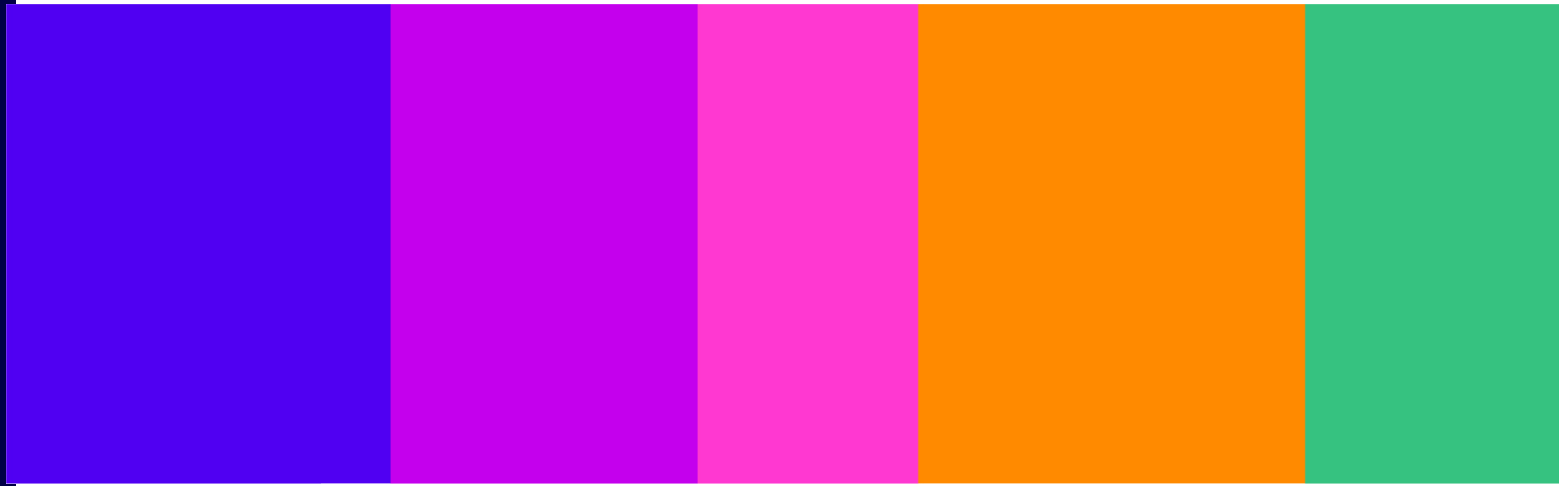


Mobile Matters 2026

Technical and statistical methodologies

Report

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A1 Technical methodology

Ofcom relies on test results collected from mobile devices to measure the performance and consumer experience of using different mobile networks. Opensignal's data collection methodology is based on a sample of UK smartphone users who have installed apps that include the Opensignal software development kit (SDK) on their device. The data collection framework and sample methodology were developed and managed by Opensignal Limited ('Opensignal'), with the resulting data licensed to Ofcom. Opensignal also managed the collection and aggregation of the crowdsourced data.

Data collection

Individual measurements from smartphones are collected every day, under conditions of normal use. They include measurements in both indoor and outdoor locations.

Opensignal measures the end-to-end consumer network experience and full path from the user device all the way to the content delivery networks (CDNs) that host popular apps, services and websites.

The measurements of network speed are collected based on both user-initiated tests and automated tests. Most measurements are generated through automated tests (i.e. without user interaction), and are executed independently and at random intervals to capture what users are experiencing at a typical moment in time.

A rigorous post-processing system is used, which takes the raw measurements and calculates robust and representative metrics. This includes several steps to quality-assure the measurements. For example, if a user failed to download any content, this measurement is eliminated and treated as a 'failed test' rather than being included in the average calculation.¹

This year, where appropriate, tests have been excluded that were restricted by the device rather than the network, or where the connection technology changed during the test such as moving from 4G to 5G or moving between cells.

