LONDON'S BEST MOBILE NETWORK

BENCHMARK MEASUREMENT OF MOBILE NETWORKS IN THE GREATER LONDON AREA

OCTOBER / NOVEMBER 2024

NET CHECK

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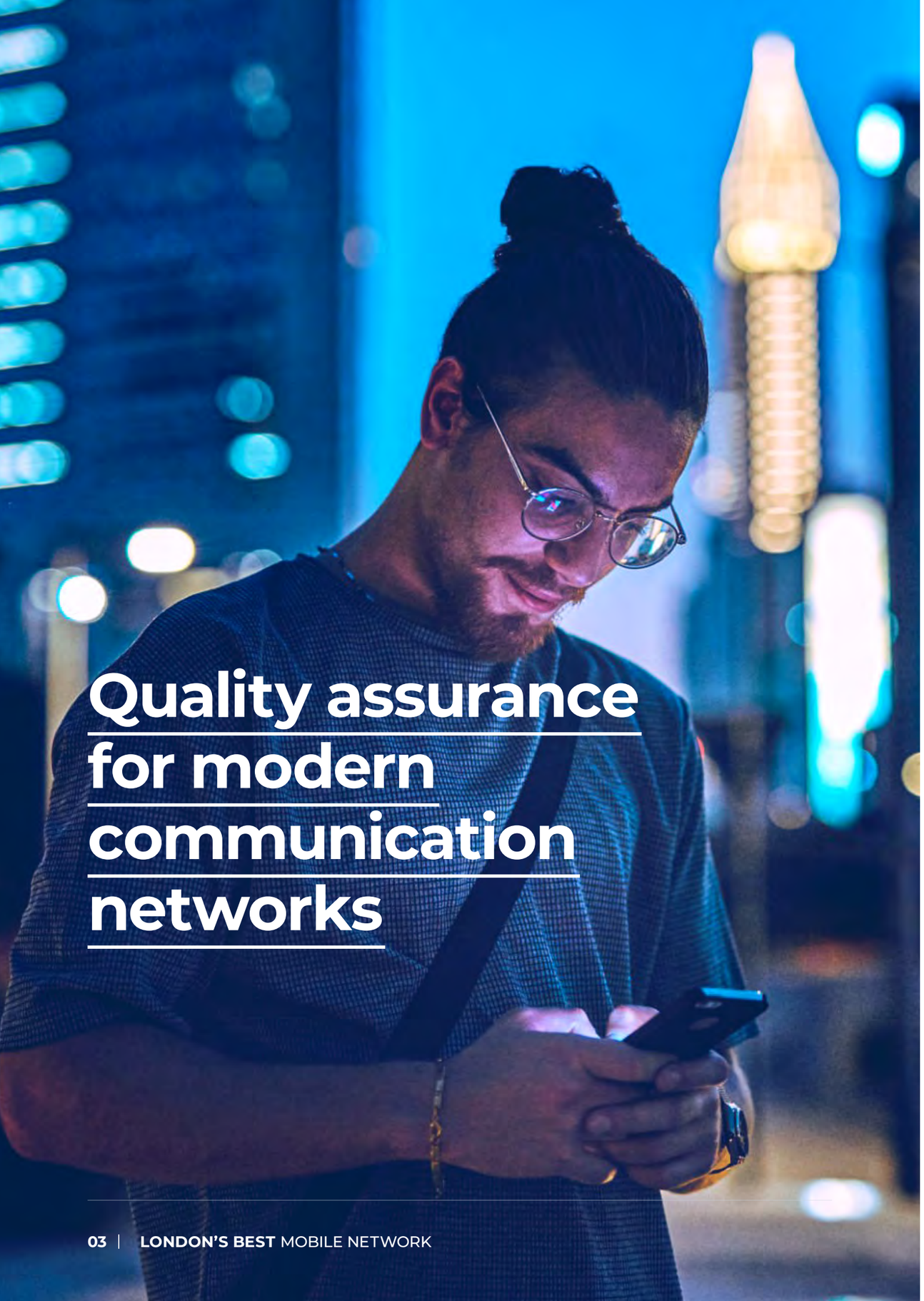


Quality assurance for modern communication networks

ABOUT NET CHECK

NET CHECK was founded in 1999 to improve the quality of communication networks. Since then, NET CHECK has become one of the leading partners of network operators and infrastructure providers in the operation and optimisation of mobile and fixed communication networks of all technologies.

