operator in the U.S. to be recognized as a Global Rising Star – it earns this recognition due to a 62.4% increase in the average overall download speeds observed by our users on its network. Out of the four national operators in the U.K., only 3 is a Global Rising Star – achieving this accolade for the percentage improvement in its Download Speed Experience and Time on 4G/5G scores – 51.5% and 9.6%, respectively. In Hong Kong only 3 (Games Experience) and csl (Games Experience, Voice App Experience) are Global Rising Stars.

In Europe, only one operator is a Global Rising Star across three categories – A1 Bulgaria (Download Speed Experience, Upload Speed Experience and Time on 4G/5G). Four European operators have two such accolades to their name: Telemach Croatia (Download Speed Experience and Time on 4G/5G), Telekom Romania, 3 Sweden and 3 U.K.



## Games Experience – Most Improved Year on Year



(Only highest ranked operators listed on chart)



OPENSIGNAL

0% 10% 20% 30% 40% 50%  
Change in Games Experience

Data collection period 1 July – 27 December 2021 & 2022 | © Opensignal Limited



Here we recognize operators for the percentage improvement in our user's experience when playing multiplayer mobile games over cellular connections between H2 2021 and H2 2022. Out of the 30 operators whose scores have risen the most, 12 hail from Africa and the Middle East, including the operator with the greatest global percentage improvement, Orange Morocco (47.4%) and its national rivals, inwi (44.3%) and Maroc Telecom (35.8%). Other operators from this region that gain this accolade include Oman's two established operators – Omantel and Ooredoo – as well as Orange Egypt and stc Saudi Arabia.

The region with the second largest representation in the top 30 is Asia Pacific with 11 operators, including Globe (31.8%) and DITO (19.3%) in the Philippines, along with 3 (19.3%) and csl (18.5%) in Hong Kong. The operator in the region with the largest improvement is Dialog Sri Lanka (37%), while our Globe users reported the greatest increase in South East Asia (31.8%).

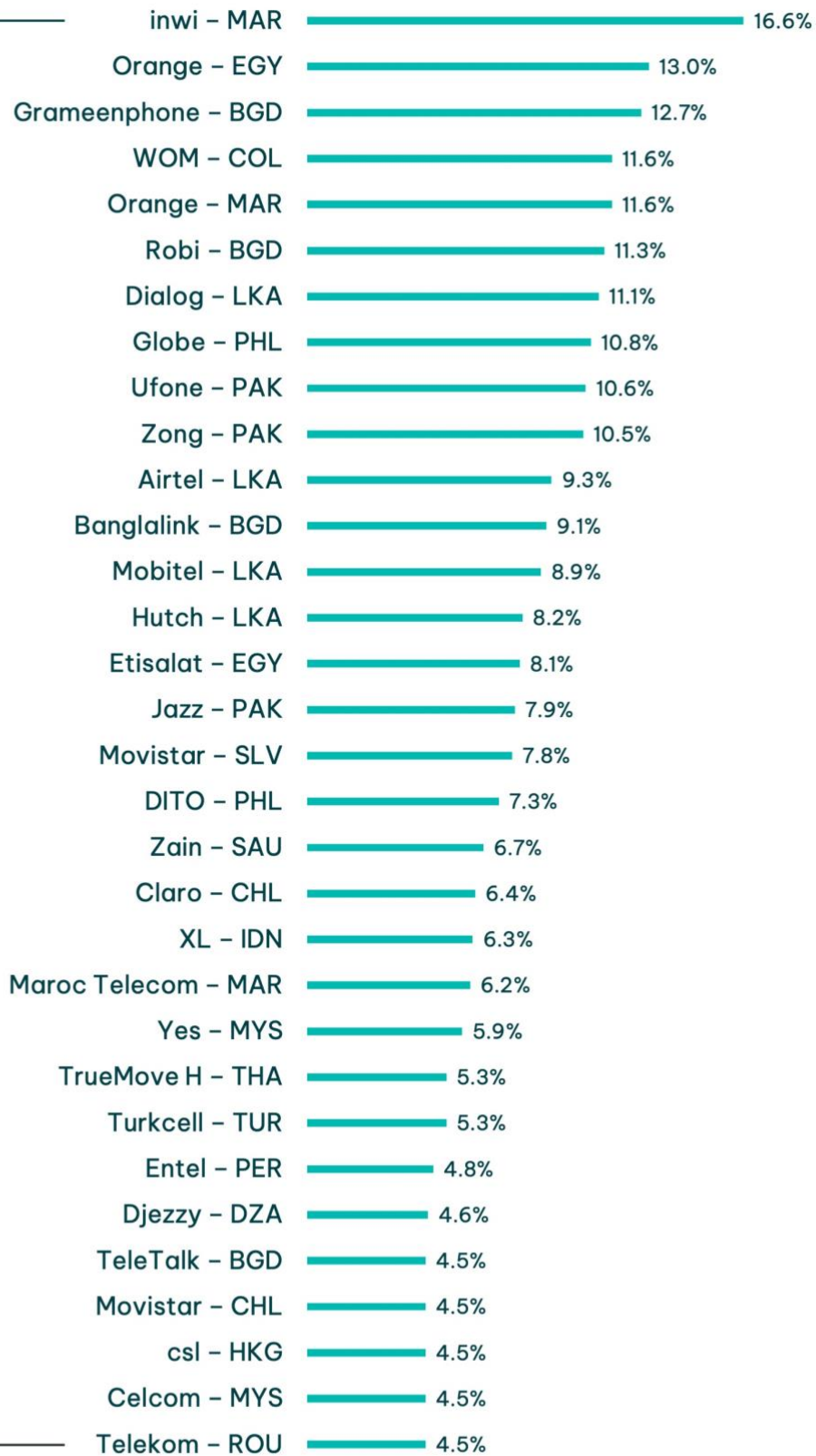
South and Central America makes up the balance, with seven operators making it through to the top 30, such as Tigo Paraguay (37.3%) – the operator with the greatest improvement in the region – along with Chile's Movistar (33.2) and Claro (32%), El Salvador's Movistar (28.4%) and Kölbi Costa Rica (19.2%).

