umlaut

connect

THE 2020 MOBILE NETWORK TEST IN SPAIN

For the sixth time, the benchmarking expert umlaut and connect magazine have conducted their authoritative benchmark of the Spanish mobile networks. And, once again, we seized the opportunity to further enhance the underlying methodology.

While all operators in Spain strongly worked on expanding their 4G networks and on establishing their first 5G installations, we wanted to find out: Which contender offers the best performance and the highest reliability of mobile voice and data services?

Gijon
Bilbao
León
Pamplona/Iruña
Vigo
Zaragoza
Barcelona
Madrid
Leganés
Albacete
Valencia
Córdoba
Murcia
Sevilla
Jaén
Cartagena
Jerez de la Frontera
Málaga
Marbella
Almería
Algeciras

- Drivetest
- Walktest
— Roads

KEY FINDINGS

Vodafone wins the umlaut connect Mobile Benchmark Spain for the sixth time in a row. Movistar follows with a gap of only three points and leads in the Data category. Orange ranks third and Yoigo fourth.

umlaut's network benchmarks are widely accepted as the de-facto industry standard and for being highly objective. The carefully designed methodology of our 2020 benchmark in Spain reflects umlaut's holistic approach to network benchmarking. Its benchmarks combine drivetests and walktests to execute detailed voice and data measurements under controlled circumstances with a sophisticated crowdsourcing approach. This provides profound insights into the overall coverage of voice and data (with focus on 4G and 5G) services, real-world User Download Speeds and the Quality of Broadband Service. The drivetests and walk-tests allow for evaluating the maximum of the networks' capabilities. Crowdsourcing reveils the service quality and performance actually experienced by real users. We have thoroughly weighted these components in order to give a realistic and authoritative assessment of the rated networks' true potential and performance.
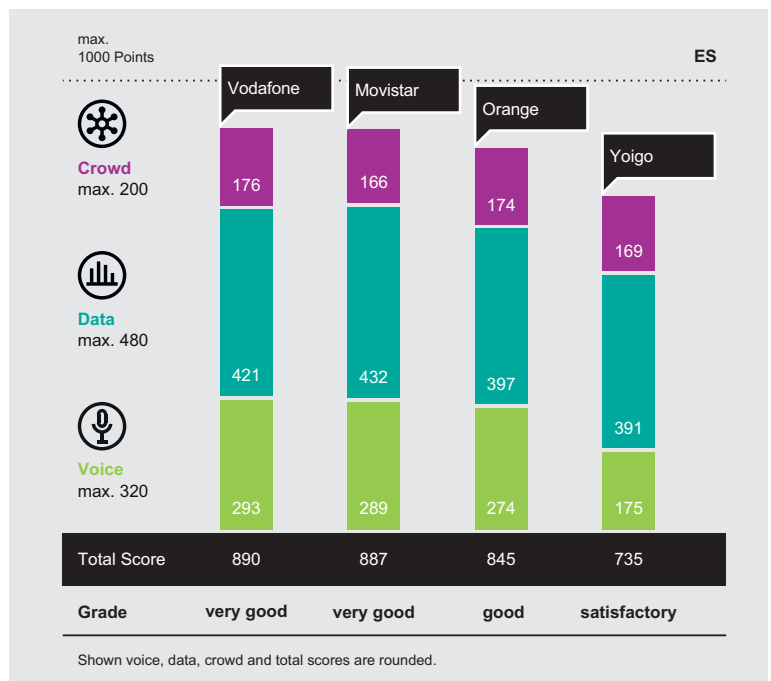
Even in the time of the Corona pandemic, our analyses showed that the networks remained stable, though with somewhat altered customer usage patterns. When conducting this year's benchmark, we have of course carefully adapted the logistics to ensure maximum safety for our team members.

VODAFONE IS THE OVERALL WINNER, MOVISTAR ACHIEVES HUGE SCORE IMPROVEMENT

Vodafone managed to continue its winning streak, scoring best in the umlaut connect Mobile Benchmark Spain for the sixth time in a row. The win is achieved by taking the lead in the Voice and Crowdsourcing categories. However, Movistar comes very close with a gap of only three points to Vodafone, showing a massive score improvement of 63 points compared to last year's result – mainly gained in the Voice category. In contrast, the other three contenders could not maintain their score levels from the previous year and have lost points. Also, Movistar is taking the lead in the Data category.

Orange falls back to the third position from last year's second rank and achieves the grade "good" (2019: "very good"). Yoigo ranks last, falling back from 2019's "good" to the grade "satisfactory" this year. Still, Yoigo ranks second in the Crowdsourcing category, and together with Orange achieved the fastest crowdsourced user Download Data Rates.

> Vodafone is the overall winner, with Movistar following at a close distance while impressively improving its score compared to our 2019 benchmark – achieving a plus of 63 points. Orange ranks in the midfield with a good result, Yoigo achieves the overall grade "satisfactory".

	Vodafone	Movistar	Orange	Yoigo
Crowd max. 200	176	166	174	169
Data max. 480	421	432	397	391
Voice max. 320	293	289	274	175
Total Score	890	887	845	735
Grade	very good	very good	good	satisfactory

Shown voice, data, crowd and total scores are rounded.

Overall Results		Vodafone	Movistar	Orange	Yoigo
Voice	max. 320 P.	293	289	274	175
Cities (Drivetest)	144	91%	90%	83%	54%
Cities (Walktest)	48	99%	96%	97%	67%
Towns (Drivetest)	64	97%	95%	93%	58%
Roads (Drivetest)	64	82%	82%	76%	44%
Data	max. 480 P.	421	432	397	391
Cities (Drivetest)	216	87%	89%	82%	80%
Cities (Walktest)	72	93%	92%	89%	88%
Towns (Drivetest)	96	88%	91%	83%	85%
Roads (Drivetest)	96	87%	89%	78%	78%
Crowdsourced Quality	max. 200P.	176	166	174	169
Crowd	200	88%	83%	87%	84%
Connect Rating	max. 1000 P.	890	887	845	735

Percentages and points rounded to integer numbers.
For the calculation of points and totals, the accurate, unrounded values were used.

SPAIN'S OPERATORS

The three largest Spanish mobile network operators are in constant competition for subscribers and market share. After having consistently increased their LTE coverage and speeds, now all four Spanish operators have also launched 5G installations in varying degrees.

movistar

Movistar is the brand name the Spanish telecommunications company Telefónica uses for the mobile network in its home market. Telefónica S.A. is one of the largest telco companies in the world. The operator is active in 17 countries with a total of 117,300 employees and achieved worldwide revenues of over €48 billion in its fiscal year 2019. While the company introduced the Movistar brand in Latin American countries in 2005, it has been active in Spain since the launch of GSM services back in 1995. Today, Movistar is the largest mobile operator in Spain with approx. 19 million subscribers, which equates to a market share of over 30 per cent. It offers GSM service at 900 and 1800 MHz, UMTS/3G at 900 and 2100 MHz and LTE at 800, 1800 and 2600 MHz. Movistar is supporting 4G+ carrier aggregation with maximum speeds reaching up to 1 Gbps. The operator claims to provide 4G coverage of more than 96 per cent of the Spanish population and has recently switched on 5G on 3500 MHz alongside reformed 1800 and 2100 MHz frequencies, claiming to provide 5G signals to 75 per cent of the Spanish population by the end of 2020.

