

Audit Report.

Mobile Data performance
in Romania, 2021





Measurement Overview

umlaut has tested and measured the performance of its data services on smartphones in comparison to other LTE/UMTS/GSM mobile radio networks in metropolitan and rural areas of Romania.

The audit was done as a performance benchmark performed by umlaut between 24.02.2021 and 22.03.2021 in cities and towns as well as on connection roads. Dedicated measurements have been executed as drive tests outdoors using a Samsung Galaxy S10 Cat20 2000/150 Mbps and Samsung Galaxy S20+ Cat20 2000/200 Mbps; 5G (5+ Gbps DL) Smartphone.

All data measurements have been performed in 4G preferred mode and 5G preferred mode.

The following pages provide a comparative overview about the performance results observed for the different tested service types.

This audit report was commissioned by Vodafone Romania.



Measurement setup

Drivetest	Data
Device	Samsung Galaxy S10 4G pref (System1) Samsung Galaxy S20+ 5G pref (System2 and 3)
Test Cases	Data 4G/5G preferred CA HTTP DL datastream 7s HTTP UL datastream 7s HTTP 5MB DL fixed file transfer HTTP 2.5MB UL fixed file transfer Web Browsing – Kepler ETSI Ref. Page 10 Live web pages 3 YouTube HD video ~ 45s
Mobility and Route Types	Drivetest and city Walktest 59% in Cities, 14% in Towns and 27% on Roads
Samples	~ 36300 per Operator
Dates	17 drivetest and 6 walktest measurement days 24.02.2021 – 22.03.2021



Testing area

Drive route



38%
of population measured



8784 km
measuring distance

5G results are based on measurements in 7 cities (Bucuresti, Timisoara, Cluj Napoca, Iasi, Ploiesti, Brasov, Constanta), where Vodafone Romania has 5G available. The measurements has been performed with a 5G capable device in 5G preferred mode in mobility testing.



Methodology

The leader in mobile benchmarking, umlaut, has analyzed the mobile networks of Romania with regards to mobile network performance. We measure smartphone voice and data performance based on extensive drivetests – from major metropolitan areas to smaller cities and connection roads.

We objectively define the routes and test methodology and publish the results through certificates or public benchmark reports.

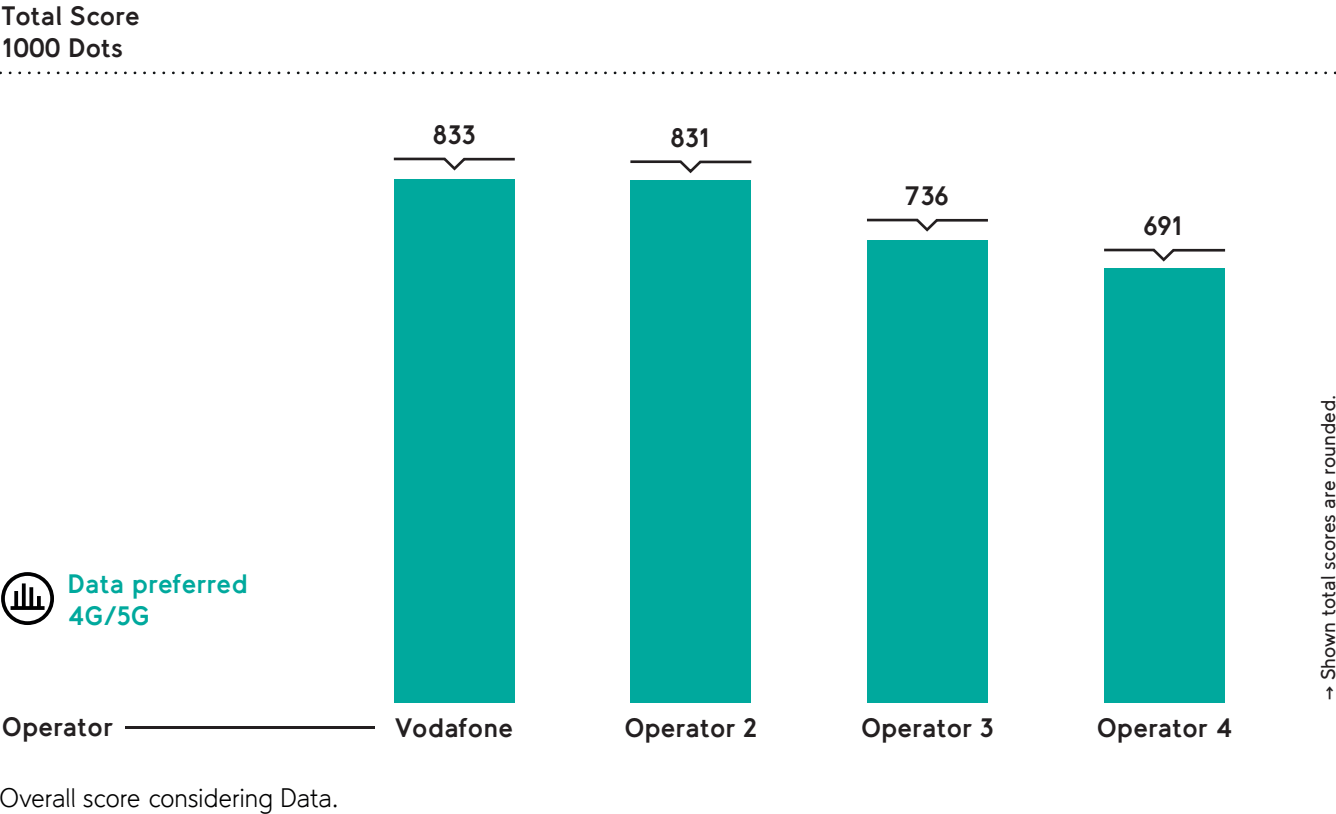
As the de-facto industry standard, our benchmarking methodology focuses on customer-perceived network quality and covers a wide range of mobile services.