Neither European nor North American operators have placed in the top 30. While not being Global Rising Stars, Telenet Belgium (15.6%) and AT&T Mexico (5.1%) saw the greatest percentage improvement in their Games Experience scores in these two regions.

All of our Global Rising Stars for Games Experience increased their scores by at least 12 percentage points more than the Global average improvement of 6.1%.



## Voice App Experience – Most Improved Year on Year



(Only highest ranked operators listed on chart)



OPENSIGNAL

0% 5% 10% 15% 20%

Change in Voice App Experience

Data collection period 1 July – 27 December 2021 & 2022 | © Opensignal Limited

Our users on inwi Morocco's network saw the greatest improvement in their Voice App Experience between H2 2021 and H2 2022 – an impressive 16.6%, which moved their experience when using over-the-top voice apps from the Very Poor (60–66) category to Acceptable (74–80). Out of all 32 Global Rising Stars for Voice App Experience, inwi is the only operator to go up two categories.

In total, eight Global Rising Stars come from Africa and the Middle East, including inwi and Orange Egypt, which saw the second largest percentage improvement in Voice App Experience (13%). All three of Morocco's national operators (inwi, Maroc Telecom and Orange) are Global Rising Stars for Voice App Experience.

More than half of the Global Rising Stars in this category hail from the Asia Pacific region, including Bangladesh's Grameenphone, which saw the greatest percentage improvement in the region (12.7%). All of Bangladesh's and Sri Lanka's national operators are Global Rising Stars for Voice App Experience.

Looking at South East Asia, the Philippines' Globe comes top with 10.8% and is closely followed by DITO with 7.3%. In East Asia, our csl users in Hong Kong saw the greatest improvement – 4.5%.

