

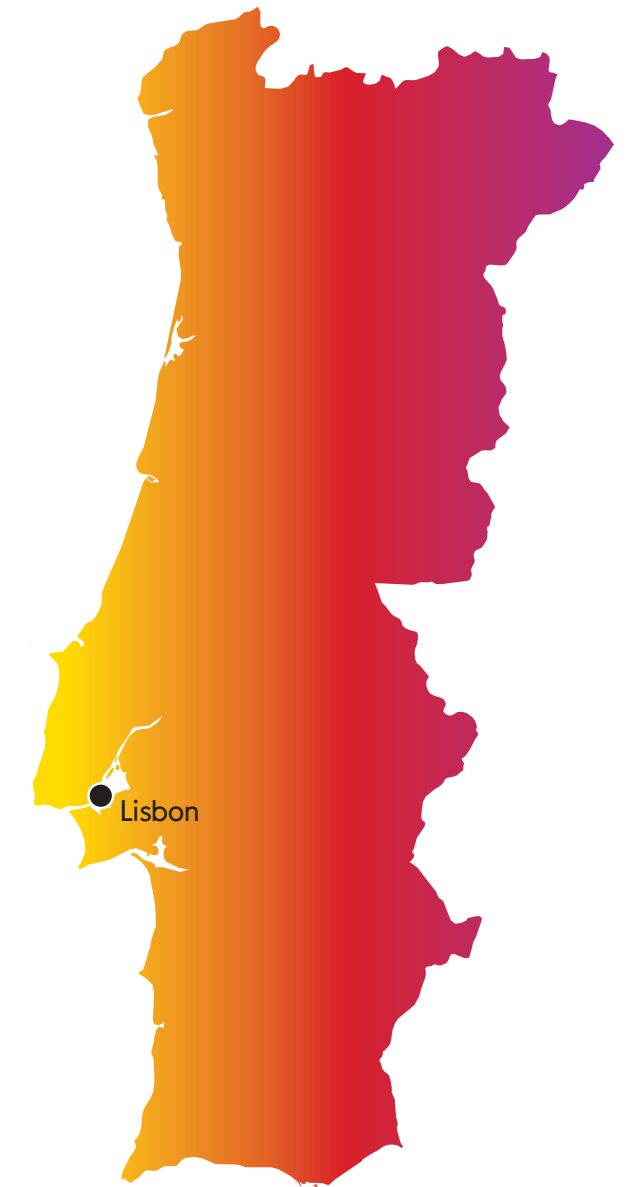
Audit Report

Portugal, Lisbon — 2024





Foreword



We have analyzed the mobile network performance of the mobile networks of MEO, Vodafone and NOS in Lisbon, the capital and most populated city of Portugal.



Measurement Overview

umlaut tested and measured the performance of its voice and data services on smartphones in comparison to other 5G/LTE mobile radio networks in Portugal, Lisbon. The audit was done as a performance benchmark performed by umlaut between 13.02 and 17.02 2024. Dedicated measurements have been executed as drive tests outdoors using a Samsung Galaxy S23+. All data measurements have been performed in 5G preferred mode. Voice measurements have been done in 5G/5G preferred mode on both sides, while call origin has been alternated.

In addition crowdsourced performance data has been collected and evaluated between CW35 2023 and CW06 2024. The following pages provide a comparative overview about the performance results observed for the different tested service types.