orange™

Orange España is the brand name of France Telecom's mobile network in Spain. It has been operating under this name since 2006. Previously, the network was known as "Amena" – this brand name lives on in Orange Spain's portfolio as a low-cost offer that is only available via the internet. Also, its network serves a number of mobile virtual network operators such as MasMovil, Carrefour Móvil and others.
With approx. 16 million mobile customers, Orange is the second largest Spanish mobile operator with a market share of about 25 per cent. In the fiscal year 2019, Orange Spain reported a revenue of €5.3 billion which contributed approx. 13 per cent to the Orange Group's total revenue. Orange Spain has deployed 2G networks at 900 and 1800 MHz, 3G networks at 900 and 2100 MHz and 4G at 800, 1800 and 2600 MHz. The operator claims that its 4G network reaches more than 97 per cent of the Spanish population. In 2020, Orange has launched 5G services on 3500 MHz in selected parts of the five cities Madrid, Barcelona, Valencia, Seville and Malaga and plans to expand it rapidly to other cities.

vodafone

Vodafone España has been present on the Spanish mobile communications market since the year 2000. Then, the British Vodafone Group acquired Airtel Móviles which had operated in Spain since 1994. With approx. 14 million subscribers, Vodafone has a share of about 23 per cent of the Spanish mobile market. This makes Vodafone the third largest operator in the country following at close distance behind its competitor Orange. In the fiscal year 2019, Vodafone Spain achieved revenues of €4.3 billion which contributes about 12 per cent to the whole Vodafone Group's financial results.
Vodafone's mobile network in Spain offers GSM service at 900 and 1800 MHz, UMTS/3G at 900 and 2100 MHz and LTE at 800, 1800, 2100 and 2600 MHz. The Vodafone 4G network in Spain supports LTE 4 carrier aggregation (4CA or "4G+") with maximum speeds of 1 Gbps. Vodafone España claims to offer the best LTE coverage in Spain, reaching approx. 98 per cent of the Spanish population. The operator was the first to launch 5G in Spain and now operates 5G network cells on 3500 MHz in 21 cities across the country.

yoigo

Yoigo was the latest mobile operator to enter the Spanish market. Founded in 2000 under the name Xfera, the company started its actual operation in 2006, offering only a UMTS/3G network at 2100 MHz. At this time, the Swedish telecommunications company TeliaSonera acquired the majority of shares and rebranded the network as "Yoigo". In June 2016, the former MVNO Másmóvil bought the company. For its fiscal year 2019, Másmóvil reported a record year with revenues of €1.7 billion and an increase of 1.4 million customers, resulting in now 7.4 million mobile subscribers or a market share of approx. 14 per cent. Yoigo had a national roaming agreement with Movistar until the end of 2016. Since January 2017, Yoigo customers freely roam in the 2G , 3G and 4G networks of Orange at locations without Yoigo coverage. Yoigo operates 3G at 2100 MHz as well as 4G at 1800 MHz and 2100 MHz. Thanks to its roaming agreements, the operator claims an LTE coverage of approx. 98 per cent of the population. As the only Spanish operator, Yoigo currently does not support VoLTE. In 2020, Másmóvil has started to deploy 5G in 15 cities. Its further 5G roadmap is based on a combination of own infrastructure and an agreement with Orange.

The network benchmarks conducted by umlaut and connect are widely accepted as a completely objective authority. In 2020, we present the umlaut connect Mobile Benchmark Spain for the sixth time, with a further enhanced methodology

A CLOSE LOOK AT THE SPANISH NETWORKS

> Congratulations to Vodafone for being "Best in Test" the sixth time in a row now. On top, Vodafone successfully increased their 5G footprint, delivering high 5G throughputs. Congratulations also to Movistar. This operator is following with impressive improvements on a very good second position.
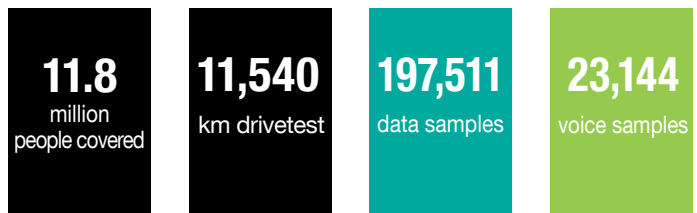>
> Hakan Ekmen, CEO Telecommunication at umlaut

umlaut, based in Aachen, Germany, is a world leader in mobile network testing. The company was formerly known as P3 and changed its name in fall 2019 in the course of restructuring and refocusing its activities. umlaut has over 4,500 employees, distributed over about 50 locations all over the world, and a turnover of more than 400 million Euros.

umlaut is partnering with the international telecommunications magazine connect, which has more than 25 years of editorial expertise and is one of the leading test authorities in Europe for telecommunications products and services. Together, umlaut and connect have been conductin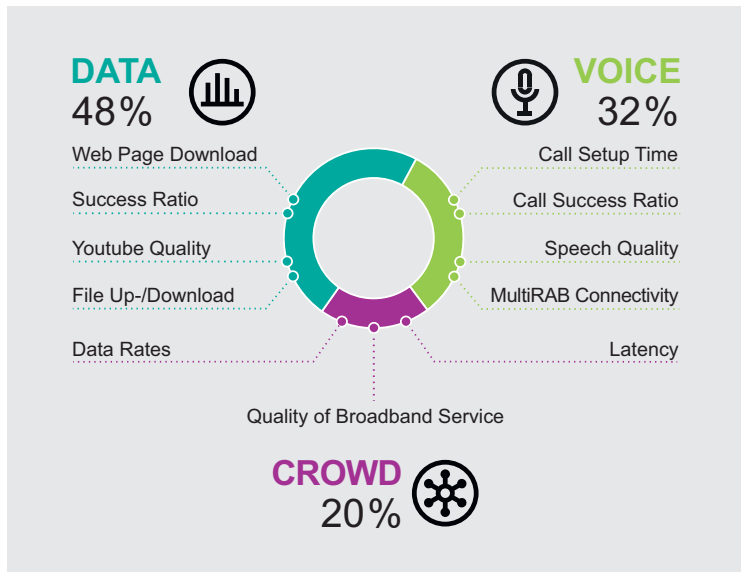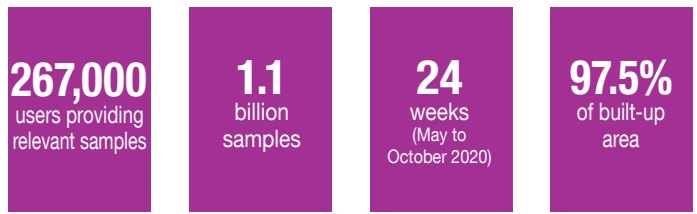g the most important network benchmark test in Germany for more than 15 years, extending it to other European countries since 2009. As the de-facto industry standard, umlaut's benchmarking methodology focuses on customer-perceived network quality.

Conducting the 2020 umlaut connect Mobile Benchmark Spain was certainly challenging in the light of the Corona pandemic. But the drivetest and walktest teams managed to realize all planned measurements during October 2020, covering a total of 11,540 km and approx. 25.4 per cent of the Spanish population. In addition, the score includes the results of extensive crowdsourcing analyses considering 24 weeks from May to October, 2020.

