

2.1 Mio.
Inhabitants
(drivetest and walktest)

6,500
km drivetest

140,007
Data Samples
(drivetest and walktest)

14,887
Voice Samples
(drivetest and walktest)

54,000
Users
(crowd-sourcing)

153 Mio.
Samples
(crowd-sourcing)

3
Months
(September to November 2018)

83%
Coverage of built-up area
(crowd-sourcing)



THE GREAT 2019 MOBILE NETWORK TEST SWITZERLAND



This year, we had to slightly postpone our renowned and sophisticated network test for Switzerland. But now, following the publication of those for Germany and Austria in December 2018, the Swiss results are also available.

Due to logistical reasons, we had to schedule our Great Mobile Network Test in Switzerland a little later than its equivalents for Germany and Austria (see connect 1/2019). From November 28 to December 20, two of P3's drivetest vehicles equipped with sophisticated measurement gear visited 18 larger cities and 31 smaller towns in Switzerland, together covering a total of 6,500 kilometres. Of these, 3160 km accounted for the connect-

ing roads between the cities and towns. Those measurements by car were complemented by walktests, conducted in eight Swiss cities, as well as by test journeys performed on Swiss trains. The detailed test routes can be seen on the map above, the key figures of our benchmark are listed on the left.

Results enthusiastically awaited
Not just the Swiss operators and their customers, but also participants and users from other coun-

tries, eagerly expected the results. The reason for this anticipation is that the results of our network test in Switzerland traditionally range on a very advanced level – ahead of those from Germany and Austria.

Once again, the Swiss operators gave each other a neck-and-neck race. The 2018 network test in Switzerland resulted in a tie of Sunrise and Swisscom. This time we have a clear winner, though with a very narrow margin.

Hannes Rügheimer



Voice **This discipline already demonstrates the high performance level of the Swiss mobile networks.**

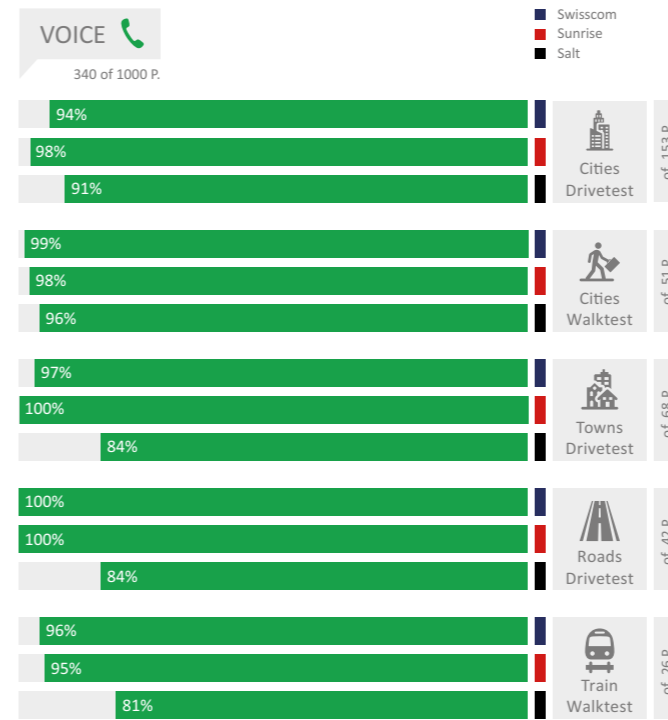
While Swisscom and Sunrise have already rolled out Voice over LTE (VoLTE) in their networks and additionally support the modern EVS codec („Enhanced Voice Services“), Salt's network does not yet offer this improved voice mode.

Looking at the results of the drivetests conducted in 18 larger Swiss cities, Sunrise scores ahead of Swisscom in the voice discipline. Among other factors, this might be explained with the fact that almost a 100 per cent of the test calls set up in the Sunrise network could be established via LTE – thus allowing for fast call setup times. But even though Salt customers still have to use the older circuit-switched fallback (reverting to 3G) in order to conduct phone calls, they also get high voice quality and reliability.

