

Connected Nations 2022

Scotland report



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1. Overview

Ofcom's objectives include delivering internet we can rely on through ensuring fast and reliable connections and services for everyone, everywhere. In this annual Connected Nations Scotland report, we measure progress in the availability of broadband and mobile services across Scotland and the UK, including the newest gigabit-capable, full fibre and 5G networks now being rolled out.

Alongside this Scotland report, we also publish separate reports on broadband and mobile availability for the [UK as a whole](#) and [each of its nations](#). [Our interactive dashboard](#) allows people to easily access data for specific types of services across Scotland and the UK. We are also releasing the [International Broadband Scorecard 2022](#), which compares the UK's recent position on broadband availability with a number of other European nations.

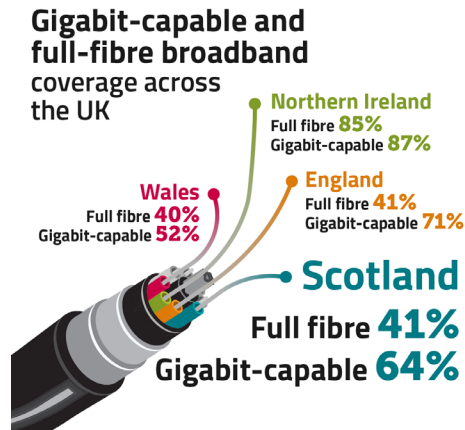
What we have found

- **Coverage of high-speed networks continues to grow.** Full fibre is now available to over 1 million homes in Scotland, with coverage now standing at 41%, (an increase of 14 percentage points from 2021 and one of the largest across the UK). Gigabit-capable broadband is now available at 1.7 million homes (64%). As well as delivering faster speeds, these services are more reliable than older broadband technologies.
- **There continues to be wide coverage of superfast broadband.** Speeds of 30 Mbit/s are available to 94% of homes in Scotland, an increase of over 62,000 premises since last year. We estimate that around 71% of Scottish premises that are able to get superfast broadband actually take a superfast or faster service.
- **The number of premises in Scotland without access to decent broadband continues to fall.**¹ Factoring in coverage from both fixed and fixed-wireless networks, we estimate that around 21,000 homes and businesses in Scotland are still without a decent broadband connection. We also estimate that around 8,000 premises in Scotland cannot access either a decent fixed broadband service or get good 4G coverage indoors. The increased availability of low earth orbit satellite services in Scotland may also offer a possible alternative option for these customers.
- **The availability of 5G services continues to grow.** The level of coverage provided outside of premises provided by individual Mobile Network Operators (MNO) in Scotland now ranges from 29-51% (based on our High Confidence level), the second highest of the four UK nations.
- **4G continues to underpin the mobile experience in Scotland.** 83% of Scotland's landmass has 4G geographic coverage from at least one of the mobile operators (up from 82% in 2021) but only 46% has coverage from all 4 operators (up from 45% in 2020).
- **There continues to be a high level of 4G outdoor premises coverage in Scotland.** Individual mobile operator coverage ranges between 97-99%, with a range of 89-97% for rural areas.
- **The storms last winter had a significant impact on communications services:** this was primarily because of lengthy power outages, which led to communications services becoming unavailable in impacted areas, particularly in the North East of Scotland, Dumfries and Galloway and the Borders. It initially took providers longer than expected to recover from these impacts, which has highlighted the need for better co-ordination across the communications and energy sectors. Improvements are already being made in this area and we urge industry and others to continue this progress.

¹ Unless otherwise specified, coverage figures for decent broadband count all premises (residential and commercial). Coverage for all other speed tiers counts residential premises only, unless otherwise specified.