DRIVETEST AND WALKTEST FACTS

11.8 million people covered	**11,540** km drivetest	**197,511** data samples	**23,144** voice samples

CROWDSOURCING FACTS

267,000 users providing relevant samples	**1.1** billion samples	**24** weeks (May to October 2020)	**97.5%** of built-up area

DATA 48%
- Web Page Download
- Success Ratio
- Youtube Quality
- File Up-/Download
- Data Rates

VOICE 32%
- Call Setup Time
- Call Success Ratio
- Speech Quality
- MultiRAB Connectivity
- Latency

Quality of Broadband Service

CROWD 20%

VOICE

Many customers use voice services less intensely than data. However, when actually taking or placing a phone call, they expect reliable connections. How do the Spanish mobile networks manage to fulfil these expectations?

With the ongoing prevalence of LTE provision in the Spanish mobile networks, the use of Voice over LTE (VoLTE) has become the standard mode for the transmission of voice calls in most of the networks. At the time of testing, only Yoigo did still not support this modern voice standard and still offered its voice service on legacy-based technology.

VoLTE transmits voice calls as data packets over a 4G connection. This way, the otherwise necessary "circuit-switched fallback", which forces smartphones to switch back to 3G or 2G in order to take or place a phone call, can be avoided. Furthermore, VoLTE codecs potentially support a wider audio bandwidth. Another advantage of realising voice connections via LTE is that VoLTE typically reduces call setup times.

For the Voice rating, each drive test car and each walk test team carried one Samsung Galaxy S10 smartphone per operator. The phones in the cars called a counterpart in one of the other cars. The phones carried by the walk test teams in the cities called a stationary counterpart. In order to simulate normal smartphone usage, additional data transfers took place in the background of the test calls. In addition, we also evaluate the so-called Multirab (Multi Radio Access Bearer) Connectivity. This value denominates whether data connectivity is available during the phone calls. The Voice scores account for 32 per cent of the total result.

VODAFONE SHOWS THE BEST VOICE RESULTS, MOVISTAR RANKS SECOND, ORANGE THIRD AND YOIGO LAST.

CITIES DRIVETEST
VODAFONE & MOVISTAR

VODAFONE AND MOVISTAR HAVE A NECK AND NECK RACE IN THE VOICE DRIVETESTS IN CITIES
As in other subdomains of this year's benchmark, Vodafone and Movistar have a neck and neck race in the voice drivetests conducted in the larger cities. With a distance of one per cent, Vodafone takes a narrow lead. Orange ranges in the midfield, and Yoigo shows some potential for improvements.
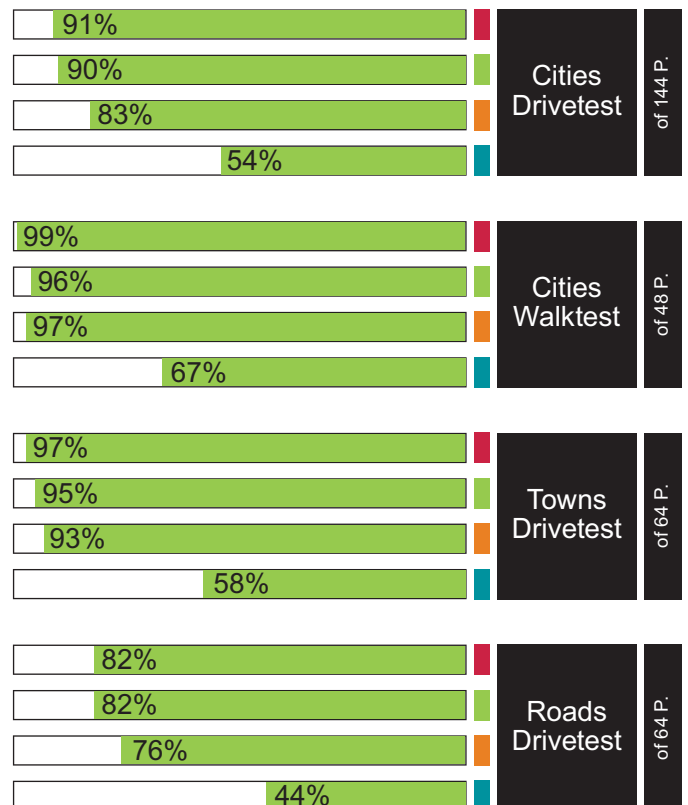
TOWNS DRIVETEST
VODAFONE

VODAFONE AHEAD IN DRIVETEST VOICE RESULTS IN SMALLER TOWNS
In the smaller towns, we see a close contest of the three strong candidates Vodafone, Movistar and Orange. Vodafone takes the overall lead in this category, with Movistar and Orange following closely, each at a distance of only 2 per cent. Yoigo brings up the rear, but similar to the other contenders scores a little stronger in smaller towns than in the cities.

Voice
320 of 1000 Points

Legend:
- Vodafone
- Movistar
- Orange
- Yoigo

Cities Drivetest (of 144 P.)
- 91%
- 90%
- 83%
- 54%

Cities Walktest (of 48 P.)
- 99%
- 96%
- 97%
- 67%

Towns Drivetest (of 64 P.)
- 97%
- 95%
- 93%
- 58%

Roads Drivetest (of 64 P.)
- 82%
- 82%
- 76%
- 44%

ROADS DRIVETEST

VODAFONE & MOVISTAR

FOR VOICE TELEPHONY ON THE ROADS, VODAFONE LEADS THE FIELD, FOLLOWED BY ORANGE

In the drivetests conducted on the connecting roads, all operators show somewhat increased reliability issues with call success ratios dropping to a level of around 95 per cent. Vodafone and Movistar both achieve 82 per cent of the possible points in this category, with Orange following at 76 per cent. In this category, Yoigo falls behind the competition with the most distinct gap due to considerably longer call setup times and a speech quality MOS of only 3.0 on average.

CITIES WALKTEST

VODAFONE

STRONG RESULTS FOR VODAFONE, ORANGE AND MOVISTAR IN THE VOICE WALKTESTS CONDUCTED IN SEVEN LARGER SPANISH CITIES

In the walktests which umlaut conducted in seven larger cities (Barcelona, Bilbao, Madrid, Málaga, Murcia, Sevilla and Zaragoza), Vodafone takes the lead again and manages to achieve an impressive score of 97 per cent of the available points. This time, the leader is closely persecuted by Orange who scores with a narrow gap ahead of Movistar. These three operators score very close together in this category, offering an excellent voice experience to their customers. Yoigo scores better than in the other Voice categories, but still ranks last.

"

VOICE RESULTS AT A GLANCE

Vodafone achieves the highest score in the Voice discipline, Movistar follows closely on the second rank. Both operators make use of the full potential of VoLTE/EVS and provide excellent speech quality to their customers. Orange scores behind the leading two contenders and ranks third in this discipline, showing very good results in the city walktests as well as in the drivetests conducted in smaller towns. Yoigo loses valuable points particularly in the Voice category.