In the walktests conducted within the larger cities, Swisscom leads by a narrow margin. In the smaller towns, Sunrise is ahead. Salt manages to keep up in the examined larger cities, but when it comes to the 31 smaller towns, this smallest

Swiss operator falls a little behind. Similar results can also be observed on the connecting roads, where Swisscom and Sunrise impress with a success ratio of 100 per cent. In such a strong environment, even Salt's high success ratio of about 97 per cent looks almost like a weak result. But as this operator also shows longer call setup times and a lower voice quality MOS, Salt overall falls a little behind on the connecting roads. Still, the partial scores of our telephony tests all in all range on a pleasantly high level.

This is also true for the measurements performed on the Swiss railways. Here, the operators from Switzerland traditionally demonstrate to their peers in Germany and also Austria what a leading performance means. This year makes no exception to this rule – particularly the success ratios and setup times of calls initiated while travelling on the trains score in a range that providers and customers from the neighbouring countries can only dream about.



OPERATOR	Swisscom	Sunrise	Salt
VOICE (Cities; Drivetest)			
Call Success Ratio (%)	99.0	99.6	99.2
Call Setup Time Ø (s) / P90 (s)	1.4/1.6	1.1/1.3	3.3/3.7
Speech Quality (MOS-LQO)	4.3	4.3	3.7
VOICE (Cities; Walktest)			
Call Success Ratio (%)	99.9	99.7	100.0
Call Setup Time Ø (s) / P90 (s)	1.4/1.6	1.1/1.3	3.1/3.5
Speech Quality (MOS-LQO)	4.4	4.4	3.8
VOICE (Towns; Drivetest)			
Call Success Ratio (%)	99.5	100.0	97.8
Call Setup Time Ø (s) / P90 (s)	1.4/1.6	1.1/1.3	3.2/3.6
Speech Quality (MOS-LQO)	4.4	4.4	3.7
VOICE (Roads; Drivetest)			
Call Success Ratio (%)	100.0	100.0	96.8
Call Setup Time Ø (s) / P90 (s)	1.4/1.6	1.1/1.3	3.4/3.8
Speech Quality (MOS-LQO)	4.3	4.4	3.8
VOICE (Train; Walktest)			
Call Success Ratio (%)	99.1	98.7	96.1
Call Setup Time Ø (s) / P90 (s)	1.5/1.7	1.2/1.4	3.4/3.7
Speech Quality (MOS-LQO)	4.2	4.2	3.7

Data

When it comes to data communications, the Swiss operators once again compete at the highest level.

► In the important discipline of data communications, all considered scenarios reveal quite a similar picture: The two top contenders Sunrise and Swisscom give each other a neck-and-neck race for the highest rank, while the smallest contender Salt follows at close distance with still very good results.

In the big cities, Swisscom takes a narrow lead – both in the drive-tests and in the walktests. However, all three providers achieve very high reliability rates, ranging well above 99 per cent for most of the examined use cases. In the small number of instances where this threshold is not met, the margin is only in a magnitude of some tenths of a percentage point.

High share of 4CA at Swisscom

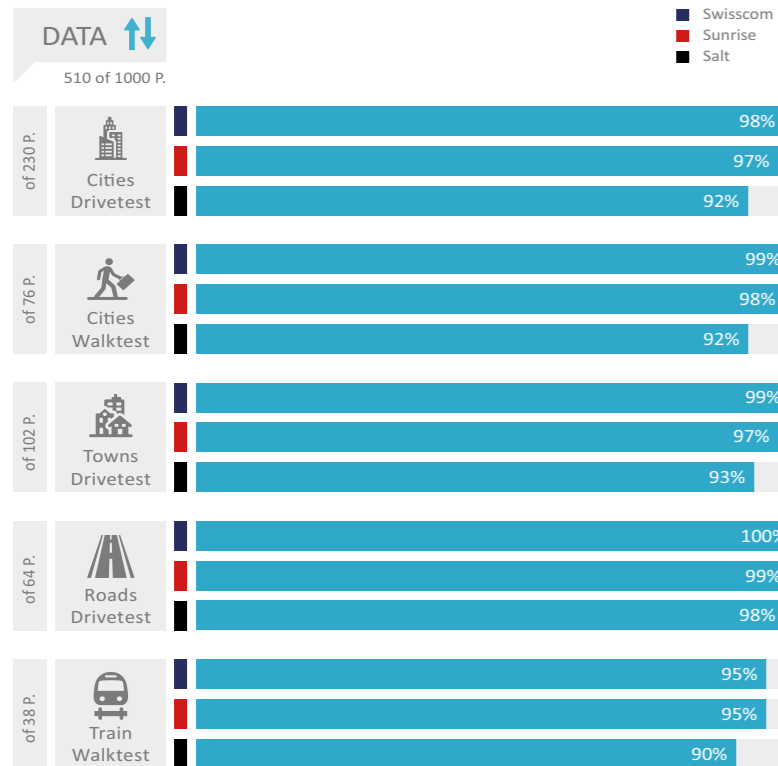
Market leader Swisscom achieves its narrow lead over the also very strong Sunrise mostly due to slightly higher data rates. A more detailed view at the gathered measurement results reveals Swiss-