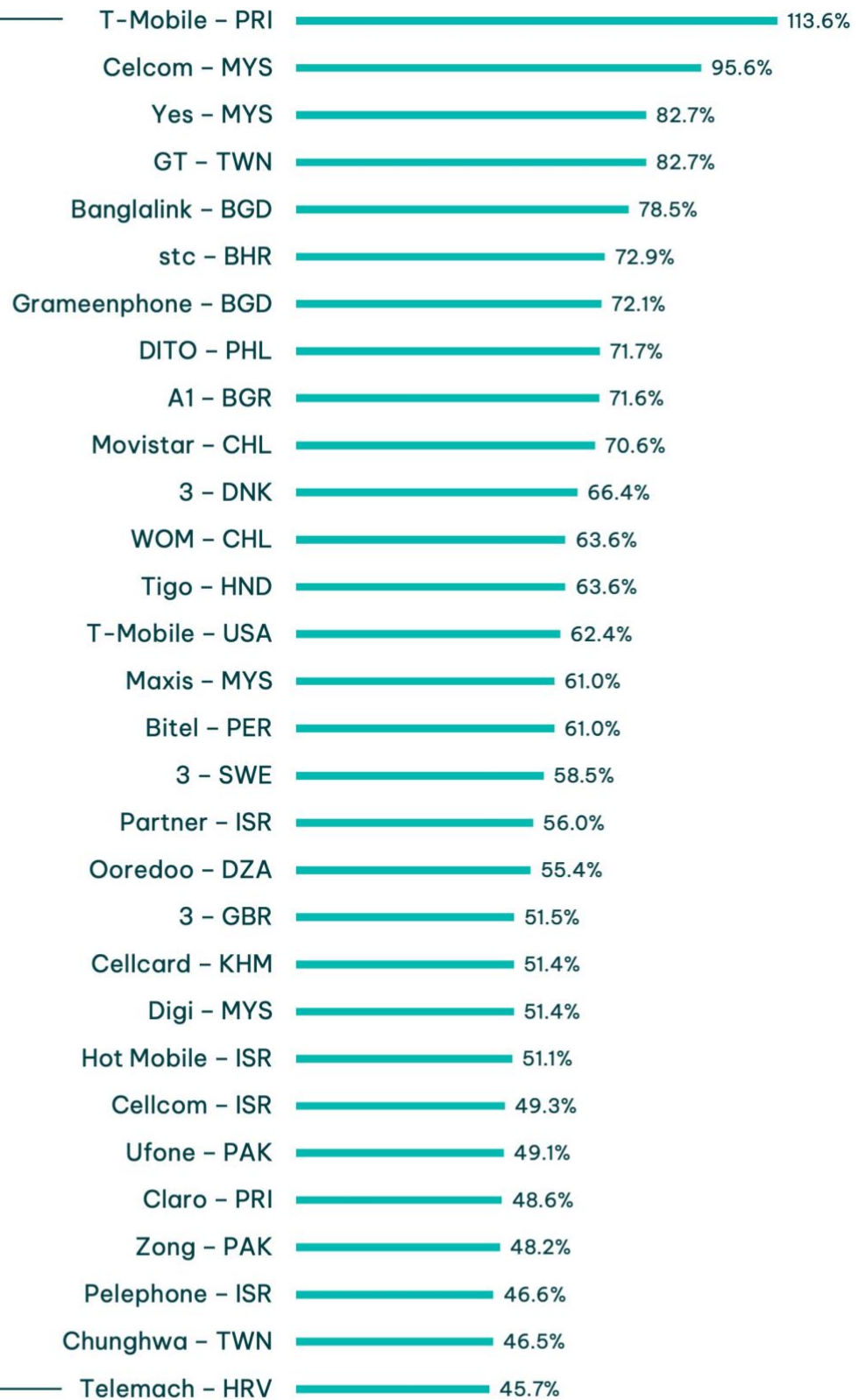
South and Central America contributes five Global Rising Stars, including WOM Colombia – which saw the greatest improvement in the region (11.6%) – Movistar El Salvador (7.8%), Chile's Claro (6.4%) and Movistar (4.5%) and Entel Peru (4.8%).

Only one Global Rising Star for Voice App Experience comes from Europe – Romania's Telekom with an improvement of 4.5%.

All of our Global Rising Stars for Voice App Experience increased their scores by at least 3.1 percentage points more than the Global average improvement of 1.4%.



## Download Speed Experience – Most Improved Year on Year



(Only highest ranked operators listed on chart)



OPEN SIGNAL

0% 20% 40% 60% 80% 100% 120%  
Change in Download Speed Experience

Data collection period 1 July – 27 December 2021 & 2022 | © Opensignal Limited

While South and Central America accounts for only six of the 30 Global Rising Stars for Download Speed Experience, these six include T-Mobile Puerto Rico, which saw its average overall download speeds increase by a massive 113.6% between H2 2021 and H2 2022. Also hailing from this region are Movistar Chile (70.6%), Tigo Honduras (63.6%), Bitel Peru (61%) and Claro Puerto Rico (48.6%).

There are 12 Global Rising Stars that are based in the Asia Pacific region, including Celcom Malaysia, which saw the largest percentage improvement in the region (95.6%) and three of its national rivals. Other Global Rising Stars for Download Speed Experience from Asia Pacific include Bangladesh's Banglalink (78.5%) and Grameenphone (72.1%), DITO in the Philippines (71.7%), Cambodia's Cellcard (51.4%) and Chunghwa Taiwan (46.5%).

