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The 2024 Mobile Network Test in Spain

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For the ninth time, we – umlaut and connect – have conducted our comprehensive assessment of the Spanish mobile networks. The results show two operators on the first place, a runner-up with the biggest improvement compared to previous year's results on the third place – and on the second place an operator with a performance that only differs from the winners by two points.

The carefully designed methodology of our 2024 Mobile Netzwork Test in Spain represents a holistic approach to network benchmarking. It includes drive tests and walk tests for executing detailed voice and data measurements under controlled circumstances combined with a sophisticated crowdsourcing methodology. The drivetests and walktests allow that the maximum capabilities of the networks can be evaluated. The crowdsourcing methodology provides profound insights into the overall coverage and performance of Voice, Data and 5G services as well as the actual User Download and Upload Speeds and Latencies. We have thoroughly weighed these components in order to give a realistic and conclusive assessment of the rated networks' true potential and performance.

Scope

The 2024 umlaut connect Mobile Network Test in Spain consists of drive tests and walk tests conducted from January 20th to February 6th, 2024. Four drive test cars together covered a total of 11,490 kilometres, visiting 20 cities and 23 towns. Additionally, one walk test team visited seven cities. The test areas account for 12.77 million people, or approx. 27 percent of the total Spanish population. In addition, the results of extensive crowdsourcing analyses, considering 24 weeks from mid-August 2023 (calendar week 34) to early February 2024 (CW 5) are included in the score. Our detailed methodology is described on pages 10/11.

DRIVE TEST AND WALK TEST FACTS

12.77 million people covered	11,490 km drive test	189,953 data samples	25,886 voice samples

CROWDSOURCING FACTS

5.6 billion samples	24 weeks (mid August 2023 to early February 2024)	99.0% of built-up area covered	99.8% of population covered

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The Spanish Mobile Operators

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 company operates networks in 12 countries and is present in 38. It counted more than 103,600 employees and achieved worldwide revenues of almost €40 billion in its fiscal year 2023.
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. 22 million subscribers.
It offers GSM, UMTS/3G, LTE and 5G. Movistar is supporting 4G+ carrier aggregation with maximum speeds reaching up to 1 Gbps.
The operator claims to provide 4G coverage of more than 98 percent of the Spanish population. After having launched 5G in 2020, Movistar claims that its 5G covers more than 83 percent of the population of Spain.

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 Día Móvil, Happy Móvil, Pepephone, Simyo and others.
At the time of writing, Orange prepared a merger with Másmóvil/Yoigo – however, this was not yet in effect during our tests.
With approx. 16.2 million mobile customers, Orange is now the second largest Spanish mobile operator.
In the fiscal year 2023, Orange Spain reported a revenue of €4.5 billion which contributed approx. 9.8 percent to the Orange Group's total revenue.
Orange Spain has deployed 2G/GSM, 3G/UMTS, 4G/LTE and 5G. The operator claims that its 4G network reaches more than 99 percent of the Spanish population.
Orange also reports to reach more than 80 percent of the Spanish population with its 5G service.

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. 13.5 million subscribers, Vodafone is the third largest mobile operator in Spain. In its fiscal year 2023, Vodafone Spain achieved revenues of €3.9 billion which contributes about 8.5 percent to the whole Vodafone Group's financial results.
Vodafone Spain has announced to sell its assets and brand to Zegona Communications plc in 2024. However, this sale did not take place before the publication of this report.
Vodafone's mobile network in Spain offers GSM, UMTS/ 3G, LTE and 5G. The Vodafone 4G network in Spain supports LTE 4 carrier aggregation (4CA or "4G+") with maximum speeds of 1 Gbps.
Vodafone España claims to reach approx. 98 percent of the Spanish population. The operator was the first to launch 5G in Spain and now reports to reach about 56 percent of the Spanish population with its 5G service.

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 2023, Másmóvil reported revenues of €2.2 billion. Its latest customer numbers are 12.4 million mobile customers (prepaid and postpaid).
Since January 2017, Yoigo customers can roam in the 2G , 3G and 4G networks of Orange at locations without Yoigo coverage.
Remark: umlaut's methodology has algorithms in place which recognize situations in which the measurement phones use the same radio ressources for Orange and Yoigo and handles such cases accordingly.
Yoigo operates own 3G, 4G and 5G networks. Thanks to its roaming agreements, the operator claims an LTE coverage of approx. 99 percent of the Spanish population. Yoigo claims to reach 77 percent of the population with 5G thanks to a combination of its own infrastructure and its agreement with Orange.

Note: All claims about network coverage reported here are based on the operators' own statements, and are in no way benchmark results determined by umlaut.

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Results at a Glance

vodafone

In an overall tight race, Vodafone shares the first rank with Orange this year. The operator achieves this position by showing the best Voice results and also very good scores in the Data and Crowdsourcing categories. Also, Vodafone is leading in the Reliability category. Compared to previous year's test, Vodafone managed to improve its score by 29 points. In terms of 5G, clear advancements in the country-wide roll-out can be seen.

orange

In this year's umlaut connect Mobile Network Test in Spain, Orange shares the first rank with Vodafone. The operator achieves this win with very strong results in all three categories, Voice, Data and Crowdsourcing. Orange managed to improve its score by 26 points compared to last year's result. In our 5G assessment, Orange shows the highest share of 5G samples in the cities and on the roads.