com achieving a high share of connections with “4 carrier aggregation” – downlinks on four combined carrier frequencies, which allows a theoretical maximum data rate of 900 Mbps on suitable end-user devices in accordingly equipped LTE network cells. However, the average data rates achieved in the measurements are considerably lower (see adjacent table).

Sunrise also offers carrier aggregation technology in a number of Swiss cities. Outside of these urban regions, the operator supplies its customers at least with up to 300 mpbs. Therefore, it is no surprise that the data rates measured in Sunrise’s network are in a similar range than those of Swisscom.

In mid 2018, Salt reported to have upgraded more than a hundred mobile network basestations to “4G+“ with up to 500 Mbps. This is indeed reflected in the data rates that we have gathered during our drivetests and walktests. The results of our measurement cars visiting

OPERATOR	Swisscom	Sunrise	Salt
DATA (Cities; Drivetest)			
Web-Page Download (Live/Static)			
Success Ratio (%/%)	99.9/99.8	99.8/99.7	99.3/99.8
Static: Avg. Session Time (s)	0.9	0.8	1.1
Live: Reaction Time (ms)	214	203	341
Live: Volume in 1. sec (kB/s)	755	749	651
File-Download (3MB)			
Success Ratio/Ø Session Time (%/s)	100.0/0.8	99.9/0.9	99.9/1.6
90%/10% faster than (kbit/s)	21667/87912	15951/103004	9208/71027
File-Upload (1MB)			
Success Ratio/Ø Session Time (%/s)	99.9/0.4	99.9/0.5	99.8/0.7
90%/10% faster than (kbit/s)	16971/34632	14149/34632	10593/29304
File-Download (7 seconds)			
Success Ratio (%)	99.9	99.9	99.9
Ø Throughput (kbit/s)	90041	77953	48068
90%/10% faster than (kbit/s)	26311/168770	19800/149355	12121/98226
File-Upload (7 seconds)			
Success Ratio (%)	99.8	99.9	99.8
Ø Throughput (kbit/s)	46672	43155	36870
90%/10% faster than (kbit/s)	22277/61041	18751/59844	13004/59062
Youtube Videos			
Success Ratio/Start Time (%/s)	99.7/1.0	99.9/1.1	99.3/1.3
Playouts without Interruptions (%)	100.0	99.7	99.4
Ø Video Resolution (p)	1078	1079	1072
Youtube Live			
Success Ratio/Start Time (%/s)	99.8/1.7	99.6/1.7	98.8/2.1
Playouts without Interruptions (%)	99.2	99.5	98.5
Ø Video Resolution (p)	1077	1078	1073
DATA (Cities; Walktest)			
Web-Page Download (Live/Static)			
Success Ratio (%/%)	99.9/100.0	99.9/100.0	99.5/100.0
Static: Avg. Session Time (s)	0.9	0.8	1.1
Live: Reaction Time (ms)	207	206	376
Live: Volume in 1. sec (kB/s)	760	749	644
File-Download (3MB)			
Success Ratio/Ø Session Time (%/s)	100.0/0.7	100.0/0.8	100.0/1.7
90%/10% faster than (kbit/s)	24113/111111	24783/106667	9581/76433
File-Upload (1MB)			
Success Ratio/Ø Session Time (%/s)	100.0/0.4	100.0/0.5	99.4/0.9
90%/10% faster than (kbit/s)	20747/34483	13232/35088	7613/28249
File-Download (7 seconds)			
Success Ratio (%)	99.8	99.8	100.0
Ø Throughput (kbit/s)	120136	86691	48628
90%/10% faster than (kbit/s)	36264/250333	26126/165888	11499/101651
File-Upload (7 seconds)			
Success Ratio (%)	100.0	100.0	99.2
Ø Throughput (kbit/s)	49682	41563	32854
90%/10% faster than (kbit/s)	28739/61513	17389/58349	10201/55759
Youtube Videos			
Success Ratio/Start Time (%/s)	100.0/1.0	99.8/1.1	100.0/1.4
Playouts without Interruptions (%)	100.0	99.6	99.6
Ø Video Resolution (p)	1079	1074	1070
Youtube Live			