All four of Israel's operators are in the top 30 – Cellcom, Hot Mobile, Partner and Pelephone.

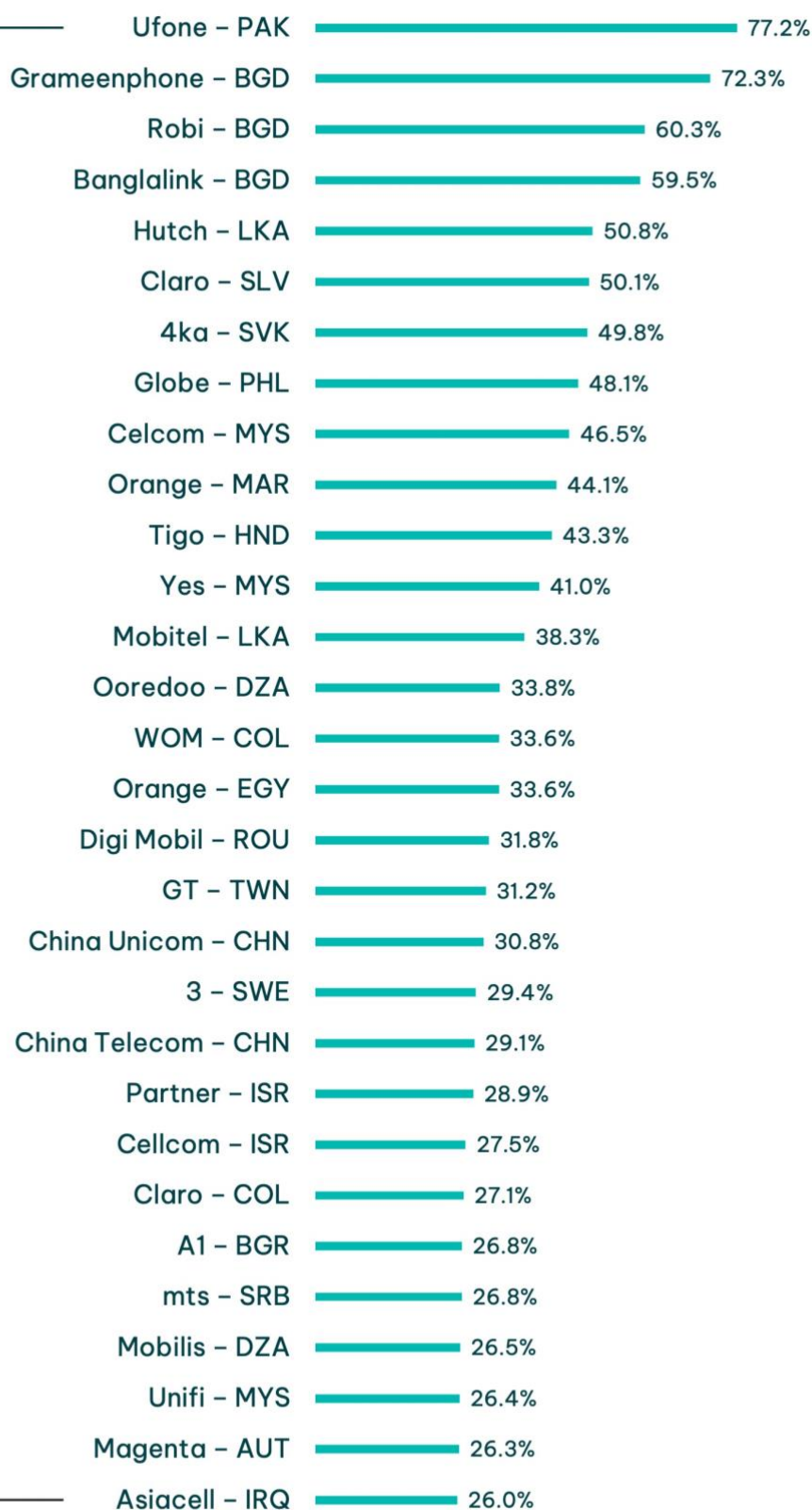
T-Mobile is the only operator in North America to be recognized as a Global Rising Star for Download Speed Experience – due to a 62.4% increase in the average overall download speeds observed by our users on its network.