Movistar

Movistar also achieves a very good result and scores just two points behind the winning two operators. The operator achieves the highest scores of this year's test in the Data and Crowdsourcing categories. Compared to the previous year, Movistar improved by 20 points. In our 5G assessment, this operator shows a slightly higher 5G share in the smaller towns than its competitors.

yoigo

Spain's smallest provider achieves the overall grade "good". It shows an impressive advancement in comparison to the previous year's result (+34 points) and thus continues to reduce the gap to the larger three operators. Yoigo shows good results in all three categories, Voice, Data and Crowdsourcing and has also made good progress in its 5G roll-out.

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BEST IN TEST
VODAFONE
2/2024
MOBILE NETWORK TEST IN SPAIN
www.connect-testlab.com
4 operators tested, 2 winners

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BEST IN TEST
ORANGE
2/2024
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4 operators tested, 2 winners

"We see the very positive results of all Spanish operators increasing their efforts to offer top performance – with all candidates improving their scores considerably over the previous year. Congratulations to the very good joint winners Vodafone and Orange, with Movistar scoring only two points behind. Yoigo shows the biggest improvement compared to the previous year."

Hakan Ekmen, Global Networks Lead, Comms Industry and CEO umlaut

Overall Results		Vodafone	Orange	Movistar	Yoigo
Voice	max. 270.00 P.	255	250	236	224
Cities (Drivetest)	121.50	96%	95%	89%	88%
Cities (Walktest)	40.50	99%	99%	97%	93%
Towns (Drivetest)	54.00	91%	87%	85%	75%
Roads (Drivetest)	54.00	90%	88%	78%	73%
Data	max. 480.00 P.	426	428	436	416
Cities (Drivetest)	216.00	91%	92%	92%	89%
Cities (Walktest)	72.00	94%	96%	94%	95%
Towns (Drivetest)	96.00	83%	81%	89%	79%
Roads (Drivetest)	96.00	86%	86%	88%	82%
Crowd	max. 250.00 P.	216	219	223	207
Crowd	250.00	86%	88%	89%	83%
Connect Rating	max. 1000 P.	897	897	895	847

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

All scores shown in this document are rounded.

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Voice

VODAFONE AHEAD IN BIG CITIES VOICE DRIVETESTS, ORANGE FOLLOWS AT NARROW DISTANCE

In the voice tests conducted by umlaut's test cars while driving in Spain's big cities, Vodafone achieves the highest score, followed by Orange at a narrow gap of just one percentage point. Movistar and Yoigo fall a little behind in this aggregation, scoring close together. While Movistar shows the longest call setup time, Yoigo has some room for improvement in terms of Speech Quality.

CITIES DRIVETEST

VODAFONE

VODAFONE AND ORANGE ON A PAR LEADING IN VOICE IN BIG CITIES WALKTESTS, MOVISTAR FOLLOWS AT CLOSE DISTANCE AND YOIGO NOT FAR BEHIND

In the walktests, conducted in Barcelona, Bilbao, Madrid, Murcia, Sevilla, Valencia and Zaragoza, Vodafone and Orange on a par with excellent results. Movistar follows at close distance, and also Yoigo performs well. Except Yoigo, all operators use to a high extent the potential of the voice technologies VoLTE (Voice over LTE) and the EVS codec (Enhanced Voice Services). Yoigo is using VoLTE, however not EVS yet.

CITIES WALKTEST

VODAFONE & ORANGE

VODAFONE LEADS IN SMALLER TOWN VOICE DRIVETESTS, ORANGE RANKS SECOND AND MOVISTAR THIRD

In the voice tests conducted by umlaut's test cars while visiting 23 smaller towns in Spain (see route map on page 1), Vodafone takes the lead. Orange ranks second at some distance, and Movistar third at a gap of only two percentage points behind Orange. Here, Yoigo falls behind at a wider gap. The generally high levels of success rates and MultiRAB connectivity however show that voice services are mostly working well also in the more rural areas of Spain.

TOWNS DRIVETEST

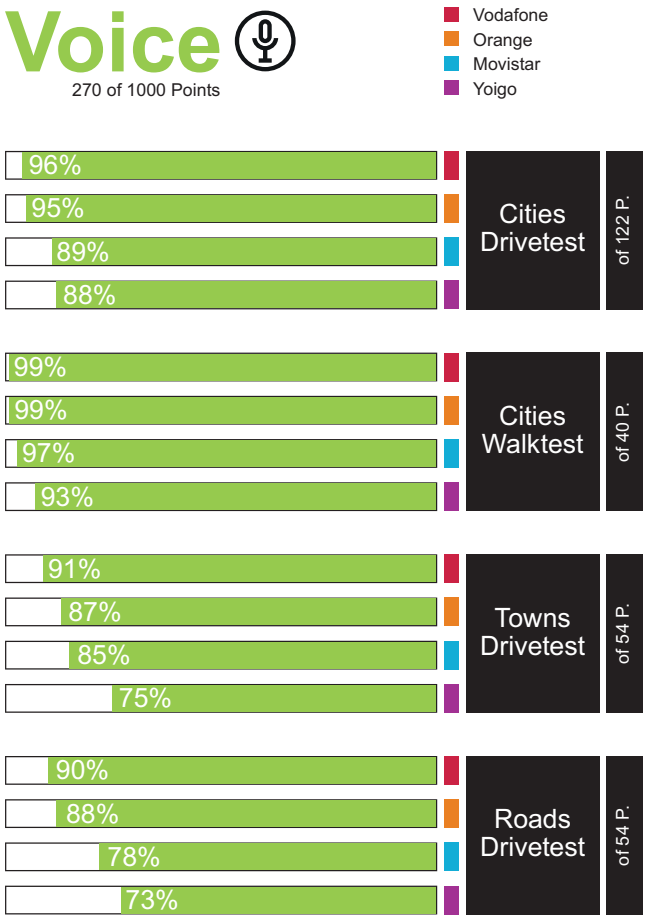
VODAFONE

VODAFONE SCORES BEST IN VOICE TESTS ON ROADS, ORANGE FOLLOWS AT VERY CLOSE DISTANCE

The Drivetests performed on Spanish roads are an important indication for drivers who want to conduct phone calls while driving in Spain. Here, Vodafone also takes the lead, with Orange following at a close distance of two percentage points. Movistar ranks third with a little more pronounced gap, and Yoigo manages to come quite close to the third-ranking Movistar. Movistar and Yoigo show some room for improvement in this area with call failure rates of nearly 5 percent.