Operator	Vodafone	Movistar	Orange	Yoigo
Cities (Drivetest)				
Sucess Ratio (%)	98.8	99.0	97.5	98.2
Call Setup Time (s)	1.6	2.6	1.7	5.9
Call Setup Time P90 (s)	2.1	3.0	2.1	7.3
Speech Quality (MOS-LQO)	4.4	4.3	4.2	3.1
Speech Quality P10 (MOS-LQO)	3.7	3.6	3.4	2.5
Multirab Connectivity (%)	100.0	100.0	99.9	89.1
Towns (Drivetest)				
Sucess Ratio (%)	99.8	99.8	99.4	98.6
Call Setup Time (s)	1.8	2.7	1.7	5.7
Call Setup Time P90 (s)	2.2	3.0	2.2	6.6
Speech Quality (MOS-LQO)	4.4	4.3	4.2	3.1
Speech Quality P10 (MOS-LQO)	3.8	3.6	3.4	2.5
Multirab Connectivity (%)	100.0	99.5	100.0	91.2
Roads (Drivetest)				
Sucess Ratio (%)	95.5	96.3	94.3	94.4
Call Setup Time (s)	1.9	2.8	1.9	6.4
Call Setup Time P90 (s)	2.6	3.2	2.8	8.0
Speech Quality (MOS-LQO)	4.2	4.1	4.0	3.0
Speech Quality P10 (MOS-LQO)	3.3	3.3	3.0	2.4
Multirab Connectivity (%)	99.8	99.7	99.8	83.9
Cities (Walktest)				
Sucess Ratio (%)	100.0	99.9	99.8	99.7
Call Setup Time (s)	1.4	2.5	1.5	5.5
Call Setup Time P90 (s)	1.6	2.8	1.9	6.3
Speech Quality (MOS-LQO)	4.5	4.3	4.3	3.0
Speech Quality P10 (MOS-LQO)	4.0	3.8	3.8	2.6
Multirab Connectivity (%)	100.0	100.0	100.0	93.2

DATA

The volume of transmitted data is growing rapidly, which emphasises the importance of data connectivity. Which operator in Spain manages best to keep up with the increasing demand?

All Spanish mobile operators have worked hard on further expanding their LTE networks to provide their customers with the best LTE coverage as well as to deliver the highest data rates. In Spain, for many years, Vodafone, Orange and Movistar have been constantly competing to gain the lead in these areas. Meanwhile, the smallest Spanish operator, Yoigo, has been concentrating on expanding its 4G footprint – and claims to have reached 98 per cent LTE coverage of the population thanks to its roaming agreements.

At the same time, the Spanish operators have started their deployments of 5G (for more details, see page 10). We have honoured these advancements by fully integrating 5G measurements into our methodology framework: In each of the two test cars four smartphones were used for the data measurements – one per operator. In the first car, Galaxy S10 smartphones were used, set to 4G preferred mode. This device and setting can make full use of the 4 carrier aggregation (4CA), meanwhile offered by Movistar, Orange and Vodafone. In the second car as well as in the backpacks of the walktest teams, one Galaxy S20+ per operator was used, set to 5G preferred mode and thus enabling 5G connectivity wherever possible.

umlaut's testing considers fast throughputs as well as the networks' availability and stability. In order to assess both typical performance and peak speeds, we consider two values: the minimum data rate that is available in 90 per cent of the cases, and additionally the peak data rate that is surpassed in 10 per cent of the cases. Web page and file downloads or file uploads reward fast speeds, while the determination of success ratios and assessing YouTube playouts mainly concentrate on reliability aspects.
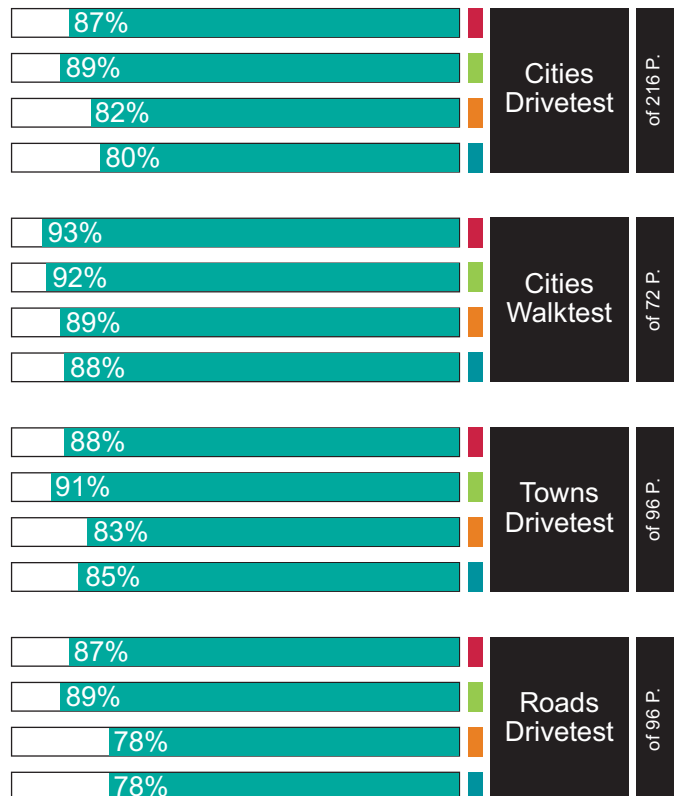
MOVISTAR RANKS FIRST IN THE DATA DISCIPLINE, VODAFONE FOLLOWS ON THE SECOND RANK. ORANGE AND YOIGO RANK ON THE THIRD AND FOURTH POSITIONS, SCORING CLOSELY TOGETHER.

Data
480 of 1000 Points

- 🟥 Vodafone
- 🟩 Movistar
- 🟧 Orange
- 🟦 Yoigo

	Cities Drivetest (of 216 P.)
Vodafone	87%
Movistar	89%
Orange	82%
Yoigo	80%

	Cities Walktest (of 72 P.)
Vodafone	93%
Movistar	92%
Orange	89%
Yoigo	88%

	Towns Drivetest (of 96 P.)
Vodafone	88%
Movistar	91%
Orange	83%
Yoigo	85%

	Roads Drivetest (of 96 P.)
Vodafone	87%
Movistar	89%
Orange	78%
Yoigo	78%

CITIES DRIVETEST

MOVISTAR

MOVISTAR LEADS IN LARGER CITY DATA DRIVETESTS, WITH VODAFONE FOLLOWING AT CLOSE DISTANCE

The results of our drive tests conducted in 20 larger Spanish cities (also see page 1) confirm the broad LTE roll-out of all operators in urban areas. In this category, Movistar takes a narrow lead ahead of Vodafone due to slightly higher success ratios and data rates in most of the download and upload tests. However, Vodafone follows at very close distance, surpassing Movistar in some of the KPIs such as the average throughputs of the 7 second file downloads and uploads. Orange and Yoigo fall a little behind, both still achieving overall good results in this category. All four operators show some room for improvement when it comes to the reliability of YouTube video streams.

CITIES WALKTEST

VODAFONE

VODAFONE TAKES A NARROW LEAD IN THE LARGER CITIES DATA WALKTESTS

In the results of the walktests conducted in Barcelona, Bilbao, Madrid, Málaga, Murcia, Sevilla and Zaragoza, Vodafone manages to reclaim a narrow lead ahead of Movistar. But also Orange and Yoigo achieve quite high scores in this category and rank close together, emphasizing that pedestrians in larger Spanish cities can expect a good level of quality for mobile data usage. Again, our findings show some room for improvements in the YouTube category – which applies to all four Spanish operators particularly regarding service reliability.