Table 1: Data collection processes and actions

Process	Action taken
Initial filtering	Certain entries are automatically filtered out (e.g. when a phone is on a call), which are known to produce atypical results.
Operator name mapping	Results reflect the experience of customers who have bought services running on the UK's four mobile networks. This includes subscribers of both mobile networks' own retail services and those of certain mobile virtual network operators (MVNOs), which are allocated to the relevant host network where performance is comparable. These subscribers may be subject to different quality of service (QoS) restrictions than an operator's own customers and so

¹ This is not the case when looking at video streaming success rates, as our analysis includes incomplete tests as failed video streams.

their experience may be different. Ofcom removes results from devices that are roaming.

Selection of network type

Opensignal consolidates data into technology types. For example, when considering 3G connections, Opensignal includes the various 3GPP releases, including HSDPA, HSUPA and UMTS R99, into one group.

Source: Ofcom / Opensignal

The metrics analysed by Ofcom are:

- Share of mobile network connection attempts;
- Data connection success rates;
- Response time (latency);
- Video streaming success rates;
- Time to download a 2 MB/ 5 MB file;
- Time taken to upload a 1 MB file;
- Distribution of download speeds; and
- Distribution of upload speeds.

Good mobile performance score

This is the first year that Mobile Matters includes an assessment of how well mobile networks are performing using Ofcom's good performance score.

Good performance is defined as connectivity providing:

- A download speed of at least 5 Mbit/s;²
- An upload speed of at least 1.5 Mbit/s;³ and
- Latency of no more than 50 milliseconds (ms).⁴

These measurement thresholds are combined with data connection success rates to generate the good performance score.

Our [Connectivity you can count on](#) discussion paper proposed that each mobile network should achieve a benchmark good performance score of at least 90% in each area.

Individual performance measures

Mobile Matters continues to analyse individual performance metrics separately. These metrics have been aligned with the good performance standard methodology where possible.

² Over a 5 Mbit/s connection, 1 MB of data will take around 1.6 seconds to download.

³ Over a 1.5 Mbit/s connection, 1 MB of data will take around 5.4 seconds to upload.

⁴ The connection speed measurements used to calculate the good performance score are taken from the results of small file transfer tests similar to those also used to derive the time to download and time to upload metrics included in this report. Latency is calculated as half the Round-Trip Time (RTT/2), which approximates the one-way delay for a data packet to travel from a mobile device to a server. The calculation uses the minimum measured RTT across 100 UDP packets.

Share of mobile network connection attempts

Share of mobile network connection attempts measures the frequency of devices being connected to different mobile technologies. The share of mobile network connection attempts metric is calculated across all mobile network generations.

Table A2: Identification of mobile network generations

Category	Description
2G	Records when the user was connected to 2G (network type is one of 'GPRS', 'EDGE', 'GSM').
3G	Records when the user was connected to 3G (network type is one of 'UMTS', 'WCDMA', 'HSDPA', 'HSUPA', 'HSPA').
4G	Records when the user was connected to LTE (network type is 'LTE') i.e. 4G.
5G	Records when an NR connection has been allocated to the device (NR State=3 in non-standalone access) or when there is a standalone access 5G connection.

Source: Ofcom / Opensignal

Data connection success rate

The data connection success rate metric provides a view on the success of an Opensignal server response test to connect to the internet, using 3G, 4G, 5G SA or 5G NSA mobile data network connectivity. The Opensignal server response test is also used to measure latency, and this methodology is recorded below.

Response time (latency)

Response time, often referred to as latency, is the delay between a consumer making a request to their mobile network for information and the network providing this information to the device.

Server response tests are performed against a number of leading CDNs that are typically used to host popular apps, websites, and mobile services.

A server response (SR) test is defined as a test which determines the latency, jitter and packet loss of the current connection using UDP. This year measures are based on minimum latency on the current wireless connection (in milliseconds). Using the minimum instead of average latency recorded during the test, better reflects active network response times by excluding initial "warm-up" delays where the device has been idle.

The SDK chooses the closest test server based on the geographical distance between the device and the server locations. Each packet is then sent to the test server via UDP, which is connectionless. This means that, unlike TCP connections, there is minimal handshaking involved; handshaking can produce measurement results that indicate slower than actual speeds.

The UDP protocol is also used to simulate latency-sensitive applications, such as video and VoIP calling. The precise time that each packet is sent out is recorded to nanosecond precision and stored for later calculations. The packet spacing is 20ms between packets.