Of the five European operators that have made it through to the top 30, our users saw the greatest improvement on A1 Bulgaria's network – a rise of 71.6%. The other European operators that are Global Rising Stars for Download Speed Experience are 3 Denmark (66.4%), 3 Sweden (58.5%), 3 U.K. (51.5%) and Telemach Croatia (45.7%).

All of our Global Rising Stars for Download Speed Experience increased their scores by at least 27 percentage points more than the Global average improvement of 18.7%.



## Upload Speed Experience – Most Improved Year on Year



(Only highest ranked operators listed on chart)



OPEN SIGNAL

0% 20% 40% 60% 80% 100%

Change in Upload Speed Experience

Data collection period 1 July – 27 December 2021 & 2022 | © Opensignal Limited



The top five operators for the highest percentage in our users' average upload speeds between H2 2021 and H2 2022 all hail from South Asia, with those on Ufone Pakistan's network reporting the largest global increase of 77.2%. Ufone is followed by three out of four of Bangladesh's national operators – Grameenphone (72.3%), Robi (60.3%) and Banglalink (59.5%) along with Sri Lanka's Hutch (50.8%).

The next three operators have the greatest improvements in their respective regions: Claro El Salvador (South and Central America, 50.1%), 4ka Slovakia (Europe, 49.8%) and Globe in the Philippines (South East Asia, 48.1%). Out of all the operators analyzed from Africa and the Middle East, Orange Morocco comes top with an increase of 44.1%.

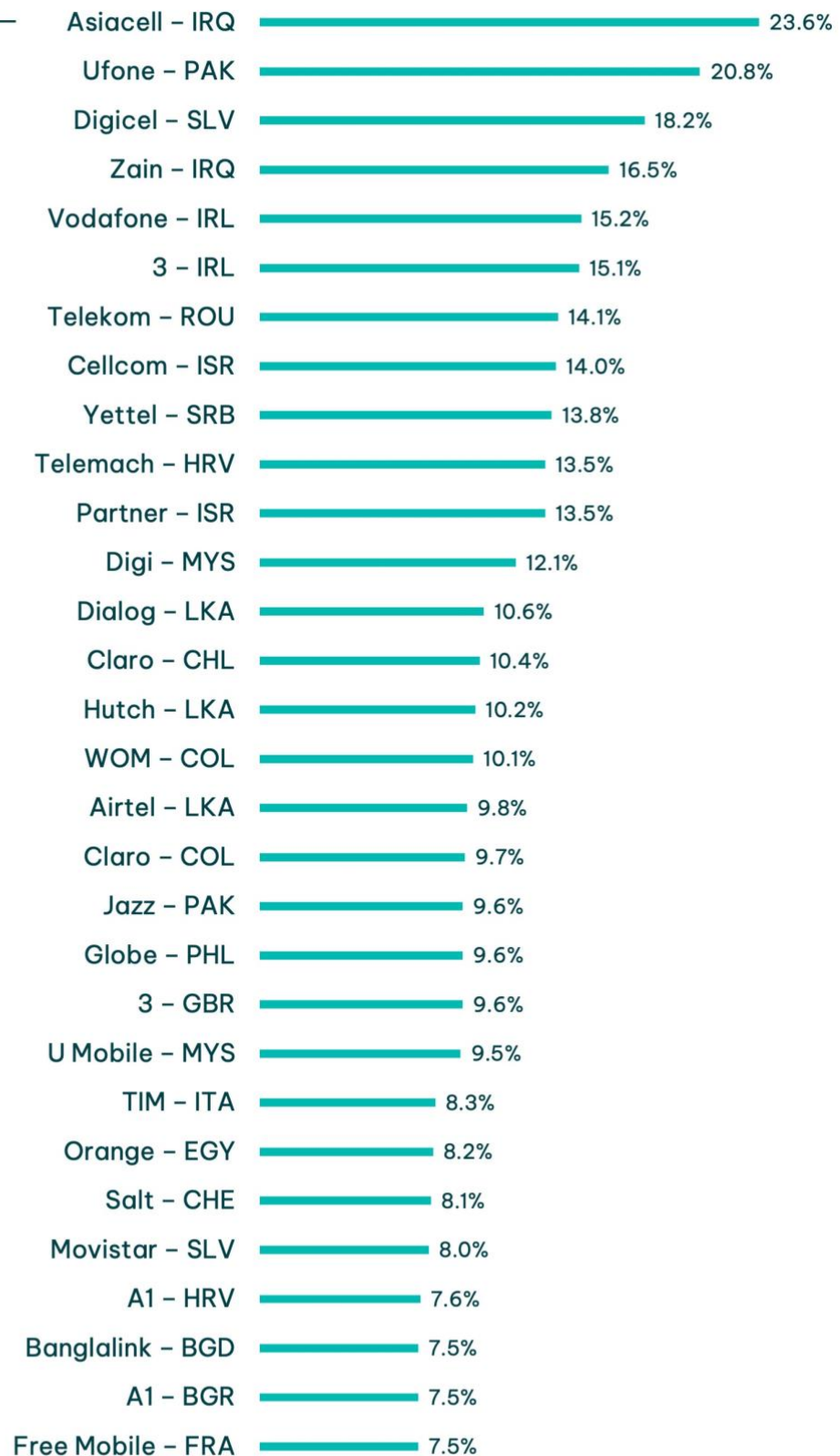
Altogether, 13 of 30 Global Rising Stars for Upload Speed Experience hail from the Asia Pacific region, followed by seven from Africa and the Middle East, six from Europe and four from South And Central America.