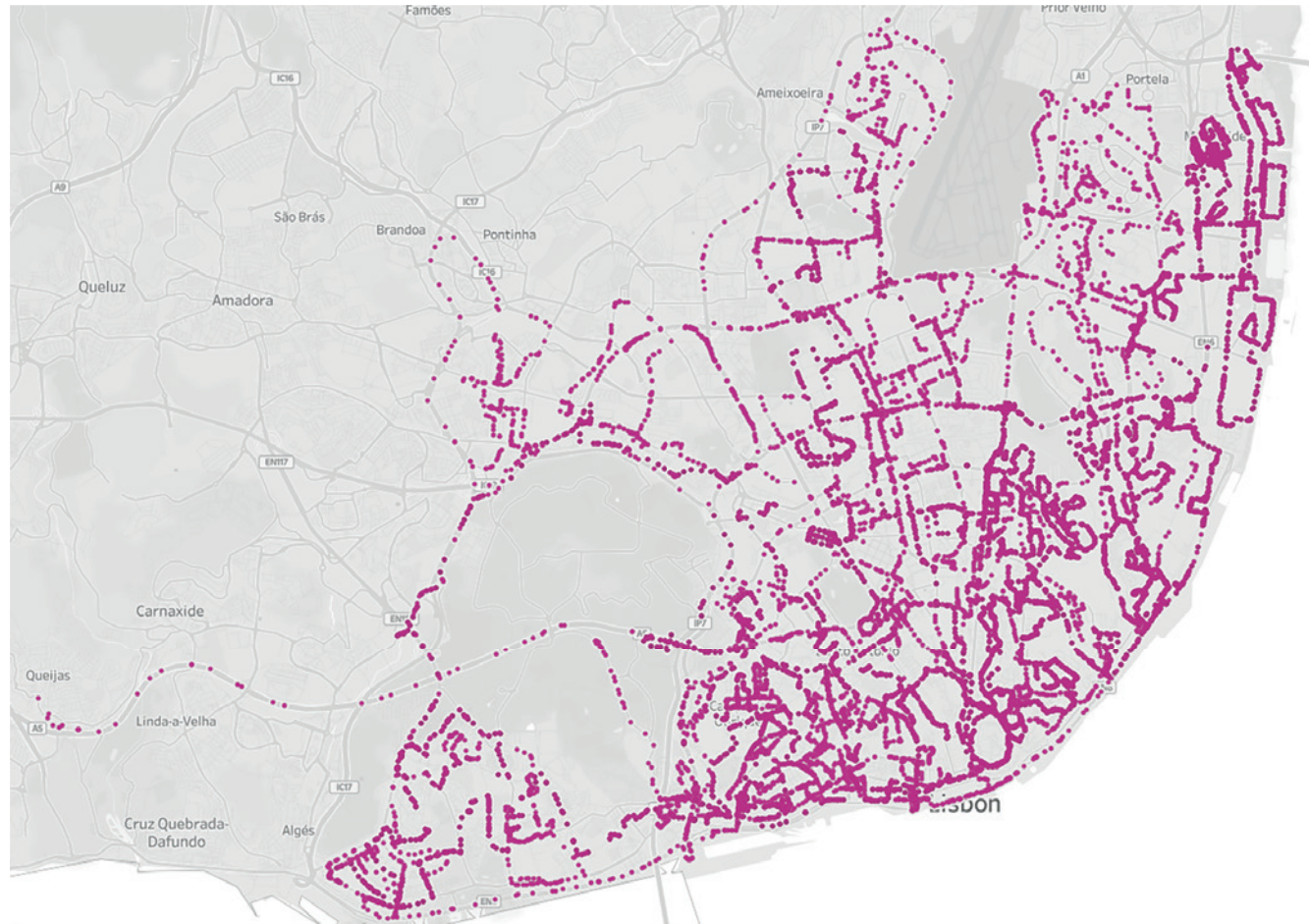
Measurement setup

Drivetest	Voice	Data
Device	Samsung Galaxy S23+	Samsung Galaxy S23+
Test Cases	Mobile-to-Mobile (M2M) Side1 (VoLTE) to Side2 (VoLTE) 105 sec call window 70 sec call duration Full 5G voice Scope Device capabilities and features depending on firmware British English speech sample (super wideband) 100KB HTTP traffic injection 15s Opt D Call Setup Timeout	Data 5G preferred CA HTTP DL datastream 7s HTTP UL datastream 7s HTTP 10MB DL fixed file transfer HTTP 5MB UL fixed file transfer 10 Live web pages YouTube v16 Interactivity testing (eGaming) Generic OTT voice channel
Mobility and Route Types	Drivetest	
Samples	2025 in total	16243 in total
Dates	13.02.2024 - 17.02.2024	
Crowd Data Assessment	24 weeks CW35 2023 - CW06 2024	



Testing areas

Driven routes in Lisbon by Drivetest cars



Drivetest



~ 550 km
measuring distance

Crowd



87.23 km²
size of tested area



100 %
of the 'built-up area' covered



100 %
of the 'Population area' covered



Score and breakdown

MEO achieved the highest overall score among competitors with 966 dots out of 1000.



→ Shown total scores are rounded.

Overall score considering Voice, Data and Crowdsourcing.

Total score

	MEO	Vodafone	NOS
Voice	259	253	235
Overall	96%	94%	87%
Data	472	472	467
Overall	98%	98%	97%
Crowdsourced Quality	235	235	238
Broadband Coverage	100	95%	97%
Download Speed	56	92%	92%
Upload Speed	19	97%	94%
Latency	50	94%	94%
Voice	11	83%	94%
Stability	14	95%	94%
Total	1000	966	940

Shown scores are rounded.



Achieved percentage of the maximum score in each of the different data services.