The test server receives the packets sent from the SDK and then immediately echoes them back to the listening device. The precise time that each packet is received back on the device is also recorded, along with the specific payload of each packet, as this payload indicates the ordering of

the packets returned to the device. The Metro Ethernet Forum (MEF) 10 specification is used to calculate the latency.

Latency is calculated as half the Round-Trip Time (RTT/2), which approximates the one-way delay for a data packet to travel from a mobile device to a server. The calculation uses the minimum measured RTT across 100 UDP packets.

Time taken to download a 2 MB / 5 MB file and upload a 1 MB file

The Opensignal SDK performs a collection of active tests, in which phones are prompted to download a 2 MB or 5 MB file and upload a 1 MB file, and the throughput experienced when downloading / uploading these files is recorded.

The download throughput measures the time it takes to download a 2 MB file from a randomly selected CDN test server over a TCP connection – 2 MB is selected to simulate downloading photos or short low-resolution video clips in messaging apps or via social media. The measured download throughput is recorded against the current mobile connection (2G, 3G, 4G, 5G SA or 5G NSA).

Download throughput tests are performed against CDNs commonly used to host popular website and other web applications over HTTPS. This allows test files to be downloaded with a low latency through one of the CDN edge servers located around the world. The payload is requested via URL. The end server that delivers the payload is determined by the CDN.

The fixed-size throughput tests do not measure the maximum throughput of the network. There is a technical limitation of the download throughput tests that limits the minimum throughput to 350Kbps. This is the result of the timeout implementation within the Opensignal SDK.

Each CDN service determines the closest edge test server to serve the download test file, based on the IP address of the device. The SDK opens a TCP connection (HTTPS GET) to the test server to start downloading the test file.

The current time is then recorded in nanoseconds, as well as a received (Rx) byte count. The received byte count is a numerical count of how many bytes have been delivered over the wireless radio at a given time. This is the final step performed before the actual bytes are streamed from the server, to ensure that the measurements have the highest level of accuracy. Data bytes are streamed-in as 1024-byte blocks, until either the file has completed downloading, or a timeout or a cancel test event is triggered. The connection is then closed, and the current time and the device's current received byte count are recorded.

Download and upload speed

Opensignal's download and upload speed metrics assess the mean speeds experienced on data connections to mobile networks.

They involve downloading or uploading a file for a set period of time to test the data performance of a user's mobile network, directly from their handset.

The test is performed over HTTPS connections, and multiple threads are used to simulate a typical mobile app data connection. The download and upload servers are the same as those used by popular mobile apps, websites and mobile services which internet users connect to every day, provided by the major CDNs.

Opensignal collects data primarily via automated tests that run in the background. These tests are run at various points in time to ensure that the metrics accurately reflect the speeds that users experience during normal use of their mobile network.

To calculate the metrics for download and upload throughput speed, Opensignal uses a dataset of individual test records which contains a series of fields including: test location, time, type (user-initiated or automated), network connection type (e.g. Wi-Fi, UMTS, LTE, 5G etc.), the servers that were used, the IP address, various RF parameters and a series of metrics associated with the speed and latency of the data connection that was measured during the test.

A2 Statistical methodology

The 2026 Mobile Matters report analyses findings collected from Opensignal's crowdsourced data sample between 1 August 2025 and 31 July 2026 (labelled 2025/26 in the report) and, where appropriate, compares them with the 2024/25 data collected between 1 August 2024 and 31 July 2025, which is calculated afresh.

Crowdsourced sample records were included in the analysis if they met the following criteria:

- b) The mobile network was either EE, O2, Three or Vodafone. Certain MVNOs were included where the data was available, other than where their performance suggested that the connectivity they provided was limited in some way;
- c) The location was in the UK and the UK nation was either England, Northern Ireland, Scotland, or Wales; and
- d) The mobile technology was known – either 2G, 3G, 4G, 5G, 5G SA, or 5G NSA.

Records which did not meet the above criteria were excluded from the analysis.

Ofcom has analysed the performance recorded on both Android and Apple iOS smartphones (iOS only accounts for c.1.5% of total tests as we exclude those run in the background with restricted resources for iOS v15 onwards). The inclusion of iOS is a change from previous Mobile Matters reports and video streaming analysis continues to exclude tests run on iOS devices.