Data Cities (Drivetest)	Vodafone	Movistar	Orange	Yoigo
Web-Page Download (Live/Static)				
Success Ratio (%/%)	99.7/99.7	99.8/99.8	99.6/99.6	99.0/99.0
Overall Session Time (s)	1.1	1.1	1.3	1.4
File Download (5 MB)				
Success Ratio/Avg. Session Time (%/s)	99.8/2.4	100.0/2.1	99.9/3.3	99.0/5.0
90%/10% faster than (Mbit/s)	9.7/83.5	12.0/82.8	6.6/78.6	3.9/52.2
File Upload (2.5 MB)				
Success Ratio/Avg. Session Time (%/s)	99.6/1.8	99.9/1.8	99.7/2.3	99.8/2.9
90%/10% faster than (Mbit/s)	7.2/32.9	8.0/30.2	5.8/27.9	4.0/21.8
File Download (7 Seconds)				
Sucess Ratio (%)	99.9	99.8	99.7	99.7
Avg. Throughput (Mbit/s)	80.4	61.0	46.1	30.4
90%/10% faster than (Mbit/s)	10.1/149.7	12.3/129.0	7.6/101.9	7.1/60.1
File Upload (7 Seconds)				
Sucess Ratio (%)	99.7	99.8	99.5	99.3
Avg. Throughput (Mbit/s)	29.1	28.7	25.3	18.3
90%/10% faster than (Mbit/s)	7.3/52.5	8.4/47.0	6.0/46.7	4.5/33.4
Youtube Video				
Success Ratio/Start Time (%/s)	98.4/1.3	99.3/1.2	97.1/1.5	97.8/1.4
Average Video Resolution (p)	916	914	905	911
Youtube live Smartphone				
Success Ratio/Start Time (%/s)	97.1/1.3	99.4/1.3	96.1/1.5	98.1/1.6
Average Video Resolution (p)	1033	1031	1017	1022

Data Cities (Walktest)	Vodafone	Movistar	Orange	Yoigo
Web-Page Download (Live/Static)				
Success Ratio (%)	99.9	99.9	100.0	99.9
Overall Session Time (s)	1.0	1.0	1.1	1.2
File Download (5 MB)				
Success Ratio/Avg. Session Time (%/s)	100.0/1.3	100.0/1.6	100.0/1.9	100.0/2.7
90%/10% faster than (Mbit/s)	22.2/142.6	18.9/92.1	14.8/94.2	10.0/61.7
File Upload (2.5 MB)				
Success Ratio/Avg. Session Time (%/s)	99.8/1.7	100.0/1.6	100.0/2.2	100.0/2.4
90%/10% faster than (Mbit/s)	7.7/39.6	10.1/24.6	6.2/23.6	5.4/19.5
File Download (7 Seconds)				
Sucess Ratio (%)	99.6	99.6	99.8	100.0
Avg. Throughput (Mbit/s)	200.0	84.1	61.4	41.5
90%/10% faster than (Mbit/s)	25.4/604.5	21.0/168.6	13.7/120.1	13.2/77.2
File Upload (7 Seconds)				
Sucess Ratio (%)	99.8	100.0	99.8	100.0
Avg. Throughput (Mbit/s)	36.2	32.8	26.8	21.2
90%/10% faster than (Mbit/s)	7.6/62.7	13.5/48.9	6.6/47.7	6.3/34.2
Youtube Video				
Success Ratio/Start Time (%/s)	99.4/1.1	99.2/1.1	99.6/1.3	99.4/1.3
Average Video Resolution (p)	919	918	913	918
Youtube live Smartphone				
Success Ratio/Start Time (%/s)	98.8/1.1	99.6/1.2	98.8/1.3	100.0/1.3
Average Video Resolution (p)	1040	1035	1031	1040

TOWNS DRIVETEST

MOVISTAR

MOVISTAR LEADS IN DATA DRIVE-TESTS IN SMALLER TOWNS, CLOSELY FOLLOWED BY VODAFONE

In the Data drivetests which our measurement cars performed in 27 smaller Spanish towns, Movistar once again manages to take the lead. Vodafone follows closely – both operators achieve high to very high success ratios when downloading or uploads files and also in the web browsing tests. In the Data drivetests in towns, Yoigo comes in third, and Orange ranks last – but both contenders still score closely together and on an overall high level.

ROADS DRIVETEST

MOVISTAR & VODAFONE

MOVISTAR AND VODAFONE AHEAD IN DATA DRIVETESTS ON CONNECTING ROADS, ORANGE AND YOIGO ON A PAR

It can be seen as a good sign for the overall LTE coverage in Spain that our test teams noted only "occasional LTE availability gaps" during their drives on 7,540 km of connecting roads. In this category, Movistar is again in the lead, with Vodafone following at a narrow distance. The gap to Orange and Yoigo, who score on the same level in this category, is more distinct – to some extent exhibiting a two-class society when it comes to data connectivity on Spanish roads.

Data Towns (Drivetest)	Vodafone	Movistar	Orange	Yoigo
Web-Page Download (Live/Static)				
Success Ratio (%)	99.9	99.8	99.6	99.9
Overall Session Time (s)	1.1	1.1	1.3	1.4
File Download (5 MB)				
Success Ratio/Avg. Session Time (%/s)	100.0/2.1	100.0/2.2	100.0/3.5	100.0/3.7
90%/10% faster than (Mbit/s)	11.5/73.8	18.1/86.1	6.2/80.9	5.6/57.0
File Upload (2.5 MB)				
Success Ratio/Avg. Session Time (%/s)	100.0/1.9	100.0/2.0	99.4/2.5	99.8/2.9
90%/10% faster than (Mbit/s)	6.9/29.9	6.7/28.4	5.2/24.8	4.2/20.7
File Download (7 Seconds)				
Sucess Ratio (%)	99.8	100.0	99.8	99.4
Avg. Throughput (Mbit/s)	59.2	77.9	49.9	38.2
90%/10% faster than (Mbit/s)	14.6/115.4	19.7/157.1	6.7/112.3	12.1/68.4
File Upload (7 Seconds)				
Sucess Ratio (%)	99.6	99.8	99.4	99.6
Avg. Throughput (Mbit/s)	26.3	24.7	22.7	16.7
90%/10% faster than (Mbit/s)	7.7/48.7	7.4/41.7	6.1/44.5	4.2/31.0
Youtube Video				
Success Ratio/Start Time (%/s)	98.9/1.2	99.8/1.2	98.0/1.5	99.4/1.4
Average Video Resolution (p)	919	919	909	910
Youtube live Smartphone				
Success Ratio/Start Time (%/s)	98.4/1.2	99.6/1.3	97.2/1.5	99.6/1.4
Average Video Resolution (p)	1038	1040	1028	1029

Data Roads (Drivetest)	Vodafone	Movistar	Orange	Yoigo
Web-Page Download (Live/Static)				
Success Ratio (%)	99.2	99.4	98.3	98.0
Overall Session Time (s)	1.3	1.3	1.5	1.6
File Download (5 MB)				
Success Ratio/Avg. Session Time (%/s)	99.6/3.4	99.6/2.8	99.5/4.7	99.1/5.7
90%/10% faster than (Mbit/s)	6.8/67.4	8.7/74.5	4.4/70.3	3.2/58.9
File Upload (2.5 MB)				
Success Ratio/Avg. Session Time (%/s)	98.7/2.7	99.6/2.6	98.0/3.5	98.2/4.7
90%/10% faster than (Mbit/s)	4.3/25.9	4.6/23.9	3.0/22.5	1.9/20.6
File Download (7 Seconds)				
Sucess Ratio (%)	98.6	99.5	98.9	98.4
Avg. Throughput (Mbit/s)	43.2	53.6	36.8	31.9
90%/10% faster than (Mbit/s)	7.9/91.0	10.2/116.6	5.4/83.6	5.4/70.2
File Upload (7 Seconds)				
Sucess Ratio (%)	99.0	99.0	97.2	96.4
Avg. Throughput (Mbit/s)	20.6	20.5	18.7	15.9
90%/10% faster than (Mbit/s)	5.1/39.6	5.1/40.2	2.9/39.9	3.0/31.2
Youtube Video				
Success Ratio/Start Time (%/s)	97.9/1.5	98.3/1.3	93.2/1.8	95.5/1.6
Average Video Resolution (p)	912	911	894	903
Youtube live Smartphone				
Success Ratio/Start Time (%/s)	96.2/1.5	97.9/1.5	91.2/1.7	92.7/1.9
Average Video Resolution (p)	1026	1024	1002	1006

SPANISH MOBILE OPERATORS ON A GOOD WAY TO BROADEN THEIR 5G DEPLOYMENTS

At the time of testing, all four Spanish operators have started to deploy 5G in their networks – however, doing so in varying degrees.