Today, more than 200 mobile networks in more than 120 countries are being evaluated by our unique scoring methodology. It allows a technical analysis that is unprecedented in its level of detail and enables comparisons between the network performance and capability of each mobile network. Our public benchmarks as well as the certificate benchmarks help network operators to demonstrate how well they are delivering wireless connections to consumers, business users and enterprises and reveals the areas of improvement.



Score

Data



Score Overall Data

4G/5G Drivetest & Walktest		Vodafone	Operator 2	Operator 3	Operator 4
Cities Drivetest	450	88%	87%	78%	67%
Cities Walktest	150	86%	85%	80%	84%
Towns Drivetest	200	78%	77%	70%	60%
Roads Drivetest	200	77%	79%	63%	71%
Total	1000	833	831	736	691

Shown scores are rounded.

Score 5G pref

5G pref Drivetest		Vodafone	Operator 2	Operator 3	Operator 4
Cities Drivetest	1000	91%	84%	79%	73%
Total	1000	911	844	788	733

Shown scores are rounded.



Overall Data Services KPI Overview

Achieved values of all networks under test in each of the relevant Data Key Performance Indicators (KPIs) for the geo-graphical category “Cities Drivetest”.

Data Cities (DT)	KPI Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
HTTP Live Page DL Smartphone	Qualifier	[%]	99,3	99,1	98,8	98,8
	Overall Session Time	[s]	1,3	1,3	1,5	1,5
HTTP Static Page DL Smartphone	Qualifier	[%]	99,2	99,4	99,4	99,3
	Overall Session Time	[s]	1,1	1,2	1,3	1,5
HTTP 5MB DL Smartphone	Qualifier	[%]	99,2	99,9	99,4	99,9
	Average Session Time	[s]	1,9	2,5	5,2	4,7
	90% faster than	[Mbit/s]	13,4	12,1	3,3	6,8
	10% faster than	[Mbit/s]	109,1	97,8	62,6	42,1
HTTP 2500KB UL Smartphone	Qualifier	[%]	99,9	99,6	99,7	97,2
	Average Session Time	[s]	1,5	1,9	2,0	8,2
	90% faster than	[Mbit/s]	10,0	7,8	7,6	1,1
	10% faster than	[Mbit/s]	35,6	34,5	37,3	9,5
HTTP DL FDTT	Qualifier	[%]	98,8	99,2	99,2	99,4
	Average Data Rate	[Mbit/s]	93,2	121,1	30,3	23,0
	90% faster than	[Mbit/s]	16,9	15,6	4,3	6,0
	10% faster than	[Mbit/s]	216,9	306,8	68,7	39,0
HTTP UL FDTT	Qualifier	[%]	99,5	99,7	99,9	92,9
	Average Data Rate	[Mbit/s]	36,8	36,1	32,4	5,1
	90% faster than	[Mbit/s]	12,2	9,6	11,6	1,1
	10% faster than	[Mbit/s]	64,6	56,1	53,2	9,1
YouTube	Qualifier	[%]	98,4	98,1	95,9	97,2
	Start Time	[s]	1,3	1,3	1,7	1,8
	AVG Resolution	[p]	918	911	894	901
YouTube Live Smartphone	Qualifier	[%]	97,4	97,8	93,9	97,0
	Start Time	[s]	1,5	1,4	1,8	1,8
	AVG Resolution	[p]	1036	1030	1003	1020



Achieved values of all networks under test in each of the relevant Data Key Performance Indicators (KPIs) for the geo-graphical category “Cities Walktest”.