All of our Global Rising Stars for Upload Speed Experience increased their scores by at least 17.8 percentage points more than the Global average improvement of 8.2%.

While it is not a Global Rising Star for Upload Speed Experience, our users on T-Mobile U.S.'s network saw the greatest improvement in their average upload speeds in North America – 10.3%.



## Time on 4G/5G – Most Improved Year on Year



(Only highest ranked operators listed on chart)



OPEN SIGNAL

0% 5% 10% 15% 20% 25%  
Change in Time on 4G/5G

Data collection period 1 July – 27 December 2021 & 2022 | © Opensignal Limited

Iraq's Asiacell comes top of the global pack for the percentage improvement in Time on 4G/5G with a remarkable increase of 23.6%. Our users on fellow Iraqi operator Zain saw the fourth largest increase – 16.5%. Users on Ufone Pakistan and Digicel El Salvador reported the greatest percentage improvement in South Asia, and South and Central America respectively, with gains of 20.8% and 18.2%, respectively.

Over in Europe, Vodafone Ireland narrowly saw the greatest percentage increase in Time on 4G/5G (15.2%), with 3 Ireland behind it by just 0.1 percentage points.

All of our Global Rising Stars for Time on 4G/5G increased their scores by at least 3.9 percentage points more than the Global average improvement of 3.6%.

While it is not a Global Rising Star for Time on 4G/5G, our Chunghwa users in Taiwan saw the largest percentage increase in the proportion of time they spend connected to 4G/5G in East Asia – 3.3%.

# It is the best of times, it is the worst of times – good mobile experience is vital either way

Looking ahead, there are a number of factors that will play an important role in shaping the mobile industry. Given the economic pressures caused by high inflation, consumers will keep hold of their old smartphones for longer, meaning that it will take longer for new network standards to achieve the mass adoption required for operators and app developers to take full advantage of them. Users will increasingly want to ensure their overall experience is good enough to support all of their needs – so measures such as Core Consistent Quality and Excellent Consistent Quality will prove even more important. In addition, high energy prices are prompting operators to invest in energy-saving initiatives to defend their margins and work faster to retire older generations of mobile technology.

While there was much talk of the metaverse in 2022, currently XR/VR/MR/AR is overwhelmingly an indoor experience – so without massive innovation and investment in producing light unobtrusive headgear that can safely be used on the move, the business case for including relatively expensive 5G hardware in headsets will be limited in the near to medium term. Therefore, when users are outside the home or workplace, traditional multiplayer gaming or video streaming will be the mainstays of smartphone users' entertainment. Opensignal's Games Experience and Video Experience categories highlight the operators best suited to entertaining users and distracting them from the often gloomy news headlines.

One of the biggest new developments is the arrival of smartphone satellite connectivity to fill in gaps in mobile coverage. To date, partnerships have been announced between [Qualcomm and Iridium](#), [Apple and Globalstar](#), [Bullitt and MediaTek](#), [T-Mobile U.S. and SpaceX](#), and [Huawei and BeiDou](#) among others. While it is still early days and the current solutions are proprietary, satellite connectivity is a part of upcoming 3GPP 5G standards. Satellite connectivity means that the coverage available to someone with a modern phone capable of supporting it will vary depending on the application they are trying to use.

But at best, smartphone satellite connectivity is a service to enable mobile messaging – to embrace web browsing, browse social media apps, play multiplayer games, download apps or watch video users still need access to a 4G or 5G network. This is why the time users spend connected to 4G/5G continues to be such an important measure.