Vodafone Spain was the first to start its 5G services already in mid-2019. By now, the operator has activated 5G network cells in 21 cities across the country using its spectrum in the 3.5 GHz band. Movistar (Telefónica) announced in September 2020 that it had switched on its 5G service at some first locations and plans to quickly increase 5G coverage to up to 75 per cent of the Spanish population. Orange has launched 5G services in parts of 11 cities, namely Madrid incl. Pozuelo de Alarcón, Sevilla, Valencia, Málaga, Barcelona incl. Sabadell, Logroño, Pamplona, Vigo and Zaragoza, and has announced to increase them to 93 cities by the end of 2020.

Másmóvil, standing behind the Yoigo brand, has launched 5G services based on on a combination of its own infrastructure and a "virtual active sharing mode" agreement with Orange. Currently, its 5G service is available in parts of Alicante, Alcobendas, Almeria, Avila, Barcelona, Bilbao, Hospitalet de Llobregat, Huesca, Jaen, Madrid, Malaga, Melilla, Orense, Salamanca, San Sebastian, Seville, Valencia and Vitoria. For the next step, Yoigo aims at covering about 35 per cent of the population in about 40 cities with 5G. In the more distant future, the operator plans to launch its own stand-alone 5G network.

As the 5G launches of Movistar, Orange and Yoigo took place only shortly before the start of our drivetests and walktests, in this year's benchmark, 5G could only be factored in for the Vodafone network. We will of course consider 5G for all four Spanish operators in next year's umlaut connect Mobile Benchmark Spain.

5G

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VODAFONE

INDIVIDUAL ANALYSIS OF VODAFONE DATA SAMPLES PROVES 5G SPEED ADVANTAGES

Due to its head start in the 5G deployment, Vodafone already contributed a nameable share of 5G samples especially to our drivetests and walktests conducted in the large cities of Spain.

The tables below show comparisons of the data throughputs achieved in the 7 second download and 7 second upload parts of our data tests, aggregated for 4G samples and 5G samples in the Vodafone network. The results clearly substantiate the speed advantages that 5G technology can already provide today.

Vodafone – 7s Download Data Rate		Average	P10	P90	Max
Samsung S20+ 5G	Samples with 4G reception				
	Cities – Drivetest (Mbps)	50.8	8.8	111.9	279.6
	Cities – Walktest (Mbps)	81.3	18.7	155.9	283.4
Samsung S20+ 5G	Samples with 5G reception				
	Cities – Drivetest (Mbps)	380.9	58.1	689.2	887.5
	Cities – Walktest (Mbps)	465.2	139.1	727.4	870.6

Vodafone – 7s Upload Data Rate		Average	P10	P90	Max
Samsung S20+ 5G	Samples with 4G reception				
	Cities – Drivetest (Mbps)	27.4	7.4	50.7	63.8
	Cities – Walktest (Mbps)	31.5	7.0	54.3	63.6
Samsung S20+ 5G	Samples with 5G reception				
	Cities – Drivetest (Mbps)	39.0	14.2	61.5	79.4
	Cities – Walktest (Mbps)	45.8	9.9	69.4	79.6

DATA RESULTS AT A GLANCE

In the Data discipline, Movistar takes the lead and outperforms the overall winner Vodafone. The race is close in the drivetests performed in the larger cities and smaller towns, and in the city walktests, Vodafone even manages to regain the first rank. The picture is similar on the roads: Movistar leads, Vodafone follows at a narrow distance, while Orange and Yoigo distinctly fall back. Our tests indicate an increasing 5G footprint of Vodafone. Furthermore, we observed some 4G coverage gaps on the roads and some room for improvements in YouTube reliability concerning all four Spanish operators.

✳ CROWD

267,000 Spanish users have contributed around 1.1 billion measurement samples between mid-May and the end of October 2020. umlaut has conducted a thorough analysis of this extensive data base, using a further refined crowdsourcing methodology compared to previous years.

VODAFONE TAKES THE LEAD IN THE CROWD ASSESSMENT, SLIGHTLY AHEAD OF ORANGE. YOIGO RANKS THIRD AND MOVISTAR FOURTH IN THIS DISCIPLINE.

While the drivetests and walktests determine the peak performance of the examined networks, crowdsourcing can add important dimensions such as time, geography or variety in devices and tariff plans – if done in the right way. A detailed description of our crowdsourcing methodology can be found on page 14. Based on the total population count of 46.7 million people, one of 175 inhabitants of Spain has provided relevant samples to our crowd data. The test area of our crowdsourcing represents 97.5 per cent of the built-up area of Spain.

QUALITY OF BROADBAND SERVICE

MOVISTAR

MOVISTAR LEADS THE MARKET IN QUALITY OF BROADBAND SERVICE

Movistar takes a narrow lead in the Quality of Broadband Service category. Especially the Time on Broadband KPI which designates how often a single user had 4G or 5G reception during the observation period is somewhat higher than for the other contenders. Still, Orange and Vodafone follow closely in this discipline which only slightly lower results. Yoigo is falling behind more distinctly, particularly due to a lower per centage in Coverage Excellence – the KPI which assesses the share of samples with 4G or 5G coverage and awards extra points if other contenders offer less or no broadband service at all in an evaluation area.

Crowd	Vodafone	Movistar	Orange	Yoigo
Quality of Broadband Service				
Coverage Excellence (%)	62.3	62.7	61.9	49.5
Time on Broadband (%)	94.0	95.4	94.1	93.8
Download Speed				
Basic Internet Class (%)	93.3	83.8	93.5	93.5
HD Video Class (%)	72.7	62.2	74.6	75.1
UHD Video Class (%)	14.8	13.7	13.8	13.3
Latency				
Gaming Class (%)	56.0	61.4	50.8	41.6
OTT Voice Class (%)	96.8	96.0	95.3	95.2

DOWNLOAD SPEEDS

ORANGE & YOIGO

ORANGE AND YOIGO DELIVER BEST USER DOWNLOAD SPEEDS WITH VODAFONE RIGHT BEHIND THEM

In our crowdsourced assessment of download speeds, Orange and Yoigo achieved the best results showing a particularly high share of samples meeting the requirements of the speed classes Basic Internet (up to 2 Mbps) as well as HD Video (up to 5 Mbps).

Vodafone follows right behind them achieving some points less in the lower speed classes while leading the field regarding the share of samples in the most demanding speed class, UHD Video (up to 20 Mbps).

In our crowdsourced speed assessments, the market leader Movistar scores on the last rank in the two lower speed classes, while it outranks the otherwise very strongly performing Yoigo in the fastest speed class, UHD Video – however, Vodafone and Orange still achieve slightly higher results in this KPI.