NET CHECK's core competencies include international network benchmarking (comparative measurements), network planning and fault analyses, covering drive test services, optimisation, site audit, network planning, rollouts, upgrades, swaps, root cause analysis, and advanced custom reporting.

NET CHECK is part of the NC Group, headquartered in Berlin (Germany), and independent of any industry stakeholders. It is a trusted partner of scientific and government institutions due to its high level of expertise, data quality and security.

To ensure the sustainability and reproducibility of reliable results in repeating campaigns, NET CHECK has implemented an ISO-certified management system, and approved its testing and post-processing procedures according to telecommunication industry standards.

The criteria according to which the network operators are assessed and the benchmarking created are determined exclusively by NET CHECK's experts. They follow the NET CHECK benchmarking methodology and are the same for all countries and test areas. The network operators have no influence on the routing of the tests within the test area. They also have no influence on the timing of the tests within the test period.

#1 provider of quality assurance

BENCHMARKING METHODOLOGY

The NET CHECK testing methodology strives to provide an accurate, unbiased, and balanced assessment of network performance. It is based on ETSI (European Telecommunications Standards Institute) and has been successfully implemented in various countries and by different network operators.

The main focus of the NET CHECK ranking is an evaluation of the end-user experience.

We evaluate service accessibility, retainability, network quality, and performance.

The assessment is based on data collected during a comprehensive series of drive tests. To ensure that the data sample provides a representative and accurate view of the network's overall performance, these drive tests are conducted extensively across the entire region. Testing is carried out during both weekdays and Saturdays to capture a broad range of network conditions and user behaviours, ensuring a thorough evaluation of the network's capabilities.

The winner is found by weighting all data.

Measuring various KPIs (Key Performance Indicators) for voice and data services, NET CHECK's goal is to present real customer experience, as users perceive it when using a mobile communications network. Operators can earn a maximum of **1000 points**, with **350 points** for voice services and **650 points** for data services.

The network operator receives ranking points based on the measured KPI value. Each KPI can contribute a predefined number of ranking points.