Faster, better networks are increasingly available across Scotland

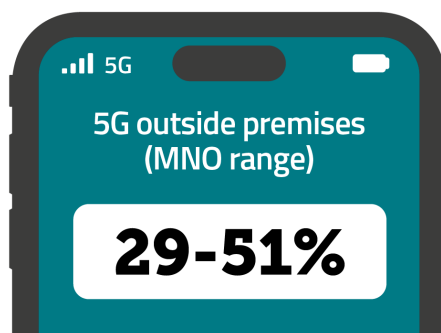
Full fibre and gigabit-capable broadband coverage continues to improve



Just over 1m (41%) of homes in Scotland now have access to full fibre connections – an increase of just under 367,000 premises in the past year. This is the largest year-on-year increase in full fibre coverage we have seen so far in Scotland and is a considerable increase from 17% in 2020.

Gigabit-capable broadband – able to provide broadband speeds of 1Gbit/s or higher – can be delivered over full fibre networks and the latest version of cable networks. Gigabit speeds are now available to around 1.7m (64%) homes. This has increased by 13 percentage points over the last year. Full fibre and gigabit-capable availability is lower in more rural areas of Scotland.

5G rollout is expanding

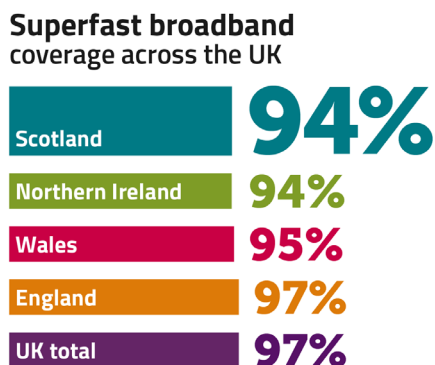


EE, Virgin Media O2, Three and Vodafone have continued to extend their 5G networks across the UK, and we are reporting individual mobile network operator coverage for the first time, based on the High to Very High Confidence range which we established in 2021.

Across the UK, we find that coverage outside premises from at least one operator has now reached around 77% at our High Confidence level, and 67% at our Very High Confidence level. For Scotland, 5G coverage outside of premises from at least one operator ranges from 68% at high confidence to 57% at very high confidence. Individual mobile operator coverage in Scotland ranges from 29-51% at High Confidence, with a range of 20-41% at our Very High Confidence level. Though most 5G sites are focused around busy urban areas, such as Glasgow and Edinburgh - providing additional capacity

to existing mobile data services - we're now seeing coverage extending into smaller towns and other high footfall locations. The distribution of this investment remains broadly similar to last year, with 86% of sites in England, 8% in Scotland, 4% in Wales and 2% in Northern Ireland.

Good connections are available to most people across Scotland



Superfast broadband (with speeds of at least 30Mbit/s) continues to be available to 94% of premises in Scotland (an increase of 62,000 premises from last year). We estimate that around 71% of premises in Scotland that are able to get superfast broadband actually take it. This highlights that some people are not choosing to take the fastest speeds available to them.

Mobile operators continue to provide a high level of 4G coverage outside of premises in Scotland, with coverage from individual operators ranging between 97-99% of premises. In addition, 96% of premises in Scotland have outdoor 4G coverage from all four operators, compared with 98% across the UK.

There continues to be a small number of premises in Scotland that cannot access decent broadband



Around 21,000 premises in Scotland cannot get a decent broadband service of at least 10Mbit/s download speed and 1Mbit/s upload speed from either fixed or fixed wireless networks. Some of these premises may be eligible to be connected under the universal broadband service.² Since its

² Where the costs to provide the connection are below the cost threshold set by the UK Parliament (£3,400), the customer can be provided a service at standard connection and rental charges without having to pay any additional installation charges. Where the cost of connection is above the cost threshold, these premises can still receive a service if the customer pays the additional costs.

launch in early 2020, there have been around 110 orders in Scotland. Each order may require network build that can serve multiple premises, and therefore will lead to full fibre connections being built that can serve just under 583 premises that do not have access to decent broadband.

We expect that many of the remaining premises will be in particularly remote areas, so households will have to contribute to the costs of building a connection. For a significant number of these, connection costs will be very high, which means they may need alternative solutions.