ROADS DRIVETEST

VODAFONE



Operator	Vodafone	Orange	Movistar	Yoigo
Cities (Drivetest)				
Sucess Ratio (%)	99.5	99.5	98.9	99.2
Call Setup Time P90 (s)	1.7	1.5	3.0	2.3
Speech Quality P10 (MOS-LQO)	4.6	4.2	4.3	3.5
Multirab Connectivity (%)	100.0	100.0	100.0	99.5
Cities (Walktest)				
Sucess Ratio (%)	100.0	100.0	99.9	99.6
Call Setup Time P90 (s)	1.7	1.4	2.6	2.0
Speech Quality P10 (MOS-LQO)	4.7	4.7	4.5	3.8
Multirab Connectivity (%)	100.0	100.0	99.9	100.0
Towns (Drivetest)				
Sucess Ratio (%)	98.8	98.3	98.3	97.1
Call Setup Time P90 (s)	1.7	1.9	3.1	2.6
Speech Quality P10 (MOS-LQO)	4.3	4.1	4.2	3.5
Multirab Connectivity (%)	100.0	100.0	99.9	99.4
Roads (Drivetest)				
Sucess Ratio (%)	97.9	97.7	95.7	95.1
Call Setup Time P90 (s)	1.7	1.9	3.2	2.9
Speech Quality P10 (MOS-LQO)	4.2	3.9	4.0	3.4
Multirab Connectivity (%)	100.0	100.0	99.8	99.5

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Data

ORANGE AND MOVISTAR LEADING TOGETHER IN BIG CITIES DATA DRIVETESTS, VODAFONE FOLLOWS CLOSELY

In the data drivetests conducted in big Spanish cities, Orange and Movistar score equally strong. Vodafone follows at a close distance of just one percentage point. Yoigo is not far behind, at a gap of just two percentage points compared to Vodafone. Generally, all Spanish operators show very good success ratios with the exception of the demanding Interactivity of e-Gaming, where Orange and Yoigo fall a little behind.

CITIES DRIVETEST

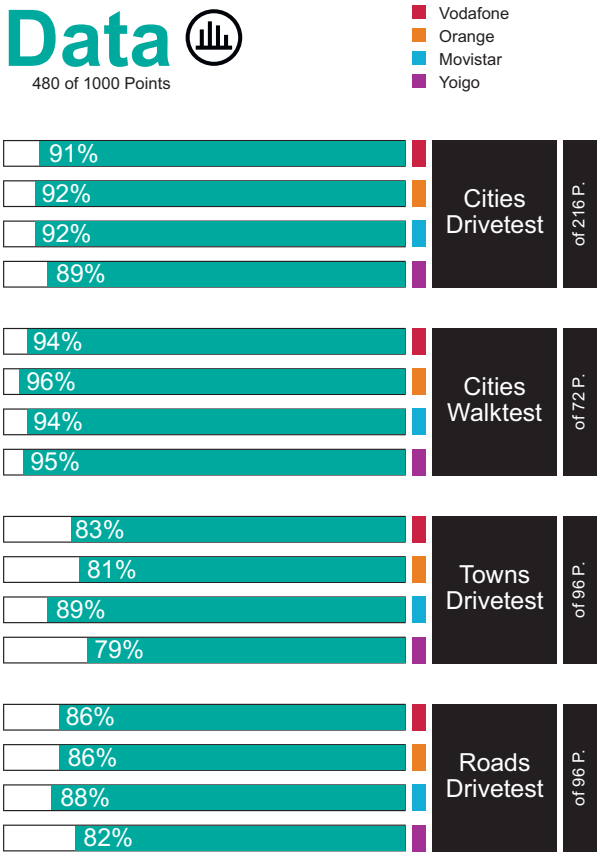
ORANGE & MOVISTAR

ORANGE RANKS FIRST IN BIG CITIES DATA WALKTESTS, YOIGO FOLLOWS CLOSELY, VODAFONE AND MOVISTAR EQUALLY STRONG HERE

In the data walktests conducted in Spain's bigger cities, Orange is ahead. In this aggregation, Yoigo follows on second place, at a distance of only one percentage point behind Orange. Vodafone and Movistar share the third rank, again just one percentage point behind Yoigo. This ranking can be seen in many of the success ratios of the various test points, but also in the performance KPIs such as data rates.