350 pts

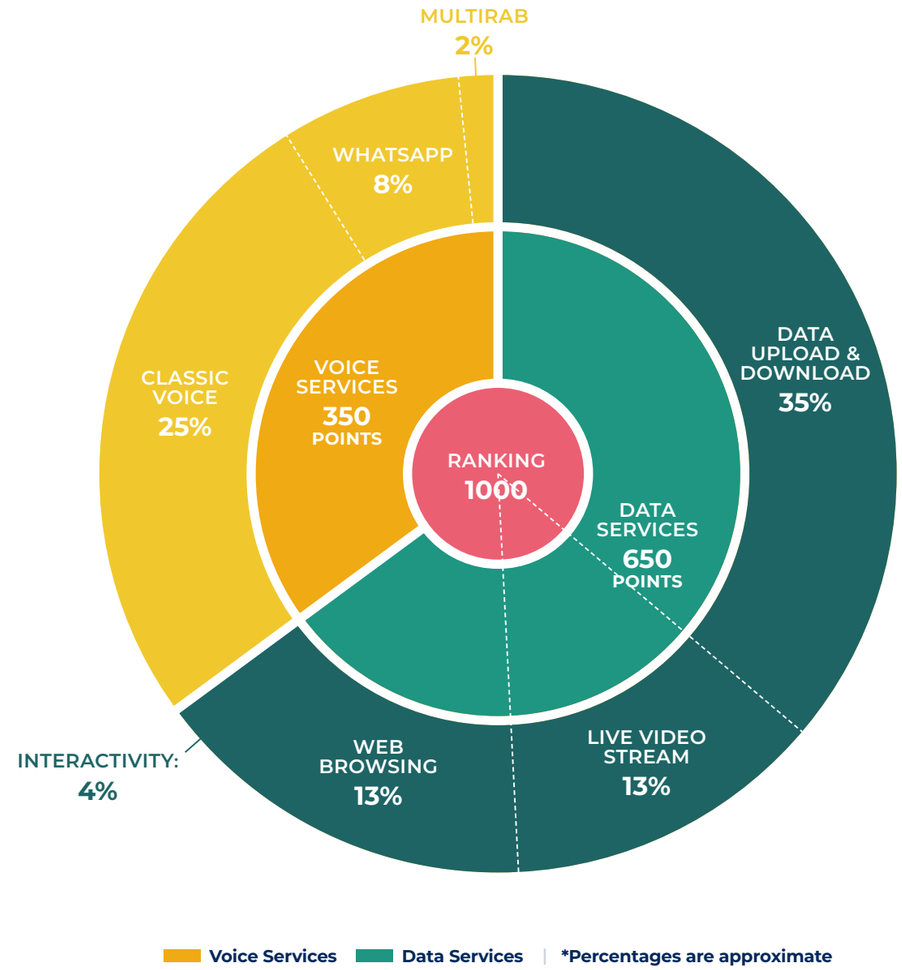
VOICE SERVICE

650 pts

DATA SERVICE

1000 pts

OVERALL RANKING POINTS



MEASUREMENT SPECIFICATIONS

MEASUREMENT BOUNDARIES

The measurement area conforms to the Greater London Area as defined in the administrative area of the Greater London Authority in 1965.

NET CHECK carried out tests in all **33 local government districts**, with the driving routes passing through all the **32 London boroughs** and the City of London. The routes were determined independently.

MEASUREMENT PERIOD

The measurements were conducted between 30th of October and 7th of November 2024.

DISTANCE COVERED

The measurement technicians drove 23 routes in the measurement vehicles and covered a measurement distance of over **1018** kilometres.