In some cases, rural addresses may be eligible to combine Scottish Government funding of up to £5,000 from the Scottish Broadband Voucher Scheme (SBVS)³ with funding from the UK Government's Gigabit Broadband Voucher Scheme (GBVS), which provides £1,500 for rural homes and £3,500 for rural businesses to provide a connection (from early next year this will be increased to £4,500 for all beneficiaries).⁴

The UK Government is also continuing to look at options for these very hard to reach premises and has recently launched a trial to see whether satellite can be used to deliver high speed connections in more than a dozen hard to reach locations across the UK.

We estimate that there are around 8,000 premises in Scotland that cannot access either a decent broadband service, or good 4G mobile coverage, compared with 30,000 across the UK.

The winter storms led to significant communication network outages across the UK, largely due to sustained power loss

The resilience and reliability of networks is critical. We rely on our connections at work, at home and on the move.

Towards the end of 2021 and in early 2022 the UK was hit by several severe storms, starting with storm Arwen in November 2021 and further storms into early 2022. These storms had a significant impact on communications services. This was primarily because of lengthy power outages which caused communication services to become unavailable in impacted areas, such the North East of Scotland, Dumfries and Galloway and the Borders. The Scottish Government's review of the impact of storm Arwen found that at the peak of disruption, almost 200,000 energy customers were affected; 10,000 properties experienced water supply issues, telecommunications were unavailable in parts of the country, schools were closed, and train and ferry services were cancelled.

During storm Arwen, thousands of mobile cell sites were disrupted by power outages, and this affected all four mobile network operators. On the fixed networks, the largest impact was due to customers losing power to equipment in their homes (e.g., broadband routers).

The recovery process following the storms, particularly after storm Arwen, took longer than expected due to the volume and scale of the power outages. This highlighted the need for better co-ordination and information sharing between the communication and energy sectors. Improvements have already been made to these processes, which helped reduce recovery times during the later

³ Digital Scotland, [Vouchers](#).

⁴ UK Government, [Major broadband rollout](#).

storms in the year. We are continuing to work with industry and government to act on lessons learnt during the storms and help ensure improved resilience of the networks in future.

In October this year, residents of the Shetland Islands were cut off from their mobile and fixed line services for approximately 16 hours.⁵ This resulted from one of the Islands' subsea fibre link cables (which connects Shetland to Orkney and onto mainland Scotland) being damaged by a fishing trawler. A secondary fibre link subsea cable to the Island was already unavailable at that time due to damage sustained the previous week.

While the impact of this incident is still under investigation, we understand that Public Switched Telephone Network landlines for voice remained largely available due to the presence of legacy low bandwidth microwave backhaul. The damage to the south fibre cable meant that there was a loss of light through the fibres, and temporary restoration of the services was achieved by increasing power output at the source. Over the next ten days, repairs were carried out across both the primary and secondary fibre cables to the islands, leading to a permanent restoration of services.

As well as delivering faster speeds, full fibre and gigabit-capable broadband technologies are also more reliable than older technologies. As part of its R100 Programme, the Scottish Government has laid 16 new subsea cables⁶ which is connecting 15 Scottish islands to faster and more reliable broadband services.

Further information about new, strengthened security duties for public telecommunications operators under the Telecommunications (Security) Act 2021, network incidents reported to Ofcom and our network resilience work can be found in the [Connected Nations UK 2022 Report](#).

⁵ BBC News, [Damaged cable leaves Shetland cut off from mainland](#), 20 October 2022.

⁶ Digital Scotland, [R100 subsea deployment](#).

2. Fixed broadband and voice

Introduction

High-speed networks continue to expand, bringing fast and reliable voice and broadband services to homes and businesses across Scotland. In this section we provide an update on the roll-out of these networks over the last year, as well as the remaining numbers of premises that still do not have access to decent broadband.⁷ We also update on the deployment of fixed wireless and satellite networks that are delivering broadband connectivity in more rural parts of Scotland.

This section also covers the take-up of fixed broadband services and the migration away from traditional voice services. Further information on the data traffic trends across broadband networks can be found in our [Connected Nations UK Report](#).