Data Cities (WT)	KPI Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
HTTP Live Page DL Smartphone	Qualifier	[%]	98,6	99,7	98,5	99,9
	Overall Session Time	[s]	1,2	1,4	1,6	1,3
HTTP Static Page DL Smartphone	Qualifier	[%]	99,8	99,2	98,5	99,4
	Overall Session Time	[s]	1,0	1,4	1,3	1,2
HTTP 5MB DL Smartphone	Qualifier	[%]	98,5	99,2	99,6	100,0
	Average Session Time	[s]	1,4	2,5	3,9	2,5
	90% faster than	[Mbit/s]	21,5	16,0	4,4	11,5
	10% faster than	[Mbit/s]	146,8	150,3	71,4	166,7
HTTP 2500KB UL Smartphone	Qualifier	[%]	99,6	99,6	100,0	99,5
	Average Session Time	[s]	1,5	2,2	2,3	4,0
	90% faster than	[Mbit/s]	9,2	5,4	6,1	2,1
	10% faster than	[Mbit/s]	34,5	37,6	39,6	25,3
HTTP DL FDTT	Qualifier	[%]	98,6	99,3	98,9	100,0
	Average Data Rate	[Mbit/s]	187,3	262,3	38,2	97,8
	90% faster than	[Mbit/s]	29,7	27,2	6,9	8,1
	10% faster than	[Mbit/s]	416,4	547,0	77,1	277,4
HTTP UL FDTT	Qualifier	[%]	98,9	98,5	98,8	98,4
	Average Data Rate	[Mbit/s]	39,4	44,7	37,3	13,2
	90% faster than	[Mbit/s]	13,4	6,6	14,6	1,6
	10% faster than	[Mbit/s]	72,9	88,5	58,2	30,2
YouTube	Qualifier	[%]	98,5	97,0	96,6	99,2
	Start Time	[s]	1,3	1,4	1,7	1,5
	AVG Resolution	[p]	919	913	902	907
YouTube Live Smartphone	Qualifier	[%]	93,2	95,7	96,5	98,1
	Start Time	[s]	1,4	1,6	1,9	1,7
	AVG Resolution	[p]	1040	1033	1019	1021



Overall Data Services KPI Overview

Achieved values of all networks under test in each of the relevant Data Key Performance Indicators (KPIs) for the geo-graphical category “Towns Drivetest”.

Data Towns (DT)	KPI Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
HTTP Live Page DL Smartphone	Qualifier	[%]	98,0	98,8	98,6	98,4
	Overall Session Time	[s]	1,3	1,5	1,9	1,6
HTTP Static Page DL Smartphone	Qualifier	[%]	98,1	99,1	98,9	97,8
	Overall Session Time	[s]	1,1	1,3	1,6	1,7
HTTP 5MB DL Smartphone	Qualifier	[%]	98,5	99,5	100,0	99,2
	Average Session Time	[s]	2,8	3,7	6,5	5,3
	90% faster than	[Mbit/s]	7,3	7,0	2,8	4,3
	10% faster than	[Mbit/s]	78,1	67,3	63,6	38,1
HTTP 2500KB UL Smartphone	Qualifier	[%]	99,2	99,7	98,4	96,6
	Average Session Time	[s]	2,2	1,7	1,9	7,6
	90% faster than	[Mbit/s]	6,4	8,3	7,2	1,2
	10% faster than	[Mbit/s]	30,8	30,9	35,3	14,5
HTTP DL FDTT	Qualifier	[%]	99,0	100,0	98,8	99,5
	Average Data Rate	[Mbit/s]	49,8	45,5	32,5	19,7
	90% faster than	[Mbit/s]	6,8	6,0	2,9	3,4
	10% faster than	[Mbit/s]	106,8	100,5	75,5	39,3
HTTP UL FDTT	Qualifier	[%]	99,5	99,7	99,7	94,1
	Average Data Rate	[Mbit/s]	23,4	27,3	29,0	6,1
	90% faster than	[Mbit/s]	6,7	10,4	8,6	1,0
	10% faster than	[Mbit/s]	43,1	46,3	49,1	13,8
YouTube	Qualifier	[%]	96,5	93,8	92,3	92,6
	Start Time	[s]	1,4	1,5	1,8	1,8
	AVG Resolution	[p]	906	903	889	894
YouTube Live Smartphone	Qualifier	[%]	95,7	92,8	89,6	93,3
	Start Time	[s]	1,5	1,6	2,0	1,8
	AVG Resolution	[p]	1018	1028	1002	1003