CITIES WALKTEST

ORANGE



Data Cities (Drivetest)	Vodafone	Orange	Movistar	Yoigo
Web-Page Download				
Success Ratio/Avg. Session Time (%/s)	99.6/1.2	99.4/1.1	99.6/1.2	99.3/1.3
File Download (10 MB)				
Success Ratio/Avg. Session Time (%/s)	99.8/2.5	99.8/1.5	99.7/2.3	99.6/2.5
90%/10% faster than (Mbps)	16.6/270.3	29.5/287.8	19.8/283.9	13.4/264.6
File Upload (5 MB)				
Success Ratio/Avg. Session Time (%/s)	99.7/2.2	99.9/2.2	99.5/2.0	99.9/2.5
90%/10% faster than (Mbps)	10.5/68.3	10.1/73.7	12.1/76.9	9.2/61.7
File Download (7 Seconds)				
Sucess Ratio (%)	99.6	99.6	99.4	99.6
10% faster than (Mbps)	576.4	693.1	754.1	594.8
Speed > 20Mbps / 100Mbps (%)	90.3/61.8	95.8/83.8	92.0/67.2	91.7/70.6
File Upload (7 Seconds)				
Sucess Ratio (%)	99.9	99.4	99.7	99.7
10% faster than (Mbps)	106.6	107.2	114.8	98.6
Speed > 2Mbps / 5Mbps (%)	99.4/97.6	99.1/97.1	99.5/97.6	98.7/96.1
Youtube				
Success Ratio/Start Time (%/s)	98.9/2.0	98.7/1.8	99.5/2.0	98.9/2.2
Average Video Resolution (p)	1078	1078	1078	1076
Youtube live				
Success Ratio/Start Time (%/s)	98.9/2.4	98.3/2.3	99.1/2.5	98.2/2.6
Average Video Resolution (p)	1078	1079	1076	1076
Conversational-App				
Sucess Ratio (%)	99.7	98.9	99.8	99.0
Speech Quality P10 (MOS-LQO)	2.7	2.7	3.3	2.8
Interactivity e-Gaming				
Success Ratio/Interactivity e-Gaming (%)	94.3/70.2	92.0/70.0	95.9/68.0	92.8/62.6

Data Cities (Walktest)	Vodafone	Orange	Movistar	Yoigo
Web-Page Download				
Success Ratio/Avg. Session Time (%/s)	99.4/1.0	99.4/1.1	99.6/1.1	99.6/1.1
File Download (10 MB)				
Success Ratio/Avg. Session Time (%/s)	99.3/1.7	100.0/1.3	99.8/2.1	100.0/1.5
90%/10% faster than (Mbps)	30.6/319.9	38.7/308.2	24.2/270.3	34.5/296.8
File Upload (5 MB)				
Success Ratio/Avg. Session Time (%/s)	99.3/1.8	99.8/1.5	99.5/1.8	99.8/1.5
90%/10% faster than (Mbps)	15.6/80.5	17.3/74.0	15.1/75.5	17.5/69.1
File Download (7 Seconds)				
Sucess Ratio (%)	99.8	100.0	99.5	100.0
10% faster than (Mbps)	722.4	797.2	765.7	665.2
Speed > 20Mbps / 100Mbps (%)	93.3/73.0	98.6/89.3	92.8/67.6	98.3/86.3
File Upload (7 Seconds)				
Sucess Ratio (%)	99.8	99.5	99.8	100.0
10% faster than (Mbps)	123.9	111.9	119.3	112.2
Speed > 2Mbps / 5Mbps (%)	99.5/98.9	99.8/99.3	100.0/98.6	99.5/99.3
Youtube				
Success Ratio/Start Time (%/s)	98.9/1.8	99.3/1.7	99.1/1.9	98.2/1.9
Average Video Resolution (p)	1079	1079	1076	1079
Youtube live				
Success Ratio/Start Time (%/s)	99.3/2.3	99.8/2.1	99.1/2.4	98.9/2.4
Average Video Resolution (p)	1076	1078	1078	1080
Conversational-App				
Sucess Ratio (%)	99.9	99.7	100.0	99.7
Speech Quality P10 (MOS-LQO)	3.3	3.7	4.1	3.8
Interactivity e-Gaming				
Success Ratio/Interactivity e-Gaming (%)	94.8/77.8	96.8/74.5	97.7/71.7	97.3/68.8

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Data

MOVISTAR LEADS IN DATA DRIVETESTS IN TOWNS, VODAFONE COMES IN SECOND, AND ORANGE THIRD

In the data drivetests performed in the visited smaller towns, Movistar is ahead. The rest of the field follows at some distance, with Vodafone ranking second and Orange third. Yoigo comes in fourth, but at a comparably narrow gap. Movistar's lead in this category is manifested by the highest data rates and success ratios in most of the test disciplines.

TOWNS DRIVETEST

MOVISTAR

MOVISTAR ALSO AHEAD IN DATA DRIVETESTS ON SPANISH ROADS, FOLLOWED BY EQUALLY STRONG VODAFONE AND ORANGE

In the data measurements performed by our test cars on Spanish roads, Movistar also leads. But Vodafone and Orange follow on a par at a narrow distance of only two percentage points. Yoigo falls a littlle behind, but scores even stronger than in the towns and has generally arrived on a comparable performance level as its competitors.