LATENCY

VODAFONE & MOVISTAR

VODAFONE AND MOVISTAR AHEAD IN LATENCY METRIC, FOLLOWED BY ORANGE AND THEN YOIGO

In our examinations of Latency, Vodafone and Movistar are leading the field, achieving the best results both in the OTT Voice Class (roundtrip times of 100 ms or less) and in the Gaming Class (roundtrip times of up to 50 ms).

Orange is following at a little distance in this discipline, achieving a share of 50.8 per cent of the collected samples meeting the requirements of the demanding Gaming Class.

Yoigo is almost on a par with Orange regarding the share of samples meeting the requirements of the OTT Voice Class, but falls a little behind the competition in the more difficult Gaming Class.

" CROWD RESULTS AT A GLANCE

In the crowdbased score, Vodafone takes the lead, two points ahead of Orange. Yoigo and Movistar follow with a more distinct gap, with Yoigo still accomplishing a very good and Movistar achieving a good overall result in this category. However, Movistar leads the market in our Quality of Broadband Service metric, closely followed by Orange and Vodafone. When it comes to the crowdsourced assessment of Download Speeds, Orange and Yoigo achieved the best result, with Vodafone right behind them. In the Latency metric, Vodafone and Movistar scored best, followed by Orange and then Yoigo.

TESTING METHODOLOGY

The methodology of the umlaut connect Mobile Benchmark is the result of more than 15 years of testing mobile networks. Today, network tests are conducted in more than 80 countries. Our methodology was carefully designed to evaluate and objectively compare the performance and service quality of mobile networks from the users' perspective.

umlaut's fleet of test cars is equipped with up-to-date test smartphones. The phones on board are operated and supervised by a unique control system.

The umlaut connect Mobile Benchmark Spain comprises of the results of extensive voice and data drivetests and walktests as well as a sophisticated crowdsourcing approach.

DRIVETESTS AND WALKTESTS

The drivetests and walktests in Spain took place in October 2020. All samples were collected during the day, between 8.00 a.m. and 10.00 p.m. The network tests covered inner-city areas, outer metropolitan and suburban areas. Measurements were also taken in smaller towns and cities along connecting highways. For the drive tests, two cars were operated by two rotating teams per each car, working on shifts. The connecting routes between the cities covered about 3,800 kilometres per car – 7,540 kilometres for both cars. In total, the two vehicles together covered about 11,540 km.

The combination of test areas has been selected to provide representative test results across the Spanish population. The areas selected for the 2020 test account for 11.8 million people, or roughly 25.4 per cent of the total population of Spain. The test routes and all visited cities and towns are shown on page 1 of this report.

The two drivetest cars were equipped with arrays of Samsung Galaxy S10 and S20+ smartphones for the simultaneous measurement of voice and data services.

VOICE TESTING

One Galaxy S10 per operator in each car was used for the voice tests, setting up test calls from one car to another. The walktest team also carried one Galaxy S10 per operator for the voice tests. In this case, the smartphones called another Galaxy S10 as a stationary counterpart. The audio quality of the transmitted speech samples was evaluated using the HD-voice capable and ITU standardised so-called POLQA wideband algorithm. All smartphones used for the voice tests were set to VoLTE preferred mode.

In the assessment of call setup times we also rated the so-called P90 value. Such values specify the threshold in a statistical distribution, below which 90 per cent of the gathered values are ranging. For speech quality, we published the P10 value (10 per cent of the values are lower than the specified threshold), because in this case higher values are better.

In order to account for typical smartphone-usage scenarios during the voice tests, background data traffic was generated in a controlled way through injection of 100 KB of data traffic (HTTP downloads). We also evaluated the so-called Multirab (Multi Radio Access Bearer) Connectivity. This value denominates whether data connectivity is available during the phone calls. The Voice scores account for 32 per cent of the total results.

DATA TESTING

Data performance was measured by using four more smartphones in each car – one per operator In Car 1, this was another Galaxy S10, set to 4G preferred mode. Car 2 and the walktest team carried one Galaxy S20+ per operator, set to 5G preferred mode – enabling 5G connectivity wherever available.

For the web tests, they accessed web pages according to the widely recognised Alexa ranking.

In addition, the static "Kepler" test web page as specified by ETSI (European Telecommunications Standards Institute) was used. In order to test the data service performance, files of 5 MB and 2.5 MB for download and upload were transferred from or to ▶

One Samsung Galaxy S10 per operator was used for the voice measurements and another Galaxy S10 for half of the data measurements. In the second car and in the walktest team's backpack a Galaxy S20+ was used and set to "5G preferred"

a test server located in the cloud. In addition, the peak data performance was tested in uplink and downlink directions by assessing the amount of data that was transferred within a seven seconds time period.

The evaluation of YouTube playback takes into account that YouTube dynamically adapts the video resolution to the available bandwidth. So, in addition to success ratios and start times, the measurements also determined average video resolution.

All the tests were conducted with the best-performing mobile plan available from each operator. Data scores account for 48 per cent of the total results.

CROWDSOURCING

Additionally, umlaut conducted crowd-based analyses of the Spanish networks which contribute 20 per cent to the end result. They are based on data gathered between mid-May and the end of October 2020.

For the collection of crowd data, umlaut has integrated a background diagnosis processes into 800+ diverse Android apps. If one of these applications is installed on the end-user's phone and the user authorizes the background analysis, data collection takes place 24/7, 365 days a year. Reports are generated for every hour and sent daily to umlaut's cloud servers. Such reports occupy just a small number of bytes per message and do not include any personal user data. This unique crowdsourcing technology allows umlaut to collect data about real-world experience wherever and whenever customers use their smartphones.

QUALITY OF BROADBAND SERVICE

For the assessment of network coverage, umlaut applies a grid of 2 x 2 km tiles (so-called evaluation areas or EAs) over the test area. For each tile, a minimum number of users and measurement values must be available. In order to assess the *Coverage Excellence*, umlaut awards one point if the considered network provides 4G or 5G coverage in an EA. Another point is awarded to a candidate for each competitor who provides a smaller or no share of broadband usage. In a country with four contenders, a candidate can thus reach up to four points per tile: one for broadband coverage and three additional ones for "beaten" competitors. The assessment then relates the obtained points to the total possible points for *Coverage Excellence*.

In addition, we consider the *Time on Broadband*. It reveals how often a single user had 4G or 5G reception in the observation period – independent from the EAs in which the samples were obtained. In order to calculate this, umlaut puts the number of samples with 4G/5G coverage into relation to the total number of all samples. *Coverage Excellence* and *Time on Broadband* results each provide 50 per cent of the points for the Quality of Broadband Service. Important: The percentages determined for both parameters reflect the respective degrees of fulfilment. They do not correspond to the percentage of 4G/5G coverage of an area or population.
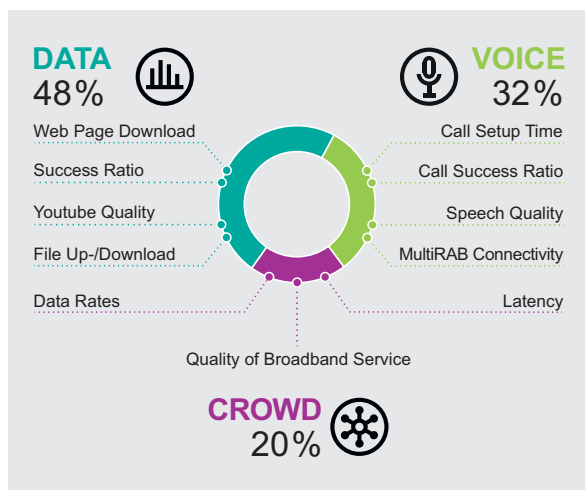
DATA RATES AND LATENCY

Additionally, umlaut investigates the *Data rates* and *Latencies* that were actually available to each user. The examination of these parameters is independent from the EAs and thus concentrates on the experience of each single user. Samples which were for instance obtained via WiFi or with the smartphone's flight mode being active, are filtered from the data pool before further analysis. In order to take the fact into account that many mobile phone tariffs limit data rates, umlaut has defined speed classes which are corresponding to particular applications: For *Basic Internet*, 2 Mbps are sufficient. *HD Video* requires 5 Mbps. And for *UHD Video* the minimum is 20 Mbps.