Success Ratio/Start Time (%/s)	100.0/1.7	99.6/1.7	98.7/2.1
Playouts without Interruptions (%)	99.6	99.6	99.1
Ø Video Resolution (p)	1080	1075	1056
DATA (Towns; Drivetest)			
Web-Page Download (Live/Static)			
Success Ratio (%/%)	100.0/100.0	99.8/100.0	99.5/99.6
Static: Avg. Session Time (s)	0.9	0.8	1.0
Live: Reaction Time (ms)	211	220	349
Live: Volume in 1. sec (kB/s)	748	744	653
File-Download (3MB)			
Success Ratio/Ø Session Time (%/s)	100.0/0.7	100.0/0.8	99.8/1.6
90%/10% faster than (kbit/s)	23810/88693	19117/96853	10694/76312
File-Upload (1MB)			
Success Ratio/Ø Session Time (%/s)	100.0/0.4	100.0/0.5	99.6/0.8
90%/10% faster than (kbit/s)	17260/34483	11561/32363	8696/29304
File-Download (7 seconds)			
Success Ratio (%)	100.0	100.0	100.0
Ø Throughput (kbit/s)	95200	72099	59028
90%/10% faster than (kbit/s)	28983/174213	21612/125309	14903/125834
File-Upload (7 seconds)			
Success Ratio (%)	100.0	100.0	99.6
Ø Throughput (kbit/s)	44864	38465	36349
90%/10% faster than (kbit/s)	20920/60925	16062/57289	10335/59440
Youtube Videos			
Success Ratio/Start Time (%/s)	100.0/1.0	100.0/1.0	99.2/1.3
Playouts without Interruptions (%)	99.8	99.6	100.0
Ø Video Resolution (p)	1079	1078	1075
Youtube Live			
Success Ratio/Start Time (%/s)	100.0/1.7	100.0/1.7	99.6/2.0
Playouts without Interruptions (%)	99.6	99.2	99.6
Ø Video Resolution (p)	1080	1080	1074



smaller Swiss towns also reveal similar tendencies – and once more pleasantly good results with the same ranking that we already determined in the bigger cities.

All three Swiss mobile networks offer top reliability

In this context, especially the high success ratios in smaller towns as well as on the connecting roads must be highlighted. Even though the data rates and reaction times fall a little behind in comparison to the urban areas, Swiss mobile customers can count on getting reliable and high-performance data connections in most rural areas and also while driving in their cars.

It is particularly pleasant to observe that this is not only true for the market leader Swisscom but also for the two smaller contenders Sunrise and Salt. Swiss customers who are looking for the highest possible performance are in good hands at Swisscom and Sunrise. If bargain tariffs are the top priority, Salt is a good choice –



where customers still receive a convincingly strong network performance.

Connectivity on Swiss trains well ahead in Europe

As already observed during the voice tests, it is quite obvious that the described results are also valid (with only very small deviations) while travelling on Swiss railways. The walktest team covered some of the distances between the visited

cities by train. In these situations, it also determined success rates of mostly over 99 per cent, comparably high data rates and fast reaction times. While railway customers in almost all neighbouring countries have to live with considerable limitations in this respect, working online while travelling on Swiss trains is convenient and stress-free. The 2019 network test once again confirms that Switzerland is well ahead in Europe in this category. >>

Extensive journeys on Swiss railways were once again part of the testing procedures of our walktest team.