Fixed broadband is available at a variety of speeds and is delivered over different technologies, including copper (ADSL), fibre to the cabinet (FTTC), hybrid fibre coaxial cable (HFC) and full fibre, or 'fibre to the premises' (FTTP). A detailed explanation of these technologies and speeds can be found in our [Connected Nations UK report](#).

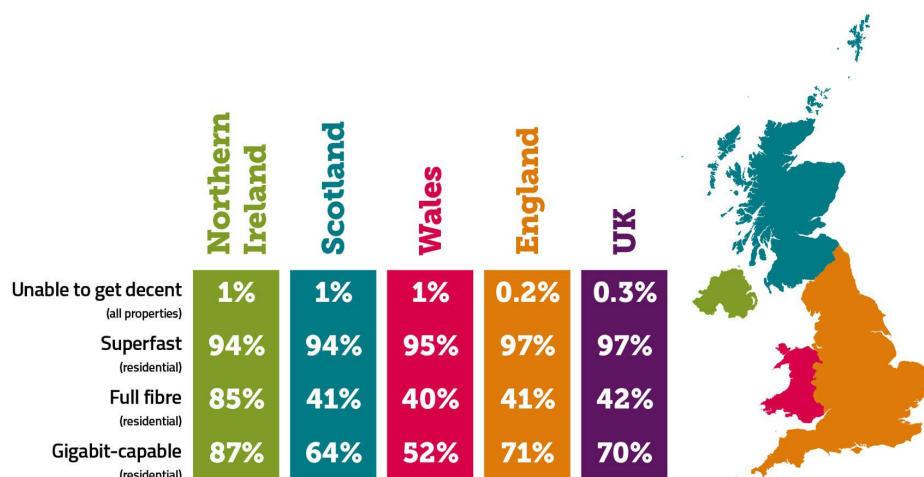
Key highlights

- **Coverage of high-speed networks continues to grow.** Full fibre is now available to over 1 million homes in Scotland, with coverage now standing at 41% (an increase of 14 percentage points from 2021). Gigabit-capable broadband is now available at 1.7 million homes (64%). As well as delivering faster speeds, these services are more reliable than older broadband technologies.
- **There continues to be wide coverage of superfast broadband.** Speeds of 30 Mbit/s are available to 94% of homes in Scotland, an increase of over 62,000 premises since last year.
- **The number of premises without access to decent broadband in Scotland continues to fall.** Factoring in coverage from both fixed and fixed-wireless networks, there are around 21,000 premises in Scotland that are still without a decent broadband connection. Some of these premises will be connected via publicly funded schemes over the next 12 months and beyond.
- **Customers are increasingly taking up the higher speed services that are now available to them.** Over 71% of consumers that have access to superfast broadband have upgraded to a superfast service. We estimate that around 23% of premises that are able to get full fibre are actually taking it.
- **Average monthly data use has grown this year** to 482 GB per connection compared to 446 GB last year.

⁷ We plan to report on the coverage of fixed broadband services to small and medium enterprises as part of our Spring 2023 update.

Summary of broadband coverage at a fixed location across the UK and Nations

Figure 2.1: Summary of broadband coverage at a fixed location across the UK and Nations



Source: Ofcom analysis of provider data (September 2022).

The availability of high-speed networks continues to grow

There has been continued investment in fixed networks in Scotland which has resulted in significant improvements in full fibre and gigabit-capable broadband services in recent years.

Our data shows that 41% (just over 1 million) homes in Scotland are now served by a full fibre connection, a considerable increase of 14 percentage points from last year – one of the largest in the UK. Gigabit-capable broadband has now increased to be available at 1.7 million homes (64%), up from 51% last year. These significant increases are largely due to the continued investment in the rollout of fibre networks by commercial providers. We expect the availability of full fibre and gigabit-capable networks to continue to increase over the next few years, with providers continuing to take different approaches to their business models for deployment.