Data	Service Group	max	MEO	Vodafone	NOS
Overall	Web Browsing	108,0	99%	100%	99%
	File Download	108,0	100%	99%	99%
	File Upload	108,0	98%	98%	97%
	YouTube	108,0	97%	97%	96%
	OTT	48,0	96%	97%	93%



Achieved percentage of the maximum score in each of the different crowdsourcing services.

Crowd	Service Group	max	MEO	Vodafone	NOS
Crowdsourced Quality	Broadband Coverage	100	96%	95%	97%
	DL Speed	56	92%	92%	92%
	UL Speed	19	97%	94%	95%
	Latency	50	94%	94%	95%
	Voice	11	83%	94%	95%
	Stability	14	95%	94%	96%



Voice KPI overview

Achieved values of all networks under test in each of the relevant Voice Key Performance Indicators (KPIs) for the geographical categories "Cities".

Voice	Service Group	Unit	MEO	Vodafone	NOS
Voice M2M	Qualifier	[%]	99,4	99,7	98,2
	Call Setup Time (P90)	[s]	1,5	3,1	2,9
	Speech Quality (P10)	[MOS-LQO]	4,7	4,4	4,6
	Multirab connectivity	[%]	99,7	100,0	100,0



Data Services KPI overview

Achieved values of all networks under test in each of the relevant Data Key Performance Indicators (KPIs) for the geographical category "Cities".

Data Cities	KPI Name	Unit	MEO	Vodafone	NOS
HTTP Web Page DL Smartphone	Qualifier	[%]	99,8	100,0	99,9
	Overall Session Time	[s]	0,8	1,0	0,9
HTTP 10MB DL Smartphone	Qualifier	[%]	100,0	100,0	100,0
	Average Session Time	[s]	0,6	0,7	0,6
	90% faster than	[Mbit/s]	150,5	60,3	145,9
	10% faster than	[Mbit/s]	362,0	425,5	377,4
HTTP 5MB UL Smartphone	Qualifier	[%]	99,8	100,0	100,0
	Average Session Time	[s]	1,1	1,3	1,3
	90% faster than	[Mbit/s]	27,1	19,5	19,4
	10% faster than	[Mbit/s]	80,3	92,8	82,5
HTTP DL FDTT	Qualifier	[%]	100,0	100,0	99,8
	10% faster than	[Mbit/s]	852,7	953,3	903,3
	faster than 20 Mbit/s	[%]	100,0	99,3	99,8
	faster than 100 Mbit/s	[%]	98,3	91,8	97,4
HTTP UL FDTT	Qualifier	[%]	100,0	100,0	99,8
	10% faster than	[Mbit/s]	136,3	146,9	117,1
	faster than 2 Mbit/s	[%]	100,0	99,5	100,0
	faster than 5 Mbit/s	[%]	99,0	98,3	99,0
YouTube	Qualifier	[%]	100,0	100,0	99,8
	Start Time	[s]	1,5	1,8	1,5
	AVG Resolution	[p]	1078,8	1079,7	1079,6
YouTube Live Smartphone	Qualifier	[%]	99,5	100,0	99,3
	Start Time	[s]	1,8	2,1	1,9
	AVG Resolution	[p]	1079,9	1080,0	1079,9
Interactivity	Qualifier	[%]	98,6	98,1	97,4
	Interactivity egaming	[%]	80,3	76,2	72,7
Conversational App	Qualifier	[%]	99,8	100,0	99,1
	Speech Quality (P10)	[MOS-LQO]	3,9	4,1	3,9