OPERATOR	Swisscom	Sunrise	Salt
DATA (Roads; Drivetest)			
Web-Page Download (Live/Static)			
Success Ratio (%/%)	100.0/100.0	99.8/100.0	99.6/99.6
Static: Avg. Session Time (s)	0.9	0.8	1.1
Live: Reaction Time (ms)	234	209	391
Live: Volume in 1. sec (kB/s)	762	757	665
File-Download (3MB)			
Success Ratio/Ø Session Time (%/s)	100.0/0.7	100.0/0.8	100.0/1.2
90%/10% faster than (kbit/s)	22719/90294	19338/102433	12454/81246
File-Upload (1MB)			
Success Ratio/Ø Session Time (%/s)	100.0/0.5	100.0/0.7	99.6/0.8
90%/10% faster than (kbit/s)	12500/34335	8661/33333	8501/29080
File-Download (7 seconds)			
Success Ratio (%)	99.8	100.0	100.0
Ø Throughput (kbit/s)	107329	76070	70845
90%/10% faster than (kbit/s)	35546/191348	19954/144859	17888/132148
File-Upload (7 seconds)			
Success Ratio (%)	100.0	99.6	99.6
Ø Throughput (kbit/s)	41728	36527	35669
90%/10% faster than (kbit/s)	15993/60276	12525/56489	13230/58751
Youtube Videos			
Success Ratio/Start Time (%/s)	100.0/1.0	100.0/1.0	100.0/1.2
Playouts without Interruptions (%)	100.0	99.8	99.8
Ø Video Resolution (p)	1080	1079	1072
Youtube Live			
Success Ratio/Start Time (%/s)	100.0/1.7	100.0/1.7	99.2/1.8
Playouts without Interruptions (%)	100.0	99.2	97.5
Ø Video Resolution (p)	1080	1080	1080

OPERATOR	Swisscom	Sunrise	Salt
DATA (Train; Walktest)			
Web-Page Download (Live/Static)			
Success Ratio (%/%)	98.8/99.7	99.6/99.0	98.1/98.8
Static: Avg. Session Time (s)	1.3	1.1	1.3
Live: Reaction Time (ms)	218	237	377
Live: Volume in 1. sec (kB/s)	677	671	598
File-Download (3MB)			
Success Ratio/Ø Session Time (%/s)	100.0/2.0	100.0/1.5	99.7/2.6
90%/10% faster than (kbit/s)	6000/64954	9604/65934	4869/62664
File-Upload (1MB)			
Success Ratio/Ø Session Time (%/s)	99.3/0.8	99.3/1.1	98.3/1.3
90%/10% faster than (kbit/s)	8860/28051	5259/29423	4767/25625
File-Download (7 seconds)			
Success Ratio (%)	99.3	99.7	99.7
Ø Throughput (kbit/s)	53709	45589	35052
90%/10% faster than (kbit/s)	11425/110393	9306/95714	6008/77313
File-Upload (7 seconds)			
Success Ratio (%)	99.0	99.7	97.2
Ø Throughput (kbit/s)	29758	26859	24706
90%/10% faster than (kbit/s)	12508/46713	7073/47701	5672/44067
Youtube Videos			
Success Ratio/Start Time (%/s)	99.0/1.3	99.7/1.4	98.6/1.6
Playouts without Interruptions (%)	99.7	99.0	99.0
Ø Video Resolution (p)	1073	1071	1061
Youtube Live			
Success Ratio/Start Time (%/s)	98.6/1.9	97.3/2.0	98.6/2.2
Playouts without Interruptions (%)	97.9	98.6	97.1
Ø Video Resolution (p)	1075	1072	1067

Crowd

In order to consider in the user experience over longer periods and also locations off our test routes and places, the results of crowdsourcing analyses are included with 15 per cent in the overall evaluation.