Achieved values of all networks under test in each of the relevant Data Key Performance Indicators (KPIs) for the geo-graphical category “Roads Drivetest”.

Data Roads (WT)	KPI Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
HTTP Live Page DL Smartphone	Qualifier	[%]	96,7	98,3	94,8	95,1
	Overall Session Time	[s]	1,4	1,5	2,1	1,6
HTTP Static Page DL Smartphone	Qualifier	[%]	96,8	97,7	95,0	96,8
	Overall Session Time	[s]	1,2	1,4	1,9	1,6
HTTP 5MB DL Smartphone	Qualifier	[%]	97,0	98,6	97,7	98,2
	Average Session Time	[s]	3,1	4,5	9,4	4,4
	90% faster than	[Mbit/s]	6,2	4,0	1,8	6,5
	10% faster than	[Mbit/s]	78,3	62,8	55,3	47,4
HTTP 2500KB UL Smartphone	Qualifier	[%]	96,9	98,5	96,2	94,9
	Average Session Time	[s]	3,3	2,6	4,4	5,5
	90% faster than	[Mbit/s]	2,9	4,2	2,1	1,8
	10% faster than	[Mbit/s]	29,2	30,0	33,0	19,1
HTTP DL FDTT	Qualifier	[%]	97,2	98,3	95,9	97,3
	Average Data Rate	[Mbit/s]	40,9	35,2	24,1	24,9
	90% faster than	[Mbit/s]	6,2	5,3	2,1	5,4
	10% faster than	[Mbit/s]	97,8	81,7	62,4	46,2
HTTP UL FDTT	Qualifier	[%]	96,3	97,6	96,2	94,4
	Average Data Rate	[Mbit/s]	18,0	21,6	18,2	9,5
	90% faster than	[Mbit/s]	3,0	4,0	2,4	1,4
	10% faster than	[Mbit/s]	36,9	44,7	44,3	21,0
YouTube	Qualifier	[%]	93,6	92,1	83,9	92,3
	Start Time	[s]	1,5	1,6	1,9	1,7
	AVG Resolution	[p]	898	895	870	902
YouTube Live Smartphone	Qualifier	[%]	94,1	91,1	88,7	94,0
	Start Time	[s]	1,6	1,5	2,2	1,7
	AVG Resolution	[p]	1009	1013	954	1008