ROADS DRIVETEST

MOVISTAR

Photo: DeltaOFF, shutterstock

Data Towns (Drivetest)	Vodafone	Orange	Movistar	Yoigo
Web-Page Download				
Success Ratio/Avg. Session Time (%/s)	99.0/1.6	99.4/1.5	99.3/1.4	99.0/1.7
File Download (10 MB)				
Success Ratio/Avg. Session Time (%/s)	99.8/4.8	99.8/4.8	99.3/2.0	99.3/5.8
90%/10% faster than (Mbps)	8.3/111.7	7.1/186.7	22.8/256.0	4.8/177.8
File Upload (5 MB)				
Success Ratio/Avg. Session Time (%/s)	99.8/3.1	99.8/3.5	98.9/2.6	99.8/3.9
90%/10% faster than (Mbps)	7.5/56.2	6.5/50.1	8.5/65.7	5.2/44.1
File Download (7 Seconds)				
Sucess Ratio (%)	99.8	98.4	99.3	98.9
10% faster than (Mbps)	160.7	376.2	728.0	356.7
Speed > 20Mbps / 100Mbps (%)	74.9/23.4	81.8/34.4	92.5/59.6	76.6/30.8
File Upload (7 Seconds)				
Sucess Ratio (%)	99.5	99.3	99.5	99.6
10% faster than (Mbps)	82.8	71.2	108.7	63.3
Speed > 2Mbps / 5Mbps (%)	98.8/96.7	98.2/94.3	99.1/95.7	97.5/90.0
Youtube				
Success Ratio/Start Time (%/s)	98.8/2.4	97.2/2.5	98.6/2.1	98.8/2.6
Average Video Resolution (p)	1074	1073	1077	1073
Youtube live				
Success Ratio/Start Time (%/s)	98.2/3.0	98.1/2.9	98.7/2.6	97.1/3.0
Average Video Resolution (p)	1064	1071	1076	1074
Conversational-App				
Sucess Ratio (%)	99.8	98.3	99.0	99.1
Speech Quality P10 (MOS-LQO)	2.8	2.7	3.1	2.8
Interactivity e-Gaming				
Success Ratio/Interactivity e-Gaming (%)	89.0/54.3	88.3/56.6	92.5/60.0	87.6/49.7

Data Roads (Drivetest)	Vodafone	Orange	Movistar	Yoigo
Web-Page Download				
Success Ratio/Avg. Session Time (%/s)	99.1/1.5	98.9/1.5	99.5/1.5	98.9/1.6
File Download (10 MB)				
Success Ratio/Avg. Session Time (%/s)	99.7/4.8	99.9/4.0	99.3/3.5	99.7/4.9
90%/10% faster than (Mbps)	7.8/86.5	10.1/111.8	12.2/164.6	7.0/97.4
File Upload (5 MB)				
Success Ratio/Avg. Session Time (%/s)	100.0/4.1	99.4/4.1	99.4/4.0	99.3/4.9
90%/10% faster than (Mbps)	5.1/49.2	4.6/44.9	5.2/53.8	4.2/40.6
File Download (7 Seconds)				
Sucess Ratio (%)	99.1	99.3	99.2	99.4
10% faster than (Mbps)	117.5	158.5	330.3	139.4
Speed > 20Mbps / 100Mbps (%)	72.4/15.2	79.8/23.7	83.8/34.2	75.0/18.6
File Upload (7 Seconds)				
Sucess Ratio (%)	99.2	99.1	98.3	98.4
10% faster than (Mbps)	65.0	65.4	78.4	59.1
Speed > 2Mbps / 5Mbps (%)	97.7/91.9	97.3/90.2	98.2/92.0	96.2/86.5
Youtube				
Success Ratio/Start Time (%/s)	98.6/2.3	98.2/2.3	98.2/2.3	97.3/2.5
Average Video Resolution (p)	1075	1075	1077	1074
Youtube live				
Success Ratio/Start Time (%/s)	98.4/2.9	96.9/2.8	98.2/2.8	97.0/3.1
Average Video Resolution (p)	1070	1075	1076	1069
Conversational-App				
Sucess Ratio (%)	99.0	98.9	99.2	98.0
Speech Quality P10 (MOS-LQO)	2.8	2.7	2.8	2.7
Interactivity e-Gaming				
Success Ratio/Interactivity e-Gaming (%)	91.0/58.0	90.7/57.4	92.5/55.5	90.7/47.9

Data: 5G

ORANGE SHOWS HIGHEST SHARE OF SAMPLES WITH 5G IN CITIES AND TOWNS, MOVISTAR ON THE ROADS. OVERALL HIGH DATA RATES, PARTICULARLY WHEN NOT USING DSS.

5G

5G is assumed to be the standard in our measurements. But to shed light on the progress of the 5G rollout, we look at the results of the KPI "Data rates of the 7 second Download tests". This gives a good indication of the data rates which are supported thanks to the 5G technology. But as this assessment does not limit the overall results to the 5G-related aspects or factors such as 5G coverage or the measured latencies of 5G-only connections, we do not identify a separate 5G category winner.

That said, in our exemplary assessment, we see Orange showing the highest share of samples with 5G (pure 5G as well as 5G and 5G-DSS combined) in the cities and on the roads, while Movistar is slightly ahead in the smaller towns. Here, in the towns, Yoigo's share of pure 5G is a little higher than that of Orange. Overall, these 5G shares have risen considerably compared to the previous year, which illustrates that all Spanish operators have made good progress with their 5G roll-outs. However, with the exception of Movistar, outside of the bigger cities all of them still rely heavily on the bridging technology DSS (Dynamic Spectrum Sharing).

Photo: Quique Olivar, Unsplash

A closer investigation shows that in the cities all operators use 5G New Radio with carrier aggregation (CA) of up to four LTE carriers. Vodafone is the only operator who utilizes 5GNR 2CA in combination with LTE CA.

Along with the 5G shares, also the observed data rates have risen distinctly. Here, Movistar takes the lead in all aggregations, followed by Orange. Vodafone comes in on the third place in the cities, while Yoigo provides somewhat faster data rates than Vodafone in the towns and on the roads.