Crowd	Swisscom	Sunrise	Salt
Voice Coverage			
Quality of Coverage (%)	99.4	99.4	98.5
Test Area Coverage (%)	99.9	99.9	99.7
Data Coverage			
Quality of Coverage (%)	99.1	99.5	98.5
Test Area Coverage (%)	99.9	99.8	99.2
4G Coverage			
Quality of Coverage (%)	94.5	93.8	87.5
Test Area Coverage (%)	99.6	99.5	95.8
User Data Speed			
10% EA faster than (kbit/s)	103431	76448	66284
10% Users faster than (kbit/s)	31458	29101	29739
Avg. Users Best Throughput (kbit/s)	10402	9761	10123
Data Service Availability			
Number of degraded days (d)	1	0	8
Number of degraded hours (h)	1	0	22

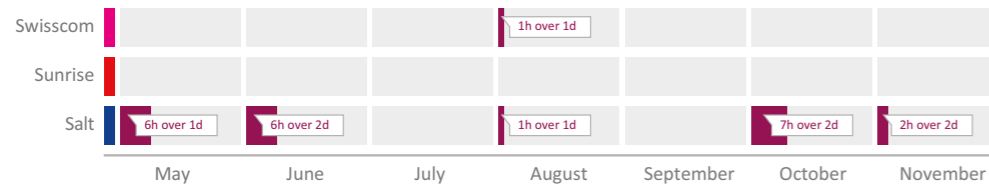
► We have filtered a small number of outliers with conspicuously good results from our crowd evaluation as we could not absolutely exclude the suspicion of fraud. Further details about this can be found in the online version of this test on www.connect-testlab.com.

High values for the crowdsourced network coverage for voice and 4G once more emphasise the good network performance in Switzerland. Also the “quality of coverage“ (how often the customers could have actually used a respective network technology) is pleasantly high. Swisscom shows somewhat higher top values for the effectively achieved data speeds. Here, Sunrise and Salt are on a par, but behind Swisscom.

For „Data Service Availability“, we have extended the observation period to last from May until November 2018. Here, Sunrise shows a convincing zero observed degradations. In the Swisscom network, we identified only one event with a length of up to one hour in August 2018. In the Salt network, we recognised degradations on eight days over a total of 22 hours in the Salt network.

DATA SERVICE AVAILABILITY

Affected hours (h) and days (d) (2018)



Fairness, transparency and sophisticated methodology

Details about the methodology and parameters can be found in connect 1/2019 or online. As our test in Switzerland uses the same methods, its results can be compared to those from Germany and Austria.

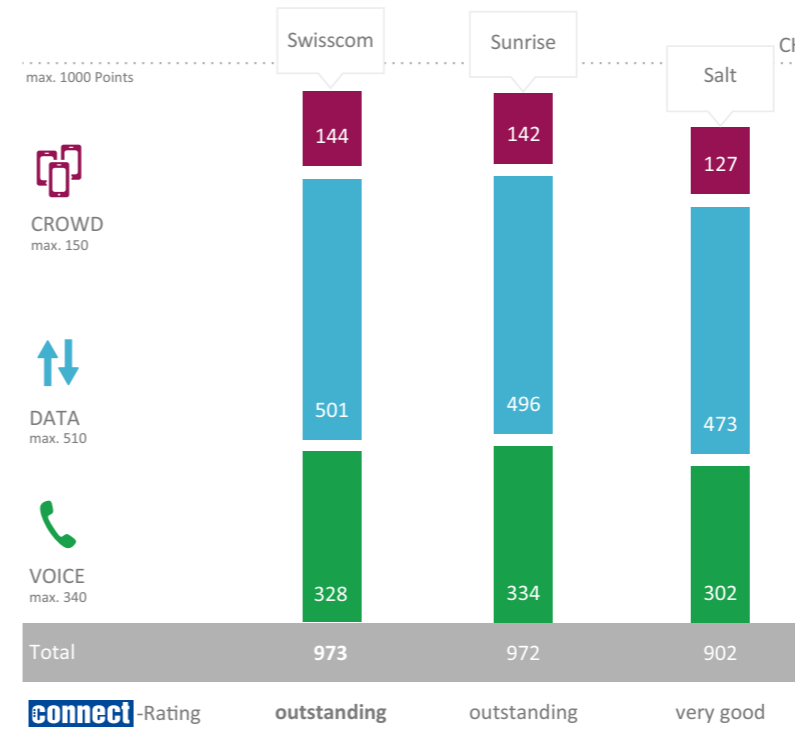
Although the drivetests, walktests and crowdsourcing evaluations for Switzerland had to take place a little later in time than those in the neighbouring countries Germany and Austria, our high standards also apply to the tests performed in Switzerland. A detailed description of our methodology as well as of the testing procedures and peculiarities during its execution can be found in connect 1/2019 or online on www.connect.de/netztest (in