In order for a sample to count as valid, a minimum amount of data must have been transmitted within a 15 minute period. The same principle also applies to the assignment of a data packet's *latency* to the according application-based classes: Roundtrip times up to 100 ms are sufficient for *OTT Voice*, 50ms and faster qualify a sample for *Gaming*.

In the assessment, umlaut assigns the data rate and latency observed in a sample to one of these performance classes. Then, *Basic Internet* accounts for 60 per cent of the Data Rate score, *HD Video* for 30 per cent and UHD Video for 10 per cent (see table on the left-hand side). The Latency score incorporates *OTT Voice* with a share of 80 per cent, *Gaming* with a share of 20 per cent.

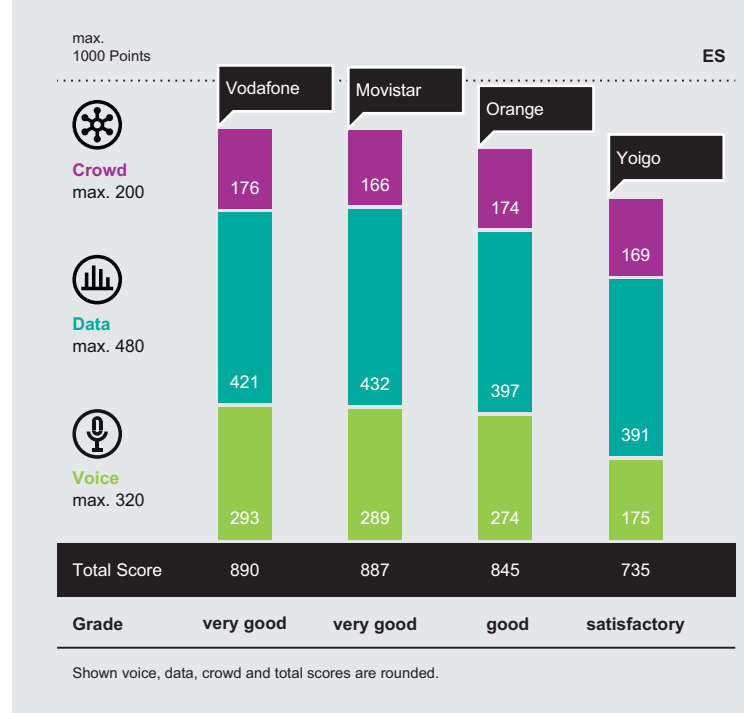| Crowdsourcing Score Model			
Quality of Broadband Service			
50%	Coverage Excellence	50%	max. 50 P.
	Time on Broadband	50%	max. 50 P.
Data rates (Download)			
30%	Basic Internet Class (up to 2 Mbps)	60%	max. 36 P.
	HD Video Class (up to 5 Mbps)	30%	max. 18 P.
	UHD Video Class (up to 20 Mbps)	10%	max. 6 P.
Latency (Roundtrip)			
20%	OTT Voice Class (up to 100 ms)	80%	max. 32 P.
	Gaming Class (up to 50 ms)	20%	max. 8 P.
Total			**max. 200 P.**

CONCLUSION

Vodafone wins for the sixth time in a row. Movistar manages to fight itself up to the second rank and follows at a distance of only three points behind the winner, achieving an impressive score improvement over the previous year. Orange ranks third with a good result and Yoigo fourth with the grade "satisfactory."

The overall winner of the umlaut connect Mobile Benchmark Spain is Vodafone – for the sixth time in a row. But Movistar comes very close at a distance of only three points to the winner Vodafone. This second rank is gained by a massive score improvement of 63 points compared to last year's result – a large part of it due to improvements in the Voice category facilitated by the introduction of VoLTE. In contrast, the other three contenders could not maintain their score levels from the previous year and have lost points. Also, Movistar is taking the lead in the Data category.

Orange falls back to the third rank from 2019's second position and achieves the grade "good" (2019: "very good") – but ranks second in the Crowdsourcing category, showing strong results in the crowdsourced user download speeds and also showing comparably short latencies.

Yoigo ranks fourth, falling back from 2019's "good" to the grade "satisfactory" this year. This is mainly due to some shortcomings in the Voice category – in the Data category Yoigo scores closely behind Orange and even outperforms the overall second-ranking Movistar in the Crowdsourcing category – achieving the fastest crowdsourced user download speeds together with Orange.

But what is most important this year: All four Spanish operators manage to provide mostly stable connections to their users - even in today's particularly demanding times.

Shown voice, data, crowd and total scores are rounded.

Overall Results		Vodafone	Movistar	Orange	Yoigo
Voice	max. 320 P.	293	289	274	175
Cities (Drivetest)	144	91%	90%	83%	54%
Cities (Walktest)	48	99%	96%	97%	67%
Towns (Drivetest)	64	97%	95%	93%	58%
Roads (Drivetest)	64	82%	82%	76%	44%
Data	max. 480 P.	421	432	397	391
Cities (Drivetest)	216	87%	89%	82%	80%
Cities (Walktest)	72	93%	92%	89%	88%
Towns (Drivetest)	96	88%	91%	83%	85%
Roads (Drivetest)	96	87%	89%	78%	78%
Crowdsourced Quality	max. 200P.	176	166	174	169
Crowd	200	88%	83%	87%	84%
Connect Rating	max. 1000 P.	890	887	845	735

Percentages and points rounded to integer numbers.
For the calculation of points and totals, the accurate, unrounded values were used.

BEST IN TEST
VODAFONE
11/2020
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1 vodafone

For the sixth time in a row, Vodafone is the winner of our Mobile Benchmark in Spain. The operator takes the win due to leading in the Voice and Crowdsourcing categories and probably also by offering the largest 5G footprint in Spain. All of this results in an appealing combination for the customers.

2 movistar

Movistar has fought its way up to the second rank following at a distance of only three points behind the winner and showing an impressive score improvement of 63 points of last year's result. Also, Movistar takes the lead in the Data category and achieves the best scores in the drive-tests performed in cities, towns and on the roads.

3 orange

Orange ranks third with an overall good result. While the operator scores in the midfield in our drive-tests and walktests, it shows particularly strong results in the Crowdsourcing category, especially due to the highest crowdsourced user download speeds in our comparison and also comparably good latencies.

4 yoigo

Spain's smallest operator ranks fourth, achieving the overall grade "satisfactory". In comparison to last year's results, Yoigo lost some points. Still, the operator scores closely behind the third-ranking Orange in the Data category and even outperforms the overall second-ranking Movistar in the Crowdsourcing category.