Data rates 7s Download	Vodafone			Orange			Movistar			Yoigo		
Samples with 5G	Share	Average (Mbps)	10% faster than (Mbps)	Share	Average (Mbps)	10% faster than (Mbps)	Share	Average (Mbps)	10% faster than (Mbps)	Share	Average (Mbps)	10% faster than (Mbps)
Cities – Drivetest	69.6%	340.3	631.6	87.5%	401.2	707.9	69.8%	461.4	819.5	79.5%	342.3	624.9
Cities – Walktest	80.7%	417.2	768.5	87.9%	475.4	813.8	68.3%	453.1	829.1	86.7%	426.2	704.8
Towns – Drivetest	8.2%	247.1	440.8	24.9%	341.8	671.4	64.6%	412.9	777.1	29.9%	270.5	518.1
Roads – Drivetest	3.6%	169.5	435.4	4.6%	208.6	480.8	33.9%	228.8	569.8	3.5%	219.3	458.9
Samples with 5G-DSS	Share	Average (Mbps)	10% faster than (Mbps)	Share	Average (Mbps)	10% faster than (Mbps)	Share	Average (Mbps)	10% faster than (Mbps)	Share	Average (Mbps)	10% faster than (Mbps)
Cities – Drivetest	7.3%	59.6	113.2	9.9%	69.8	147.4	13.9%	85.3	167.4	9.4%	65.5	161.7
Cities – Walktest	1.8%	6.3	14.4	7.3%	112.0	208.2	3.2%	52.8	128.7	7.3%	91.1	179.8
Towns – Drivetest	64.0%	58.7	124.9	57.4%	62.4	136.1	19.6%	85.8	167.0	35.0%	59.0	129.5
Roads – Drivetest	45.6%	63.1	125.0	65.5%	73.6	157.7	20.4%	81.5	168.9	59.8%	67.5	143.3

Crowd

MOVISTAR AHEAD IN OVERALL BROADBAND COVERAGE, CLOSELY FOLLOWED BY VODAFONE

BROADBAND COVERAGE

MOVISTAR

In terms of Coverage Quality (see definitions on p. 11), Vodafone is slightly ahead of Orange and Movistar. In Coverage Reach Movistar takes the lead, ahead of Orange and then Vodafone at a very close gap. In Time on Broadband, Vodafone takes the lead, ahead of Movistar and Orange, who both follow at narrow gaps. Yoigo's customer experience in terms of coverage is similar to its competitors, as customers can benefit from the expansion of network coverage achieved by roaming mainly with Orange. The stated Coverage Reach, however, reflects the actual level of this operator's own network deployment.

Operators	Vodafone	Orange	Movistar	Yoigo
Broadband Coverage				
Coverage Quality (%)	96.3	95.7	95.3	94.8
Coverage Reach (%)	91.0	91.1	94.1	89.1
Time on Broadband (%)	96.8	96.3	96.5	96.4
Download Speed (Passive)				
Basic Internet Class(%)	96.4	96.1	95.6	96.1
HD Video Class / UHD Video Class (%)	85.2/26.8	84.6/28.6	84.6/29.1	83.5/22.2
Download Speed (Active)				
Avg. Throughput (Mbit/s)	39.0	54.9	75.7	33.2
90% / 10% faster than (Mbit/s)	3.5/85.5	5.0/122.4	5.0/155.9	4.1/65.3
Upload Speed (Active)				
Avg. Throughput (Mbit/s)	17.4	17.9	20.1	12.7
90% / 10% faster than (Mbit/s)	2.4/38.8	2.0/40.8	2.3/44.9	1.7/27.5
Latency				
Gaming Class / OTT Voice Class (%)	66.0/95.8	76.2/95.5	75.2/96.7	66.9/96.0
Voice				
HD Voice (%)	94.0	90.6	92.8	81.6
Stability				
Transaction Success (%)	93.4	91.6	93.4	92.2

VODAFONE AHEAD IN PASSIVE DOWNLOAD ANALYSIS

DOWNLOADS PASSIVE

VODAFONE

In the passively observed download data rates, Vodafone is ahead in the Basic Internet Class (minimum of 2 Mbps) and in the HD Video Class (at least 5 Mbps). Orange and Movistar follow at close distance and are on a par in the HD Video Class. In the demanding UHD Video class (min. 20 Mbps), Movistar performs ahead of Orange and Vodafone. Yoigo scores on a par with Orange in the Basic Internet Class, but falls a little behind when the requirements increase.

MOVISTAR ALSO AHEAD IN ACTIVE DOWNLOAD ANALYSIS, HERE ORANGE RANKS SECOND AND MOVISTAR THIRD

DOWNLOADS ACTIVE

MOVISTAR

The actively performed download tests are conducted to better approximate the maximum performance of a mobile internet connection. In this metric, Movistar takes the lead, with Orange ranking second and Vodafone third. In the P10 (90 percent faster than) results, Yoigo scores higher than Vodafone. But in the other aggregations, Yoigo ranks fourth.

MOVISTAR ALSO AHEAD IN ACTIVE UPLOAD TESTS

UPLOADS ACTIVE

MOVISTAR

A similar result as in the active Download category can also be seen in the accompanying upload tests. Movistar delivers the highest results in the average and P90 throughputs, followed by Orange and the Vodafone. In the P10 values, Vodafone leads the field, followed by Movistar and Orange. Yoigo ranks fourth in all aggregations, but with overall good results.

VODAFONE LEADS IN HD VOICE AVAILABILITY, SLIGHTLY AHEAD OF MOVISTAR

VOICE

VODAFONE

In the analysis of the availability of HD voice connections (i.e Voice over LTE with the current state of mobile network implementations in Spain), Vodafone takes the first place. In this assessmenXt, Movistar follows at a close distance, and Orange at a little more pronounced gap. Here, Yoigo is trailing behind.