NET CHECK drive testing

33 districts

32 boroughs

TESTING AREA

23 routes

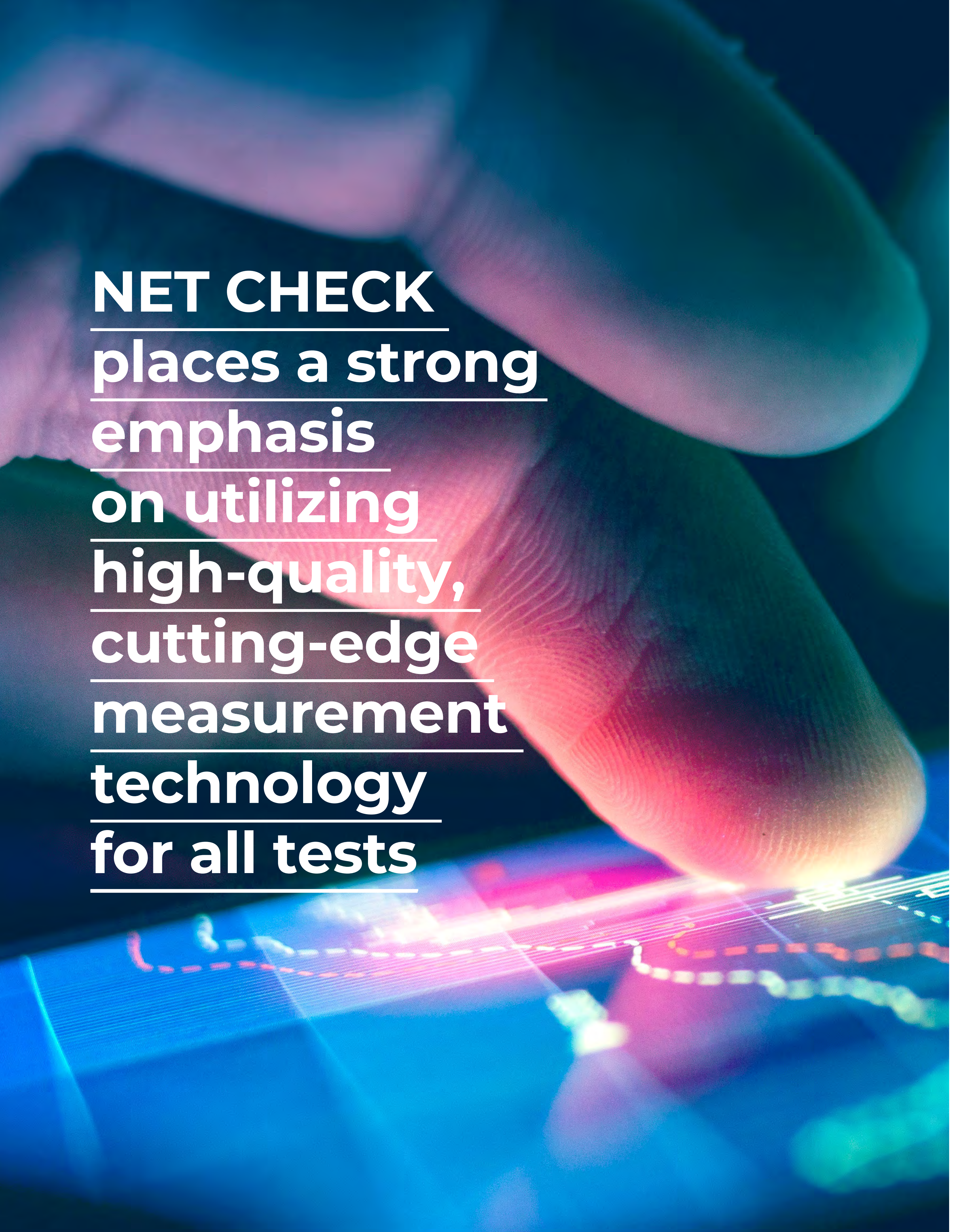
1018 kilometres

DISTANCE COVERED

TESTING AREA

KEY:

- Boundary of Greater London Area
- Testing Routes
- Areas of Water



NET CHECK places a strong emphasis on utilizing high-quality, cutting-edge measurement technology for all tests

MEASUREMENT EQUIPMENT

DRIVE TESTING

Measurement equipment: SwissQual Benchmarker II (Rohde & Schwarz) and Samsung S23+

The measuring equipment was placed in the roof boxes of two passenger cars collecting data on the performance of voice and data services during the tests. They are cooled down to avoid overheating due to sun and extensive use.

This approach allows performance measurement for all the operators simultaneously and at the same locations.

TESTING OF SERVICES

For data services, a total of around 15,700 data samples per operator were collected. For voice services, around 1,390 test calls were made and 12 speech samples were collected in each test call, resulting in a total of around 16,600 speech samples.

VOICE SERVICES

Voice services are tested through sequences consisting of a series of five mobile-to-mobile voice calls:

- 2 standard calls
- 2 calls during which a data download session is executed simulating internet usage during a call
- 1 WhatsApp call.

Then the sequence repeats.

DATA SERVICES

Data services are tested through sequences consisting of:

- Web browsing on frequently visited web-pages
- Playing a YouTube video
- Network capacity tests: downloading and uploading files of given sizes or during a given time
- Interactivity tests: Simulating online gaming and online meetings.

The sequence repeats during the entire measurement.