To help operators, regulators and users navigate these trends – and as part of its mission to advance connectivity for all – Opensignal will continue to share its deep analysis of the mobile network experience. Look out for an in-depth look at the experience of our users when watching live video streams over cellular connections in the next few weeks.

# Operators analyzed

3 – Austria	Claro – Puerto Rico	Maroc Telecom – Morocco
+Móvil – Panama *	Claro – Uruguay	Maxis – Malaysia
2degrees – New Zealand	CMHK – Hong Kong	MEO – Portugal
3 – Austria	Cosmote – Greece	Metfone – Cambodia
3 – Denmark	csl – Hong Kong	MobiFone – Vietnam
3 – Hong Kong	Dhiraagu – Maldives	Mobilis – Algeria
3 – Indonesia	Dialog – Sri Lanka	Mobily – Saudi Arabia
3 – Ireland	Digi – Malaysia ***	Mobitel – Sri Lanka
3 – Sweden	Digi Mobil – Romania	Movistar – Argentina
3 – UK	Digicel – El Salvador	Movistar – Chile
4ka – Slovakia	Digicel – Panama	Movistar – Colombia
A1 – Austria	DIGIMobil – Hungary	Movistar – El Salvador
A1 – Bulgaria	DITO – Philippines	Movistar – Mexico
A1 – Croatia	Djezzy – Algeria	Movistar – Peru
A1 – Serbia	DNA – Finland	Movistar – Spain
A1 – Slovenia	DTAC – Thailand	Movistar – Uruguay
Airtel – India	du – United Arab Emirates	MTN – Afghanistan
Airtel – Sri Lanka	EE – UK	MTN – South Africa
AIS – Thailand	eir – Ireland	mts – Serbia
ALBtelecom – Albania **	Elisa – Estonia	NOS – Portugal
Antel – Uruguay	Elisa – Finland	Nova – Greece ****
Asiacell – Iraq	Entel – Bolivia	NTT docomo – Japan
AT&T – Mexico	Entel – Chile	O2 – Czech Republic
AT&T – USA	Entel – Peru	O2 – Germany
au – Japan	Etisalat – Afghanistan	O2 – Slovakia
AWCC – Afghanistan	Etisalat – Egypt	O2 – UK
Banglalink – Bangladesh	Etisalat – United Arab Emirates	Omantel – Oman
Batelco – Bahrain	Emirates	ONE – Albania **
Bell – Canada	FarEasTone – Taiwan	Ooredoo – Algeria
Bite – Latvia	Free Mobile – France	Ooredoo – Kuwait
BITĖ – Lithuania	Globe – Philippines	Ooredoo – Maldives
Bitel – Peru	Grameenphone – Bangladesh	Ooredoo – Oman
Bouygues – France	GT – Taiwan	Ooredoo – Palestine
BSNL – India	Hot Mobile – Israel	Ooredoo – Qatar
Celcom – Malaysia ***	HT – Croatia	Ooredoo – Tunisia
Cell C – South Africa	Hutch – Sri Lanka	Optus – Australia
Cellcard – Cambodia	ice – Norway	Orange – Belgium
Cellcom – Israel	Iliad – Italy	Orange – Egypt
China Mobile – China	Indosat – Indonesia	Orange – France
China Telecom – China	inwi – Morocco	Orange – Morocco
China Unicom – China	Jawwal – Palestine	Orange – Poland
Chunghwa – Taiwan	Jazz – Pakistan	Orange – Romania
Claro – Argentina	Jio – India	Orange – Slovakia
Claro – Brazil	Kölbi – Costa Rica	Orange – Spain
Claro – Chile	Korek – Iraq	Orange – Tunisia
Claro – Colombia	KPN – Netherlands	Partner – Israel
Claro – Costa Rica	KT – South Korea	Pelephone – Israel
Claro – El Salvador	LG U+ – South Korea	Personal – Argentina
Claro – Guatemala	Liberty – Costa Rica	Personal – Paraguay
Claro – Honduras	Liberty – Puerto Rico	Play – Poland
Claro – Nicaragua	LMT – Latvia	Plus – Poland
Claro – Panama *	M1 – Singapore	Proximus – Belgium
Claro – Paraguay	Magenta – Austria	Rakuten – Japan
Claro – Peru		Robi – Bangladesh