Table 2.2 below highlights the availability of full fibre and gigabit-capable services across the four nations of the UK, with coverage in Scotland in line with broader trends in England and Wales. Northern Ireland continues to have the most widespread availability of full fibre services across the UK.

These increases are primarily driven by deployments from the larger fibre operators (Openreach, Virgin Media O2 and CityFibre) but supported by a number of smaller providers across the UK which are increasingly included within our data gathering programme.⁸ These new providers tend to be smaller and often target their rollout in underserved communities and regions. As such, they do not significantly alter the national figures, but they are important in providing full fibre coverage at the

⁸ This year we have included data from over 60 full fibre communications providers (compared to around 40 last year).

local level. For example, the Lothian Broadband Group are in the process of establishing their own network in rural or hard to reach areas of Scotland, e.g. Pencaitland and in the Highlands following cornerstone investment from the Scottish National Infrastructure Bank, with the aim of addressing inequality of access to digital infrastructure.⁹

Table 2.2: Residential gigabit-capable and full fibre coverage

	Gigabit	Full fibre
Scotland	64% (1.7m)	41% (1.1m)
England	71% (17.7m)	41% (10.1m)
Northern Ireland	87% (0.7m)	85% (0.7m)
Wales	52% (0.8m)	40% (0.6m)
UK	70% (21m)	42% (12.4m)

Source: Ofcom analysis of provider data (September 2022).

There are significant differences in coverage of full fibre and gigabit-capable services between urban and rural areas of Scotland, as shown in Table 2.3 below. Full fibre services are available at only 24% of homes in rural Scotland, compared with 35% across other rural areas of the UK. Similarly, gigabit-capable services are available at 26% of premises in rural Scotland, compared with 37% across rural parts of the UK.

Table 2.3: Residential gigabit-capable and full fibre coverage in Scotland by rurality

	Total	Urban	Rural
Gigabit-capable	64%	72%	26%
Full fibre	41%	44%	24%

Source: Ofcom analysis of operator data (September 2022).

Deploying these new networks requires significant investment and engineering resources. The UK Government has continued its work to ease the administrative burden required when agreeing access to private land for operators looking to roll-out gigabit-capable (and 5G) networks. The new Product Security and Telecommunications Infrastructure Act (PSTI),¹⁰ as well as addressing security issues, will include a number of telecommunications infrastructure measures. This will include making changes to the Electronic Communications Code¹¹ to support gigabit-capable and 5G network rollouts which will encourage collaborative negotiations between site owners and telecommunications operators, ensure expired agreements can be renewed more easily and enable telecoms providers to gain access to certain types of land more quickly in circumstances where a

⁹ The Scottish National Investment Bank, [Lothian Broadband Group](#).

¹⁰ UK Parliament, [Product Security and Telecommunications Infrastructure Act](#), December 2022.

¹¹ Ofcom, [Electronic Communications Code](#).

landowner repeatedly does not respond to access requests. We will be supporting this work through consulting on changes to the Electronic Communications Code of Practice.

Last month, the Scottish Government laid its Revised Draft National Planning Framework in the Scottish Parliament. The Revised NPF 4 sets out several measures intended to support the deployment of high-quality digital infrastructure across Scotland.¹²

Coverage of superfast broadband remains high

Superfast broadband is available to around 94% (2.5 million) of homes in Scotland, an increase of 62,000 premises compared to last year. Providers are more focused on deploying gigabit-capable networks and, in the future, will mainly deliver increased availability of full fibre. As such, we expect future increases in superfast broadband coverage to continue to be modest.

Table 2.4: Residential superfast coverage

	Superfast	Urban	Rural
Scotland	94%	99%	76%
England	97%	98%	88%
Northern Ireland	94%	99%	82%
Wales	95%	99%	84%
UK	97%	98%	86%

Source: Ofcom analysis of provider data (September 2022).

As with other technologies, there are significant differences in the availability of superfast broadband in urban and rural areas of Scotland. This is reflected in the varying levels of superfast coverage across Scotland's 32 local authority areas, which play a key role in driving improved digital connectivity.