Data 5G pref Cities – Drivetest KPI Overview

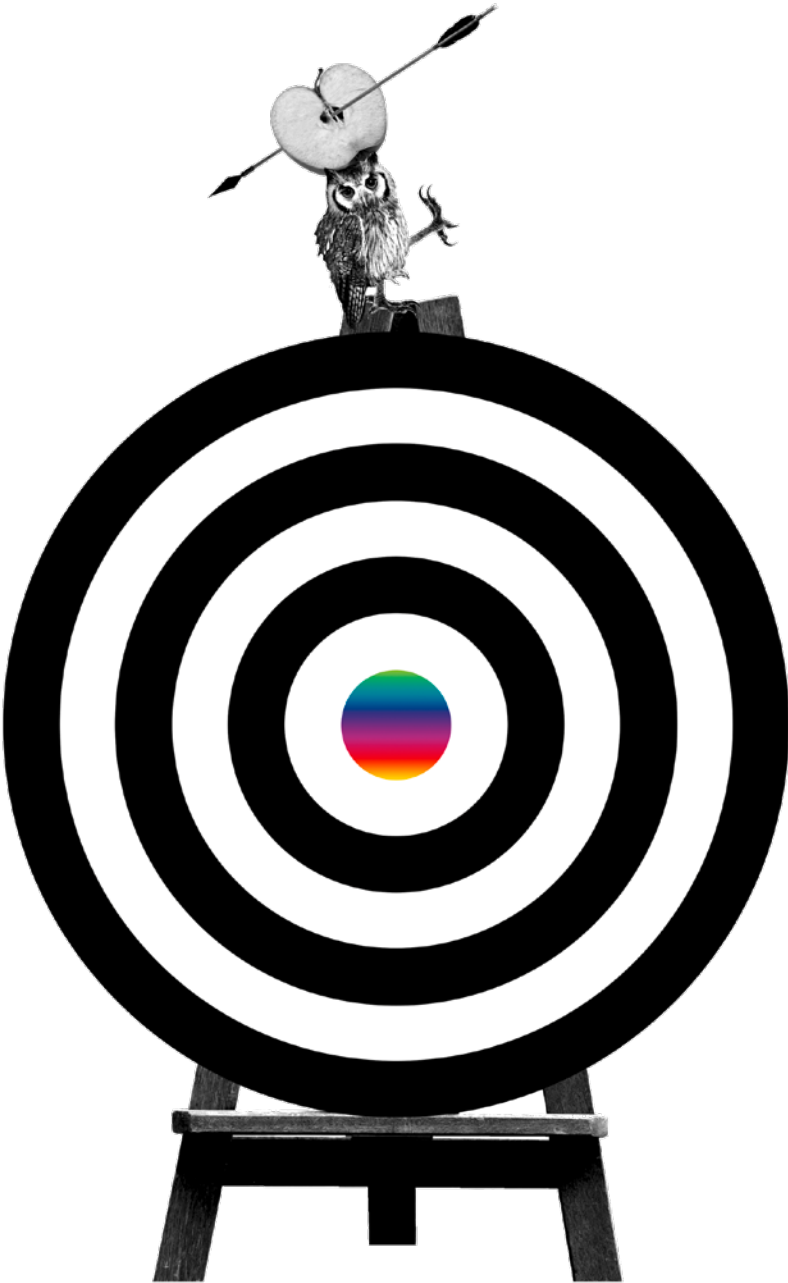
Operator 3 has not launched 5G during the measurement, so the results show only 4G. 5G results are based on measure–ments in 7 cities (Bucuresti, Timisoara, Cluj Napoca, Iasi, Ploiesti, Brasov, Constanta).

Data 5G pref Cities (DT)	KPI Name	Unit	Vodafone	Operator 2	Operator 3	Operator 4
HTTP Live Page DL Smartphone	Qualifier	[%]	99,7	98,6	99,0	99,0
	Overall Session Time	[s]	1,2	1,4	1,6	1,5
HTTP Static Page DL Smartphone	Qualifier	[%]	99,7	98,6	99,4	99,3
	Overall Session Time	[s]	1,0	1,2	1,4	1,4
HTTP 5MB DL Smartphone	Qualifier	[%]	98,6	99,8	99,7	100,0
	Average Session Time	[s]	1,6	2,5	5,3	4,7
	90% faster than	[Mbit/s]	15,8	14,4	3,2	8,5
	10% faster than	[Mbit/s]	144,9	152,0	57,8	52,2
HTTP 2500KB UL Smartphone	Qualifier	[%]	100,0	99,1	99,8	98,6
	Average Session Time	[s]	1,5	2,6	2,0	6,9
	90% faster than	[Mbit/s]	11,5	4,6	8,9	1,4
	10% faster than	[Mbit/s]	35,6	36,3	37,7	10,8
HTTP DL FDTT	Qualifier	[%]	99,7	98,5	99,5	99,5
	Average Data Rate	[Mbit/s]	133,0	204,3	28,7	27,9
	90% faster than	[Mbit/s]	19,9	20,9	4,1	6,6
	10% faster than	[Mbit/s]	339,3	520,3	65,9	41,9
HTTP UL FDTT	Qualifier	[%]	99,2	99,5	100,0	95,4
	Average Data Rate	[Mbit/s]	39,6	40,7	32,7	6,1
	90% faster than	[Mbit/s]	14,3	6,2	12,0	1,5
	10% faster than	[Mbit/s]	69,7	80,9	53,3	11,0
YouTube	Qualifier	[%]	99,3	97,8	95,9	98,2
	Start Time	[s]	1,2	1,4	1,7	1,8
	AVG Resolution	[p]	919	914	890	906
YouTube Live Smartphone	Qualifier	[%]	99,3	96,1	94,4	98,1
	Start Time	[s]	1,6	1,4	1,7	1,8
	AVG Resolution	[p]	1038	1030	992	1027



Key takeaways

- || Highest mobile score on data performance from Romania.
- || The most reliable 5G data network for Vodafone Romania among competition in mobility testing.





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