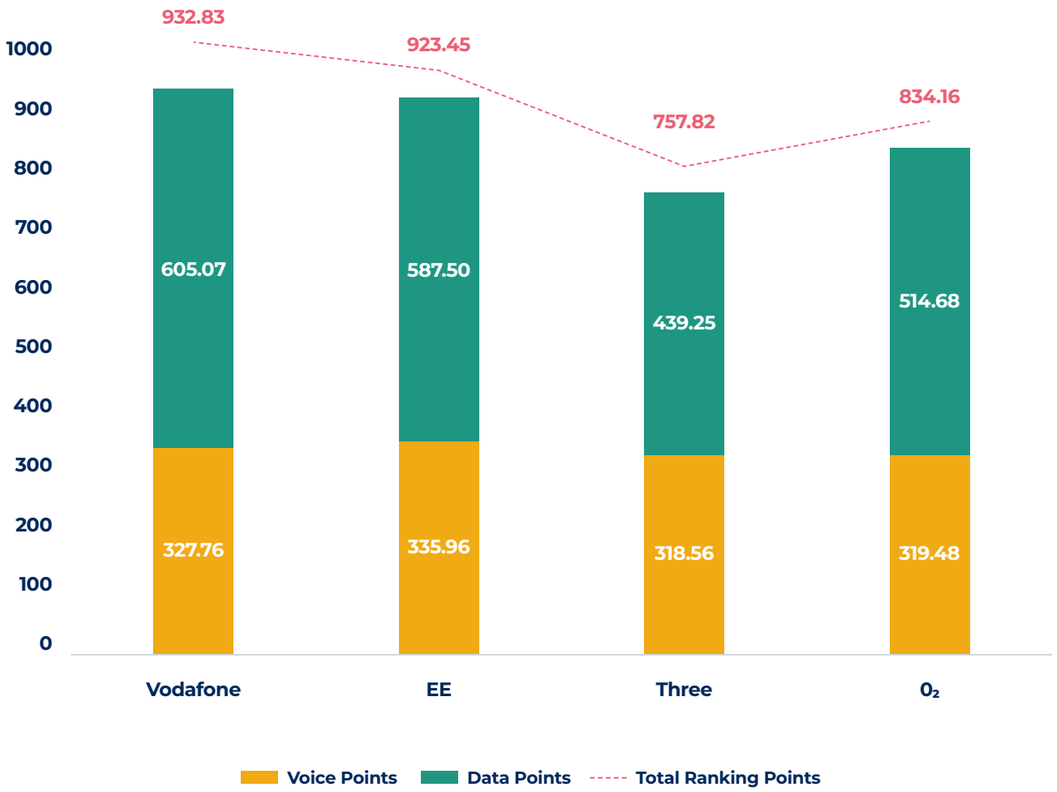
	VOICE SERVICES	DATA SERVICES
MEASUREMENT DEVICE	Samsung S23+	Samsung S23+
MEASUREMENT AREA	Greater London Area	Greater London Area
MEASUREMENT SAMPLE	1,390 calls per operator	15,700 tests per operator
TEST CASE SCENARIO	Max Call Setup Time: 30 (s) Call duration: 120 (s) Call window: 155 (s) Call mode: VoLTE preferred Speech quality: POLQA WB Reference File: English Scenario: 2 x VoLTE preferred + 2 x MultiRAB + 1 x WhatsApp call	YouTube HD (livestream) Web browsing, Kepler as static, BBC, Google, Wikipedia, Instagram, Amazon, eBay, Tiktok, Login Live as dynamic Download and Upload tests: • time based (FDTT): DL HTTP 7s / UL UDP 7s • file based (FDFS), HTTP and HTTPS: DL (10MB) /UL (5MB) Online gaming and online meeting simulations
	1,390 test calls	**15,700** data samples

OVERALL RESULTS

Vodafone scored the highest number of ranking points – 932.83 out of a possible 1,000 points. EE ranked second, closely following with around 9 points less. O_2 takes third place, while Three fell behind its competitors.

In Voice points alone, EE scored around 8 points more than Vodafone, but Vodafone's performance in Data tests shaped the final result.

Most of the overall advantage that O_2 holds over Three comes from the data score, as both operators achieved similar results in voice performance.