German language). Additionally, all test results are available on www.connect-testlab.com in English. With the outcomes published on the mentioned websites, readers can also directly compare the results achieved by the Swiss operators with their counterparts from the two neighbouring countries Germany and Austria. We have published all key figures and the specific routes of our tests in Switzerland on the first page of this report. Of course, we adhere

to our high standards for the statistical relevance of the drivetests, walktests and crowdsourced analyses in the smallest of the three participating countries as well: The drivetests and walktests cover approximately 2.1 million inhabitants in Switzerland, corresponding to about 25.4 per cent of the population. For the crowdsourcing evaluations which are also part of the assessment, approximately 54,000 users have contributed a total of 153 million samples.

Single review

Due to changes in the methodology and weighting, this year's scores are not directly comparable with last year's results. Nevertheless, Swisscom and Sunrise maintain their high performance levels. Swisscom crosses the finish line with a razor-thin lead. Salt was able to improve considerably.



■ The overall 2019 winner in Switzerland is Swisscom – with a razor-thin lead of just one point. The market leader outperforms its strong rival Sunrise thanks to the data and crowdsourcing disciplines. However, its voice results fell marginally behind in comparison to the previous year. But all in all, Swisscom deservedly claims the total victory of this test and receives the grade “outstanding”.

Sunrise

■ As in the year before, Sunrise scores ahead of its rival Swisscom in the voice discipline. The results of the data measurements and the crowdsourcing analyses are also top-class. We especially did not observe any degradations at all in Sunrise's network between May and November 2018. Scoring only one point behind the test's winner, Sunrise achieves the second rank and also the grade “outstanding”.

Salt.

■ Salt scores third, but shows the most distinct improvement over previous year's results. Both in the voice and in the data disciplines, the successor to Orange achieves better results than in our measurements conducted one year ago. Even if the crowdsourcing reveals a comparatively high number of degradations, Salt thus rises from last year's grade “good” to an impressive “very good”.

SWITZERLAND

Overall Results Voice, Data and Crowd	Swisscom	Sunrise	Salt
VOICE (max. 340 Points)	328	334	302
Cities Drivetest	153 (94%)	98%	91%
Cities Walktest	51 (99%)	98%	96%
Towns Drivetest	68 (97%)	100%	84%
Roads Drivetest	42 (100%)	100%	84%
Train Walktest	26 (96%)	95%	81%
DATA (max. 510 Points)	501	496	473
Cities Drivetest	230 (98%)	97%	92%
Cities Walktest	76 (99%)	98%	92%
Towns Drivetest	102 (99%)	97%	93%
Roads Drivetest	64 (100%)	99%	98%
Train Walktest	38 (95%)	95%	90%
CROWD (max. 150 Points)	144	142	127
Crowd Total	150 (96%)	95%	85%
Total (max. 1000 Points)	973	972	902
connect -RATING	outstanding	outstanding	very good

All values have been rounded to integer numbers. The internal calculation of points and percentages was based on three decimal places. Intermediate results therefore can slightly deviate from the specified values.



Conclusion

Hannes Ruegheimer, connect author



As it has been usual in Switzerland for years, there was a neck-and-neck race between the two extremely strong contenders Swisscom and Sunrise, taking place on the highest level. This time, the race ends with a photo finish. After we had seen a tie of the two rivals in the previous year, this time, Swisscom manages to win back the crown with a close margin in the data and crowdsourcing disciplines. Sunrise also shows outstanding results and furthermore turns out to be the strongest operator in the voice discipline. The smallest Swiss operator, Salt, also makes an excellent impression, presenting significant improvements over last year's results both in the voice and data tests. The very good performance of the Swiss providers on the trains will make German mobile customers cry – particularly as all three Swiss candidates have improved again in this discipline compared to the previous year.