Some of the lowest levels of superfast broadband coverage in Scotland are found in Orkney Islands, Shetland Islands, Na H-eileanan Siar.

Table 2.5: Lowest levels of residential superfast broadband coverage by selected Scottish local authority area

Scottish Local Authority	% of premises with speeds \geq 30 Mbit/s
Orkney Islands	65%
Shetland Islands	72%
Na H-eileanan Siar	77%

¹² Scottish Government, [National Planning Framework 4: Revised Draft](#), 8 November 2022.

Scottish Local Authority	% of premises with speeds ≥ 30 Mbit/s
Argyll and Bute	82%
Highland	84%

Source: Ofcom analysis of provider data (September 2022).

As shown in Table 2.6 below, some of the highest levels of residential superfast broadband coverage tend to be found in more densely populated urban local authority areas.

Table 2.6: Highest levels of residential superfast broadband coverage by selected Scottish local authority area

Scottish Local Authority	% of premises with speeds ≥ 30 Mbit/s
Dundee City	99%
North Lanarkshire	99%
West Dunbartonshire	99%
Clackmannanshire	99%
Glasgow City	98%

Source: Ofcom analysis of provider data (September 2022).

The Scottish Government is making substantial investments in Scotland’s digital infrastructure. Building on the work of Digital Scotland Superfast Broadband, the Reaching 100% (R100) programme is made up of three strands of activity – the £600 million R100 contracts (North, Central, and South), the R100 Scottish Broadband Voucher Scheme (R100 SBVS) and ongoing commercial deployment.¹³ All three R100 contracts are delivering connections and going beyond the original superfast commitment by providing increased gigabit-capable and full fibre coverage. Over 14,300 premises have been connected through the R100 contracts with a further 2,600 connections delivered through the voucher scheme. Island communities in Scotland will also benefit from gigabit-capable broadband following the deployment of 16 R100 subsea cables that were laid during Summer 2022.¹⁴ In August 2022, a further £36 million of funding was jointly announced by the Scottish and UK Governments, which will see an additional 2,637 premises receive access to gigabit-capable speeds.¹⁵

Coverage of superfast in rural Scotland has increased significantly in recent years but remains considerably lower than in urban Scotland and the UK average for rural premises. In some cases, rural addresses may be eligible to combine Scottish Government funding of up to £5,000 from the Scottish Broadband Voucher Scheme (SBVS) with funding from the UK Government’s Gigabit Broadband Voucher Scheme (GBVS), which provides £1,500 for rural homes and £3,500 for rural

¹³ Digital Scotland, [R100 - Access for all](#).

¹⁴ Digital Scotland, [R100 subsea deployment](#).

¹⁵ Digital Scotland, [Delivering faster internet](#), 19 August 2022.

businesses to provide a connection (and which will be increased to £4,500 for all beneficiaries from early next year).¹⁶

Broadband services using wireless networks are also available across large parts of Scotland

Broadband to fixed locations can also be delivered wirelessly, providing an alternative to fixed network connections.

Fixed wireless access (FWA) on mobile networks

Of the four mobile operators in the UK, only Virgin Media O2 does not offer fixed wireless access services. Based on information from the operators about their coverage levels, we estimate that 95% of premises in Scotland have access to a fixed wireless service from a mobile operator. This is an increase of two percentage points from last year.¹⁷

FWA services offered over the MNOs 4G and 5G networks, share the network capacity with mobile users, meaning that the capacity of the network has to be carefully managed between the demands of existing mobile users and FWA customers. This means that there may be areas of high mobile demand where a reliable FWA service cannot be offered.

We carried out research this year to better understand the performance of FWA services delivered over mobile networks. Our results show that FWA packages are offering similar capabilities to fixed connections, except in relation to latency (see the main UK report for further details). Further information about this can be found in the Connected Nations UK report.