OVERALL RESULTS

932.83 pts

#1: Vodafone

VOICE & DATA
DETAILED RESULTS

Voice KPIs

Ranking KPIs Voice	vodafone	EE	3	O2
CLASSIC CALLS				
Call Setup Success Ratio (%)	99.73	99.91	99.45	99.27
Dropped Call Ratio (%)	0.18	0.09	0.27	0.18
Average Call Setup Time (s)	2.00	1.61	1.72	2.31
Call Setup Time > 15s Ratio (%)	0.00	0.00	0.00	0.00
POLQA <=1.6 Ratio (%)	0.42	0.56	0.54	0.50
POLQA AVG MOS	4.66	4.65	4.65	4.43
Disturbed and Impaired Call Ratio (%)	0.18	0.09	0.64	0.27
WHATSAPP CALLS				
Call Setup Success Ratio (%)	98.97	100.00	99.32	100.00
Dropped Call Ratio (%)	0.00	0.00	0.00	0.34
POLQA <= 1.6 Ratio (%)	0.81	0.62	1.43	1.53
POLQA AVG (MOS)	4.13	4.24	4.19	4.15
Disturbed and Impaired Call Ratio (%)	0.35	0.00	0.68	0.69
MULTIRAB DATA				
MultiRAB Data Success Ratio (%)	99.81	100.00	99.62	99.81

KPI = KEY PERFORMANCE INDICATOR

Data KPIs

Ranking KPIs Data	vodafone	EE	3	O2
HTTP TRANSFER – FDFS DL				
FDFS DL Success Ratio (%)	99.42	99.15	56.25	98.79
Average FDFS DL Transfer Time (s)	1.91	2.52	3.97	3.42
HTTP TRANSFER – FDFS UL				
FDFS UL Success Ratio (%)	99.28	98.72	98.80	97.28
Average FDFS UL Transfer Time (s)	3.56	3.01	4.06	5.48
HTTP TRANSFER – FDTT DL				
DL Throughput > 2Mbps Ratio (%)	99.57	99.51	94.37	98.36
DL Throughput > 5Mbps Ratio (%)	99.21	98.45	89.27	95.90
DL Throughput > 20Mbps Ratio (%)	95.65	92.67	75.13	83.88
DL Throughput > 100Mbps Ratio (%)	78.94	72.57	55.29	42.09
FDTT DL MDR P90 (Mbps)	475.82	600.97	683.44	231.56
UDP – FDTT UL				
UL Throughput > 1Mbps Ratio (%)	99.41	99.42	98.70	97.31
UL Throughput > 3Mbps Ratio (%)	96.99	97.90	95.26	90.92
UL Throughput > 10Mbps Ratio (%)	85.34	87.74	79.28	69.62
UL Throughput > 20Mbps Ratio (%)	70.45	72.66	58.87	43.46
FDTT UL MDR P90 (Mbps)	86.53	68.78	109.15	41.07
HTTP/HTTPS BROWSING				
Browsing Time To 1MB (ms)	1,129.04	995.03	1,352.38	1,303.93
Browsing Success Ratio (%)	99.64	99.06	97.49	98.86
VIDEO STREAM				
Video Stream Success Ratio (%)	99.71	98.94	98.95	99.62
Video Stream TTFP >= 10s Ratio (%)	0.07	0.14	1.96	0.76
Video Stream Irritating Experience Ratio (%)	0.22	0.29	1.81	0.45
INTERACTIVITY				
Interactivity Packet Error Ratio (%)	3.59	3.07	19.66	5.05
Interactivity Median RTT (ms)	38.09	28.05	28.42	38.27