Rogers – Canada  
Roshan – Afghanistan  
Salt – Switzerland  
SFR – France  
SIMBA – Singapore  
Singtel – Singapore  
SK telecom – South Korea  
Smart – Cambodia  
Smart – Philippines  
Smartfren – Indonesia  
SmarTone – Hong Kong  
SoftBank – Japan  
Spark – New Zealand  
StarHub – Singapore  
stc – Bahrain  
stc – Kuwait  
stc – Saudi Arabia  
Sunrise – Switzerland  
Swisscom – Switzerland  
T Star – Taiwan  
T-2 – Slovenia  
T-Mobile – Czech Republic  
T-Mobile – Netherlands  
T-Mobile – Poland  
T-Mobile – Puerto Rico  
T-Mobile – USA  
Taiwan Mobile – Taiwan  
TDC – Denmark  
Telcel – Mexico  
Tele2 – Estonia  
Tele2 – Latvia  
Tele2 – Lithuania  
Tele2 – Sweden  
Telekom – Germany  
Telekom – Hungary  
Telekom – Romania  
Telekom – Slovakia  
Telekom Slovenije – Slovenia  
Telemach – Croatia  
Telemach – Slovenia  
Telenet – Belgium  
Telenor – Denmark  
Telenor – Norway  
Telenor – Pakistan  
Telenor – Sweden  
TeleTalk – Bangladesh  
Telia – Denmark  
Telia – Estonia  
Telia – Finland  
Telia – Lithuania  
Telia – Norway

Telia – Sweden  
Telkom – South Africa  
Telkomsel – Indonesia  
Telstra – Australia  
Telus – Canada  
Tigo – Bolivia  
Tigo – Colombia  
Tigo – El Salvador  
Tigo – Guatemala  
Tigo – Honduras  
Tigo – Nicaragua  
Tigo – Panama  
Tigo – Paraguay  
TIM – Brazil  
TIM – Italy  
TrueMove H – Thailand  
Tunisie Telecom – Tunisia  
Türk Telekom – Turkey  
Turkcell – Turkey  
U Mobile – Malaysia  
Ufone – Pakistan  
Unifi – Malaysia  
Verizon – USA  
Vi – India  
Vietnamobile – Vietnam  
Viettel Mobile – Vietnam  
Vinaphone – Vietnam  
Viva – Bolivia  
Vivacom – Bulgaria  
Vivo – Brazil  
Vodacom – South Africa  
Vodafone – Albania  
Vodafone – Australia  
Vodafone – Czech Republic  
Vodafone – Egypt  
Vodafone – Germany  
Vodafone – Greece  
Vodafone – Hungary  
Vodafone – Ireland  
Vodafone – Italy  
Vodafone – Netherlands  
Vodafone – New Zealand  
Vodafone – Oman  
Vodafone – Portugal  
Vodafone – Qatar  
Vodafone – Romania  
Vodafone – Spain  
Vodafone – Turkey  
Vodafone – UK  
WE – Egypt  
WindTre – Italy  
WOM – Chile

WOM – Colombia  
XL – Indonesia  
Yes – Malaysia  
Yettel – Bulgaria  
Yettel – Hungary  
Yettel – Serbia  
Yoigo – Spain  
Zain – Bahrain  
Zain – Iraq  
Zain – Kuwait  
Zain – Saudi Arabia  
Zong – Pakistan

\* Cable & Wireless Panama (CWP, +Móvil) [completed its acquisition of Claro Panama in July 2022 and integrated its mobile networks in October 2022](#). However, as of the time of writing this report, they were still trading as separate brands – so we have analyzed them separately.

\*\* The legal merger between ALBtelecom and ONE Telecommunications came into effect [on January 1, 2023](#). As the operators were separate entities during both H2 2022 and H2 2021, we have analysed them individually.

\*\*\* The merger of Celcom and Digi and the creation of a new entity, Celcom Digi took place [in late 2022](#). As both brands are still in use and operated using separate networks for the data collection period, we have treated them separately in this analysis.

\*\*\*\* Nova has replaced the Wind brand and [now includes Wind's mobile operations](#). We therefore refer to Nova in this report.



### **How Opensignal measures mobile network experience**

We report as accurately as possible the real-world mobile experience as recorded by mobile network users. To make decisions based on our market insights, network operators, regulators, analysts and consumers need to know the facts we present are accurate and that the comparisons we make are valid.

Please visit: <https://www.opensignal.com/methodology-overview>

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