Both Ofcom and Opensignal have ensured that the sample sizes are sufficient to ensure the robustness of the findings shown in the report, and that the sample distribution broadly matches both the population distribution of the UK and the relative operator shares.

The urban / rural classifications used in the analysis are taken from Bluewave Geographic's Locale dataset.

Metrics and analysis methodology

For the 2026 Mobile Matters report the following metrics were analysed:

- Share of mobile network connection attempts (%).
- Average proportion of successful data connections (%).
- Average (median) response time (milliseconds, ms).
- Average (median) time to download 2 MB and 5 MB files (seconds).
- Average (median) time taken to upload a 1 MB file (seconds).
- Distribution of download speeds (%).
- Distribution of upload speeds (%).
- Proportion of videos completed without interruption (%).

Share of mobile network connection attempts

This measure assesses how mobile network connection attempts are distributed across each mobile technology (2G, 3G, 4G, 5G SA and 5G NSA). Our analysis looked at how the proportion of these connections on each technology differed by nation, rurality, and mobile network.

Data connection success rates

To assess the data connection success rate, we looked at the total number of server response tests performed and calculated the percentage of these tests that were successful. The proportion of successful tests was then compared by nation, rurality, mobile network, and mobile technology (3G, 4G, 5G SA and 5G NSA). This year we used records where the mobile screen was on, off or unknown during this test, so that we could assess the percentage of cases when the user was able to connect to data services when the device was in active use, and when the screen was off (for example, when a device makes a data connection to check for new messages).

The proportion of successful tests with upper and lower 95% confidence intervals was calculated for each subgroup. Analysis was conducted comparing 3G, 4G, 5G SA and 5G NSA mobile technologies, nation, rurality, and mobile network (only 4G and 5G performance was analysed at network level).

Response time (latency)

Response time, or latency, which is the delay in milliseconds between a device making a request to their mobile network for information and receiving a response, was calculated as half the Round-Trip Time (RTT/2), which approximates the one-way delay for a data packet to travel from a mobile device to a server. The calculation uses the minimum measured RTT across 100 UDP packets.

Video streaming success rates

Opensignal's video streaming test streams a video from typical CDNs and measures buffering and playback activity.⁵ We analyse this data to find the proportion of tests that were completed without the playback stopping. Upper and lower 95% confidence intervals were calculated for this proportion for each subgroup.

Time taken to download files

The Opensignal dataset contains tests in which phones download 2 MB and 5 MB files, and the throughput experienced when downloading these files is recorded. We applied a conversion to this measure by multiplying the file size by 8 (to convert from MB to Mbit) and then divided this figure by the recorded throughput to produce a measure showing the time taken for the user to download a 2 MB or 5 MB file respectively. The median time taken to download files of each size was calculated for each subgroup. Performance was compared by mobile technology, nation, rurality and mobile network.

Time taken to upload files

The Opensignal dataset also contains upload tests, where the throughput experienced when uploading a 1 MB file is recorded. We applied the same conversion as above to produce a measure assessing the time taken to upload a 1 MB file. The median time taken to upload a 1 MB file was

⁵ Opensignal's video streaming test streams a 20-second test video to the user's device. The test is adaptive bit rate-based, meaning the resolution of the video can vary during the test depending on the connection quality. Resolutions from 144p to 2160p (4k) are supported and the initial resolution streamed is selected based on the connection capacity reported by the device's operating system. Videos running at 144p to 480p run at 30 frames per second (fps) while those at 1080p, 1440p and 2160p run at 60 fps. 720p videos also run at 60 fps if the data rate is sufficient to support it (minimum 3.3 Mbit/s), otherwise they run at 30 fps. The percentages shown are the proportions of 20-second video streams which completed without a buffering event, regardless of the resolution/s at which the video was streamed.

calculated for each subgroup. Performance was compared by mobile technology, nation, rurality, and mobile network.

Distribution of download and upload speeds

To assess the distribution of download and upload speeds, we used the Opensignal speed test which downloads or uploads data over a set period of time. The download/upload speed received is recorded every 30ms, and this collection of measurements is trimmed⁶ and averaged to give a single value. The distribution of these speed tests is then calculated based on different speed bands⁷ and compared by mobile technology, nation, rurality and mobile network.