MOVISTAR PROVIDES THE SHORTEST LATENCIES, ORANGE RANKS SECOND IN LATENCY ASSESSMENT

LATENCY

MOVISTAR

Movistar is ahead in the latency category, due to the best result in the OTT Voice class (roundtrip times up to 100 milliseconds). In the more demanding Gaming class (up to 50 ms), Orange is closely ahead, which earns this operator the second place in this category. Yogio comes in third here, ahead of Vodafone.

VODAFONE AND MOVISTAR LEADING ON A PAR IN TRANSACTION STABILITY, ALL SPANISH OPERATORS STRONG HERE

STABILITY

VODAFONE & MOVISTAR

In the Stability category, which looks at the success rates of regular transaction tests, Vodafone and Movistar are scoring on a par and togehter take the lead in this category. Yoigo comes in third, and Orange fourth in this assessment. Overall, all Spanish operators show strong results in this category.

Reliability

Reliability is not an additional category of our tests, but rather a different angle of looking at the results: For each KPI, our scoring distinguishes between "Qualifiers" (the expected basic performance) and "Differentiators" (the additional performance that exceeds the expected basics). The view at Reliability limits itself to most of the Qualifiers and the basic KPIs of the crowdsourcing – thus conveying an impression of the standards, a user can reasonably expect from a mobile network. The reference values in this representation are therefore only the subset of score points which we assigned to the Qualifiers. The resulting scores state the reliabili ty with which an operator offers its network services. This approach concentrates on the compulsory basics instead of the highest peaks of a network's performance.

Operator		Vodafone	Orange	Movistar	Yoigo
Voice	max. 148.5 points	138	135	128	124
Drivetest	115.1	91%	90%	84%	81%
Walktest	33.4	100%	100%	99%	96%
Data	max. 264.0 points	249	244	248	243
Drivetest	204.6	94%	91%	94%	91%
Walktest	59.4	94%	97%	95%	95%
Crowd	max. 116.9 points	108	106	108	107
Crowd	116.9	92%	91%	92%	92%
Total	max. 529.4 points	495	485	484	474

All shown scores and percentages are rounded.

VODAFONE AHEAD IN VOICE RELIABILITY, ORANGE FOLLOWING CLOSELY BEHIND

In the assessment of the Reliability of Voice connections, Vodafone achieves the highest score. Orange follows at a close distance of three score points. Movistar comes in third, also showing a high degree of Voice reliability. Fourth-ranking Yoigo also achieves a very good result, scoring just four points behind Movistar. All of the candidates score stronger in the walktests than in the drivetests.

VOICE

VODAFONE

VODAFONE LEADS IN DATA RELIABILITY, CLOSELY FOLLOWED BY MOVISTAR. ORANGE AND YOIGO ONLY ONE POINT APART IN THIS ASSESSMENT

In the Reliability assessment in the Data tests, Vodafone takes the lead. But Movistar follows on second rank at a distance of only one score point. In this aggregation, Orange ranks third, just one point ahead of Yoigo. With the exception of Vodafone, the other candidates again score stronger in the walktests than in the drivetests.

DATA

VODAFONE

CROWDSOURCING: VODAFONE AND MOVISTAR LEAD IN REALIABILITY, WITH ALL SPANISH OPERATORS RANKING CLOSELY TOGETHER

With all four Spanish operators ranking closely together in the Reliability assessment of the Crowdsourcing category, Vodafone and Movistar are on a par, reaching the highest scores. Yoigo and Orange follow with a gap of one percentage point each.

CROWD

VODAFONE & MOVISTAR

Photo: Brastock, shutterstock

Methodology

The umlaut connect Mobile Network Test is the result of extensive drivetests and walktests, combined with a sophisticated crowdsourcing analysis.

Logistics

connect's network test partner umlaut sent four measurement vehicles through the country, each equipped with twelve smartphones. For each network operator, a Samsung Galaxy S23 took the voice measurements, and another S23 established the connections for the test case "conversational app" (see section "Data connections" below). For the actual data test, we used a third Samsung Galaxy S23 per operator. For all measurements, the smartphones were set to "5G preferred" – so wherever supported by the network, the data tests took place via 5G.

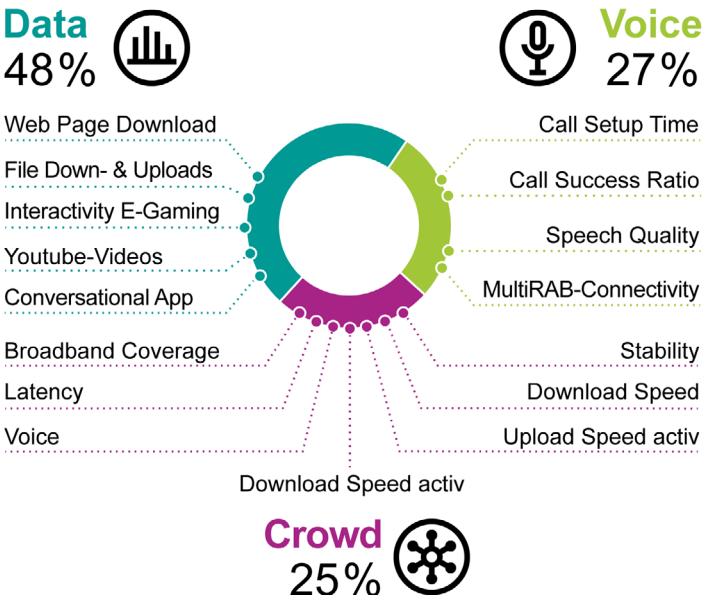
In addition to the drive tests, two walk test teams carried out measurements on foot in each country, in zones with heavy public traffic such as railway station concourses, airport terminals, cafés, public transport and museums. The walk test programme also included journeys on long-distance railway lines. For the walk tests, the same smartphone types were used per network operator for the same measurements as in the drive tests. The walk test teams transported the smartphones in backpacks or trolleys equipped with powerful batteries. The firmware of the test smartphones corresponded to the original network operator version in each case.