Crowd KPI overview

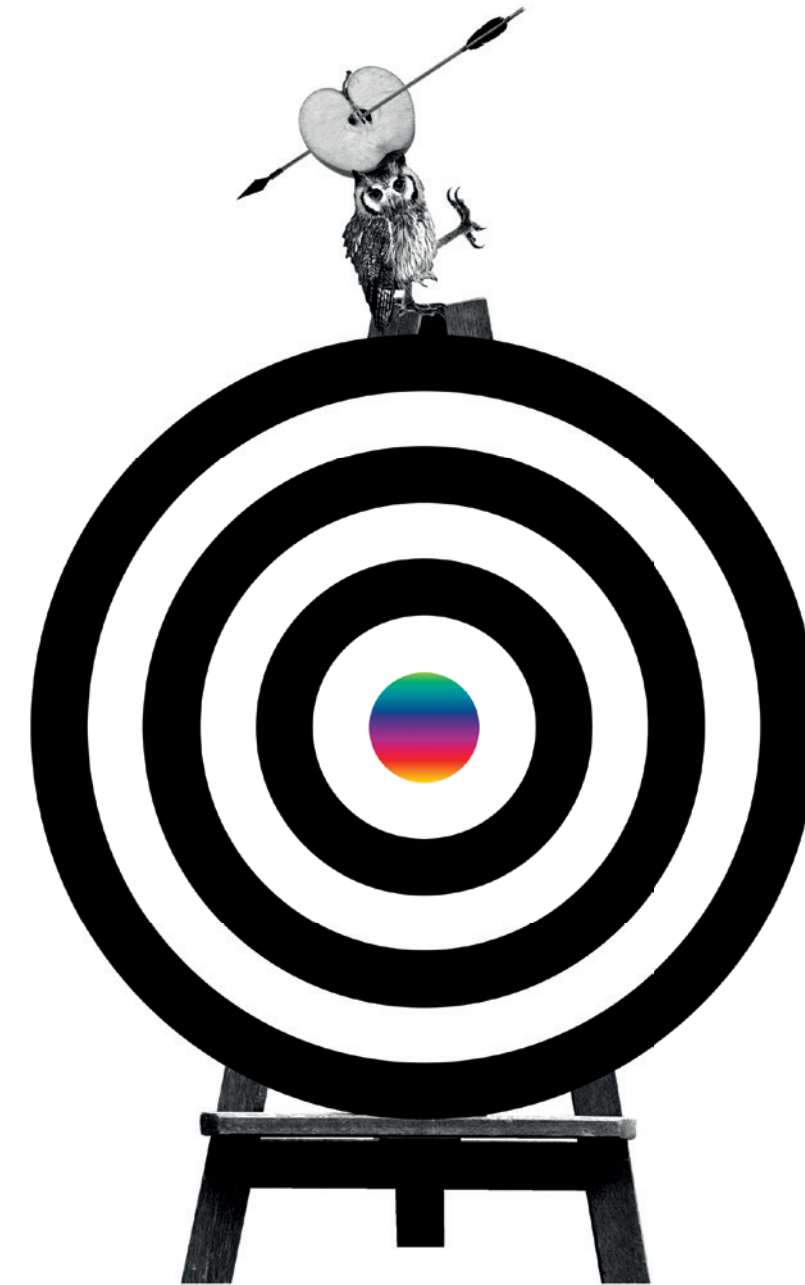
Achieved values of all networks under test in each of the relevant Crowd Key Performance Indicators (KPIs) for the categories "Broadband Coverage", "Download Speed", "Latency", "Voice Crowd" and "Stability".

Category	KPI name	Unit	MEO	Vodafone	NOS
Broadband Coverage	Coverage Quality	[%]	98.1	96.6	98.4
	Coverage Reach	[%]	100.0	100.0	100.0
	Time on broadband	[%]	96.7	97.0	98.1
Download Speed	Basic internet class	[%]	94.9	95.0	95.1
	HD video class	[%]	86.1	86.6	86.5
	UHD video class	[%]	30.8	29.2	32.7
Latency	Gaming class	[%]	94.4	94.2	94.6
	OTT voice class	[%]	97.5	97.8	98.0
Voice	HD voice	[%]	89.6	95.8	96.5
Download Speed Active	90% faster than	[Mbit/s]	7.4	10.3	9.1
	10% faster than	[Mbit/s]	245.2	225.5	302.5
	AVG data rate	[Mbit/s]	99.0	75.1	109.5
Upload Speed Active	90% faster than	[Mbit/s]	4.1	3.0	3.4
	10% faster than	[Mbit/s]	55.6	50.2	55.1
	AVG data rate	[Mbit/s]	28.4	22.5	27.4
Stability	Transaction success	[%]	95.0	94.3	96.0



Key takeaways

- ||| MEO achieves the highest score in Lisbon with 966 points out of 1000, followed by Vodafone with 960 points and NOS with 940 points.
- ≡ MEO shows the highest performance in voice services with 259 points out of 270, followed by Vodafone with 253 points and NOS with 235 points.
- ≡ MEO and Vodafone are on par in the data category with 472 points out of 480 points, followed by NOS with 467 points.
- ||| In crowdsourced quality, NOS achieves the highest score with 238 points out of 250, followed by MEO and Vodafone on par with 235 points.





umlaut – Part of Accenture

umlaut communications GmbH

Am Kraftversorgungsturm 3 · 52070 Aachen · Germany

Hakan Ekmen · Global Networks Lead, Comms Industry

cell +49 151 571 33 235 · hakan.ekmen@accenture.com

www.umlaut.com