KPI DESCRIPTION

Ranking KPIs Voice	
CLASSIC CALLS	
Call Setup Success Ratio	Percentage of successfully established calls
Dropped Call Ratio	Percentage of dropped calls
Avg Call Setup Time	Average time to establish a call
Call Setup Time > 15s Ratio	Percentage of successfully established calls where call establishment lasts more than 15s
POLQA <= 1.6 RATIO	Percentage of speech samples with voice signal quality (MOS) of 1.6 or lower
POLQA AVG (MOS)	The average value of the voice signal quality (MOS)
Disturbed and Impaired Call Ratio	Percentage of all successfully connected voice calls where 3 or more consecutive speech samples, or 5 or more speech samples in arbitrary order are evaluated with POLQA ≤ 1.6 MOS, or are perceived as completely silent speech samples
WHATSAPP CALLS	
Call Setup Success Ratio	Percentage of successfully established calls
Dropped Call Ratio	Percentage of dropped calls
POLQA <= 1.6 Ratio	Percentage of speech samples with voice signal quality (MOS) of 1.6 or lower
POLQA AVG (MOS)	The average value of the voice signal quality (MOS)
Disturbed and Impaired Call Ratio	Percentage of all successfully connected voice calls where 3 or more consecutive speech samples, or 5 or more speech samples in arbitrary order are evaluated with POLQA ≤ 1.6 MOS, or are perceived as completely silent speech samples
MULTIRAB DATA	
MultiRAB Data Success Ratio	Percentage of successfully completed data transfers during the duration of the voice service

KPI = KEY PERFORMANCE INDICATOR

Ranking KPIs Data	
DOWNLOAD (File Size 10MB)	
HTTP Transfer FDFS DL Success Ratio	Percentage of successfully completed data download transfer tests
Average FDFS DL Transfer Time	Average duration of the 10MB file download
UPLOAD (File Size 5MB)	
HTTP Transfer FDFS UL Success Ratio	Percentage of successfully completed data upload transfer tests
Average FDFS UL Transfer Time	Average duration of the 5MB file upload
DOWNLOAD (Test Duration 7 seconds)	
FDTT DL MDR P90	90% of total measured tests slower than
DL Throughput > 2Mbps Ratio	Percentage of tests with average file download speed greater than 2Mbps
DL Throughput > 5Mbps Ratio	Percentage of tests with average file download speed greater than 5Mbps
DL Throughput > 20Mbps Ratio	Percentage of tests with average file download speed greater than 20Mbps
DL Throughput > 100Mbps Ratio	Percentage of tests with average file download speed greater than 100Mbps
UPLOAD (Test Duration 7 seconds)	
FDTT UL MDR P90	90% of total measured tests slower than
UL Throughput > 1Mbps Ratio	Percentage of tests with average file upload speed greater than 1Mbps
UL Throughput > 3Mbps Ratio	Percentage of tests with average file upload speed greater than 3Mbps
UL Throughput > 10Mbps Ratio	Percentage of tests with average file upload speed greater than 10Mbps
UL Throughput > 20Mbps Ratio	Percentage of tests with average file upload speed greater than 20Mbps
BROWSING (Web Browsing)	
HTTP Browsing Time To 1MB	The time required to open a 1MB page
HTTP Browsing Success Ratio	Percentage of successfully completed web browsing tests
VIDEO STREAM (YouTube Live Stream HD)	
Video Stream Success Ratio	Percentage of successfully completed video streaming tests
Video Stream TTFP >= 10s Ratio	Percentage of tests where the video started after ten seconds or more
Video Stream Irritating Experience Ratio	Percentage of tests with significantly reduced quality of video transmission
INTERACTIVITY	
Interactivity Packet Error Ratio	Ratio of erroneous Interactivity test packets
Interactivity Median RTT	Median Round Trip Time of Interactivity test packets

IN SUMMARY

Assessing the Voice and Data services of UK mobile operators indicates that performance remains consistently strong and competitive compared to other European network operators.

In the drive tests conducted across the Greater London area, Vodafone UK once again achieved the highest overall score, maintaining its lead with commendable results in Data testing.

EE performed well, scoring highest amongst the operators in Voice testing, but only enough to make the gap to first ranked Vodafone smaller.

Greater London's mobile networks continue to provide reliable and high-quality service, meeting the needs of modern users

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