The drive and walk tests took place between 8 am and 10 pm. For the drive tests, two vehicles were in the same city, but not in the same place, so that one car would not falsify the measurements of the other. On the connecting roads, two vehicles each drove the same routes, but one after the other with some time and distance between them. For the selection of the test routes, umlaut created four different suggestions for each country, from which connect blindly selected a route.

Voice connections

Voice connections account for 27 percent of the overall result. For this purpose, mobile telephone calls were established from vehicle to vehicle ("mobile-to-mobile") and their success rates, call set-up time and voice quality were measured. The smartphones of the walk test teams made calls to a stationary (smartphone) remote station for the voice tests.

To ensure realistic conditions, data traffic was handled simultaneously in the background. We also recorded MultiRAB connectivity: the use of several "**r**adio **a**ccess **b**earers" provides data connections in the background of the voice calls. The transmission quality was evaluated with the POLQA wideband method suitable for HD voice. "VoLTE preferred" was configured on all phones – from 5G, the phones thus fall back to telephony via LTE.



Data connections

The data measurements account for 48 percent of the total result. Several popular live pages (dynamic) and the ETSI reference page known as the Kepler page (static) were retrieved to assess internet page calls. In addition, 10 MB and 5 MB files were downloaded and uploaded, respectively, in order to determine the performance for smaller data transfers. We also determined the data rate within a 7-second period when uploading and downloading large files. As Youtube dynamically adapts the resolution to the available bandwidth, the evaluation takes into account the average image resolution or number of lines of the videos as well as the success rate and the time until playback starts.

A typical over-the-top voice connection (OTT) is represented by the "conversational app" test case. To do this, we set up a voice channel via the SIP and STUN protocols using the OPUS codec and determined the success rate and voice quality. In addition, for our test point "Interactivity of eGaming" our measurements simulated a highly interactive UDP multiplayer session to determine the latency times of the connection and any possible packet losses. >>

Methodology

Crowdsourcing
Crowdsourcing results accounted for 25 per cent of the overall rating. They show which network performance actually arrives at the user – however, the end devices and tariffs used also have an impact on these results.

To obtain the data basis for these analyses, thousands of popular apps recorded the parameters described below in the background – provided the user agreed to the completely anonymous data collection. The measured values were recorded in 15-minute intervals and transmitted to the umlaut servers once a day. The reports contain only a few bytes, so they hardly burden the user's data volume.

Broadband Coverage
In order to determine the broadband *coverage reach*, umlaut laid a grid of 2 x 2 km tiles ("Evaluation Areas", in short EAs) over the test area. A minimum number of users and measured values had to be available for each EA. For the evaluation, umlaut awarded one point per EA if the network under consideration offered 3G coverage. Three points were awarded if 4G or 5G was available in the EA. The score achieved was divided by the achievable number of points (three points per EA in the "union footprint" – the area of the country measured by all testers with their smartphones).

We also looked at the *coverage quality*. For each operator, it indicates the average percentage of 4G or 5G coverage on an EA, averaged over all EAs in the common footprint, i.e. the area in which data is served by all operators.

The *time on broadband* in turn tells us how often a user had 4G or 5G reception in the period under consideration – regardless of the EAs in which the samples were recorded. For this purpose, umlaut sets the samples that show 4G/5G coverage in relation to the total number of all samples. Important: The percentage values determined for all three parameters reflect the respective degree of fulfilment – and not a percentage of 4G/5G mobile coverage in relation to area or population.

Data rates and Latencies
The *passive* determination of *download data rates* and *latencies* was carried out independently of the EAs and focused on the experience of each user. Samples that were captured via Wi-fi or when flight mode was activated, for example, were filtered out by umlaut before the analysis.

To take into account that many mobile phone tariffs throttle the data rate, umlaut defined three application-related speed classes: *Basic internet* requires a minimum of 2 Mbit/s, *HD video* requires 5 Mbit/s and *UHD video* requires 20 Mbit/s. For a sample to be valid, a minimum amount of data must have flowed in a 15-minute period.

Similarly, the latency of the data packets is assigned to an application-related class: Roundtrip times up to 100 ms are sufficient for *OTT voice services*, less than 50 ms qualify a sample for *gaming*. This way, the evaluation also does justice to the fact that the passively observed data rates depend on the applications used in each case.

In order to better assess the maximum possible throughput, umlaut also conducted *active* measurements of *upload* and *download* data rates once a month. They determine the amount of data transferred in 3.5 seconds. For the determined values, we consider the average data rate, the P10 value (90% of the values higher than the specified threshold, a good approximation of the typical minimum speed) and the P90 (10% above this threshold), a view at the peak values.

Stability
Based on the determined data rates and additional browsing and connection tests, umlaut also examined when a broadband connection could be used at all. The averaged and weighted results define the percentage of *transaction success*.

HD Voice
The parameter *HD voice* shows the proportion of the user's voice connections that were established in HD quality – and thus via VoLTE (Voice over LTE). A prerequisite was that the smartphone supports this standard.

Reliability
umlaut divided all measured values into basic requirements ("Qualifier KPIs") and values related to peak performance ("Differentiator KPIs"). The presentation of *reliability* takes into account only the "Qualifier KPIs" from the voice and data category as well as the basic KPIs from crowdsourcing.