⁶ The top and bottom 10% of the tests were discarded.

⁷ For download speed: <2 Mbit/s, ≥2 and <5 Mbit/s, ≥5 and <10 Mbit/s, ≥10 and <20 Mbit/s, ≥20 and <50 Mbit/s, ≥50 and <100 Mbit/s and ≥100 Mbit/s. For upload speed: <1.5 Mbit/s, ≥1.5 and <5 Mbit/s, ≥5 and <10 Mbit/s, ≥10 and <20 Mbit/s and ≥20 Mbit/s.

A3 Glossary of terms

Term	Description
2G / 3G / 4G / 5G	Generations of mobile technology, each offering better speed and performance than the previous one.
3G switch-off	The process by which mobile networks shut down their 3G networks, reallocating resources to newer technologies like 4G and 5G.
5G non-standalone (5G NSA)	A transitional 5G version that still uses 4G infrastructure.
5G standalone (5G SA)	A full 5G system with no reliance on 4G, offering superior performance.
Bandwidth	The maximum rate of data transfer across a network. High-bandwidth activities (like streaming) require strong, consistent speeds.
Buffering	A temporary loading pause while a video gathers enough data to continue playing smoothly. High buffering indicates slower connection or latency.
Data connection success rate	The percentage of data connection attempts that result in a successful connection to the mobile network.
Content delivery network (CDN)	A network of servers strategically placed to deliver digital content such as video streams quickly and reliably to users.
Coverage	The availability of mobile network signal in a particular geographic location.
Crowdsourced data	Data gathered from a large number of users.
Download / upload speeds	Rates at which data is received from (downloaded) or sent to (uploaded) the internet, measured in megabits per second (Mbit/s).
Download / upload time	The time it takes to retrieve a digital file from the internet to a device, measured in seconds. Lower values mean faster connections.
Featurephone	A basic mobile phone mainly for calls and texts, often with physical buttons and limited features like a simple camera or FM radio.
Latency (response time) – as below	The time (in milliseconds) it takes for data to travel between a device and the network. Low latency is crucial for real-time activities like gaming or video calls.
Mbit/s (megabits per second)	A measure of data transfer speed. Higher Mbit/s means faster internet performance. For context, 100 Mbit/s = c12.5 megabytes per second.
Median average	The middle value in a dataset, used to reflect typical performance in download tests.
Milliseconds (ms)	A unit of time measurement used to report latency or response time. One second = 1,000 milliseconds.
Mobile data connection attempt	When a mobile device tries to establish a data connection to the network while within a coverage area.

Term	Description
Mobile Network Operator (MNO)	A company that runs a mobile network, such as EE, VodafoneThree and VMED O2.
Mobile performance	A measure of how well a mobile network functions, including connectivity, speed, and responsiveness.
Mobile Virtual Network Operator (MVNO)	A company that runs retail mobile services by purchasing wholesale services from a mobile network operator.
Network availability	Indicates if a mobile signal is present and usable in a given location.
Network congestion	A condition where high network traffic causes delays, failed connections, or poor performance.
Network share	The portion of total mobile data connections using a particular network type (e.g. 5G, 4G etc).
Response time (latency) – as above	The time (in milliseconds) it takes for data to travel between a device and the network. Low latency is crucial for real-time activities like gaming or video calls.
Rurality	A geographic classification dividing areas into urban and rural for performance comparison.
Smartphone	A mobile phone that performs many of the functions of a computer, typically having a touchscreen interface, internet access, and an operating system capable of running downloaded applications.
Time-based tests	Tests that measure how much data is downloaded in a fixed amount of time, better reflecting real-world network capability on high-speed connections.
Two-tailed test	A statistical hypothesis test where the critical region of a distribution is split into two sides, testing for deviations in both directions (above or below a hypothesised value).
Video lag / delay	A symptom of high latency or slow speeds resulting in choppy or paused playback during streaming.
Video streaming success rate	The percentage of 30-second video streams that played without interruption during testing.
VoIP (Voice over Internet Protocol)	Technology that delivers voice communications and multimedia sessions over internet connections.