Fixed wireless access via wireless ISPs (WISPs)

Fixed wireless services can also be delivered over networks that communicate via a wireless link between a provider's mast site and an external antenna fixed to a customer's premises. These mostly use licence-exempt or lightly licensed spectrum, and due to the range of frequencies being used to deliver this service, performance may sometimes be limited by line-of-sight issues. We are beginning to see some use of 5G technology, which alleviates some of these line-of-sight issues. We have further expanded our collection of WISP data this year to now include 26 providers. Based on estimates from these providers, around 2% of residential premises in Scotland have coverage from a WISP network.

¹⁶ Digital Scotland, [Vouchers](#). DCMS, [Broadband beamed from space to isolated areas under plans to boost countryside internet connections](#), 30 November 2022.

¹⁷ This estimated coverage figure is based on coverage data provided by EE and Three. While Vodafone provides an FWA service across its mobile network, we do not have data at the level of granularity needed to map its coverage to UK premises and so it is not included in this figure. More generally, coverage forecasts are determined by predictive modelling tools, localised issues may mean that particular premises may not be able to receive a service despite being predicted to do so.

Table 2.7: Coverage of MNO and WISP FWA networks with at least decent broadband (residential properties)

	MNO FWA	WISP FWA
Scotland	95%	2%
England	96%	7%
Northern Ireland	85%	0%
Wales	93%	32%
UK	95%	7%

Source: Ofcom analysis of provider data (September 2022).

There continues to be a small number of premises in Scotland that cannot access decent broadband

Excluding fixed wireless access coverage, 97% of homes and businesses in Scotland have access to at least decent broadband on a fixed line connection. This means around 90,000 premises do not have access to decent broadband via a fixed connection – a drop of around 10,000 premises since last year. Most of these premises are in rural areas of Scotland.

As discussed above, MNOs and WISPs can offer a decent broadband service and can provide an alternative network technology for the premises that cannot currently access decent broadband from a fixed connection. Based on the coverage estimates from FWA providers, we estimate that 21,000 premises in Scotland still do not have access to a decent broadband service via either a fixed or wireless network.

This figure continues to decrease year on year (down from 30,000 last year). This reduction is likely due to a combination of factors, including the increased number of smaller fibre network and FWA providers from which we have gathered data, and the ongoing roll-out of some publicly funded schemes, such as the Scottish Government’s R100 Programme.

Table 2.8: Premises without access to a decent broadband service from either a fixed or wireless network

	Remaining premises without access to decent broadband
Scotland	21,000
England	40,000
Northern Ireland	9,000
Wales	10,000
UK	80,000

Source: Ofcom analysis of provider data (September 2022).

Broadband universal service obligation (USO)

The broadband USO provides everybody with the right to request a broadband connection with a download speed of at least 10 Mbit/s and an upload speed of 1 Mbit/s (as well as a number of other specific technical characteristics).¹⁸

Where an affordable service¹⁹ with these characteristics is not available, or due to become available in the next 12 months under a publicly funded scheme, the customer is eligible for the USO if the costs of providing the connection are below £3,400 or, where the costs are above £3,400, the customer agrees to pay the excess.²⁰ BT is the USP for the UK (excluding Hull), and KCOM for the Hull area. They are required to provide the USO and to report at six monthly intervals on delivery.²¹

As of October, this year, BT had received 110 orders in Scotland (compared with 1851 orders across the UK).²² Each order may require network build that can serve multiple premises, and therefore will lead to full fibre connections being built that can serve just under 583 premises in Scotland that do not have access to decent broadband.

Satellite services

Satellite broadband services have been available in the UK for some time, but take-up of these services has remained low compared to traditional broadband services.²³ The technology for

¹⁸ In particular these are: a contention ratio of no more than 50:1; latency which is capable of allowing the end user to make and receive voice calls effectively; and the capability to allow data usage of at least 100GB a month.

¹⁹ When the USO was launched (in March 2020), we specified in the USO conditions that an affordable service was one that costs £45 per month, rising annually by CPI. This has now risen to £48.90 per month in line with CPI.

²⁰ In calculating whether the costs are below or above £3,400, the universal service provider (USP) must take into account where costs could be shared by several USO eligible premises.

²¹ BT Group, [A Universal Service Obligation - Keeping the UK connected](#).

²² BT's public reporting shows a slightly lower number of total confirmed orders, this is because it only covers orders prior to, and during, network build, whereas the 1851 figure also includes orders made once build has completed.

²³ We report in the [2022 Communications Market Report](#) that there were 25,500 fixed broadband satellite connections at the end of 2021. This figure represents data collected from a non-exhaustive list of UK satellite service providers (excluding Starlink).

delivering satellite broadband has evolved significantly in recent years, and continues to do so, with an increasing number of satellite constellations now being launched.

Geostationary (GSO) satellites, which orbit the earth at about 36,000km, have traditionally been the primary way of delivering satellite communication services. However, Low Earth Orbit (LEO) satellite constellations, which can deliver lower latency services, are now also available offering residential and business broadband to UK customers. Starlink launched its LEO satellite broadband service in the UK last year and it now provides coverage across the UK (excluding the top two thirds of the Shetland Islands).²⁴

Further information about satellite services can be found in our [Connected Nations UK Report](#).

Planned network deployment

We recently published our first forward looking report about planned network deployments of full fibre.²⁵ This report is based on the stated deployment plans of network operators as of March 2022 up to three years in advance, and it includes plans that are privately funded as well as those that are supported through public funds/intervention (that were known at the time the data was collected in May 2022).²⁶

Using the same data, we have now also estimated how this expected deployment of full fibre broadband services is likely to reduce the number of properties that cannot get decent broadband from either a fixed or fixed wireless connection over the next three years. Specifically, our estimates indicate that, by March 2025, there will be 12,200 premises in Scotland which will continue to be without access to decent broadband, and which may therefore be eligible for the broadband USO.

More consumers are upgrading to higher speeds

It is important to understand whether consumers are benefiting from higher speed and more reliable broadband services when they are available.

We estimate that for those premises that are able to take superfast broadband or a higher speed (94% of all premises in Scotland), around 71% of them do so. This is an increase from around 68% last year. Furthermore, we estimate that the take-up of full fibre services in Scotland, where they are available, is around 23%. Our reporting of full fibre take-up may appear lower than expected, this is because, while networks are being deployed at pace, take-up is likely to lag coverage.

²⁴ See Starlink's [online coverage map](#). In September, Starlink expanded its coverage further north, reaching up to around the bottom third of the Shetland Islands, with the rest planned to follow in the first quarter of 2023. ISPreview, [Starlink Expand UK Coverage to Include Part of Shetland Islands](#), 27 September 2022.

²⁵ Ofcom, [Planned Network Deployment](#), November 2022.

²⁶ The report only takes account of communications providers planned deployments (whether privately or publicly funded), and therefore does not account for any aspirations or plans by public authorities, whether national or local, to roll out networks in their geographical areas.

Table 2.9: Take-up of broadband service by speed (as a percentage of premises where those services are available)

Nation	Superfast and above	Full fibre
Scotland	71%	23%
Wales	71%	28%
Northern Ireland	73%	25%
England	73%	25%
UK	73%	25%

Source: Ofcom analysis of provider data (May 2022).

Data usage over fixed networks continues to grow

Consumers in Scotland continue to use more data over their fixed connections as more people use broadband for data-heavy activities such as streaming. The average monthly data usage now stands at 482 GB per connection, up from 446 GB last year and 433 GB in 2020. This is the second highest of all the nations with only Wales (501 GB) having a higher average monthly data usage.

3. Mobile, Data and Voice

Introduction

Mobile services continue to play an ever more central role in people's lives, from on-the-go calls and internet access to wireless connectivity for smart meters. In this chapter, we provide an update on the progress operators are making with their 5G rollout plans, while continuing to report on the broader availability of mobile coverage across Scotland, both outside and inside premises, across its landmass and along major roads.

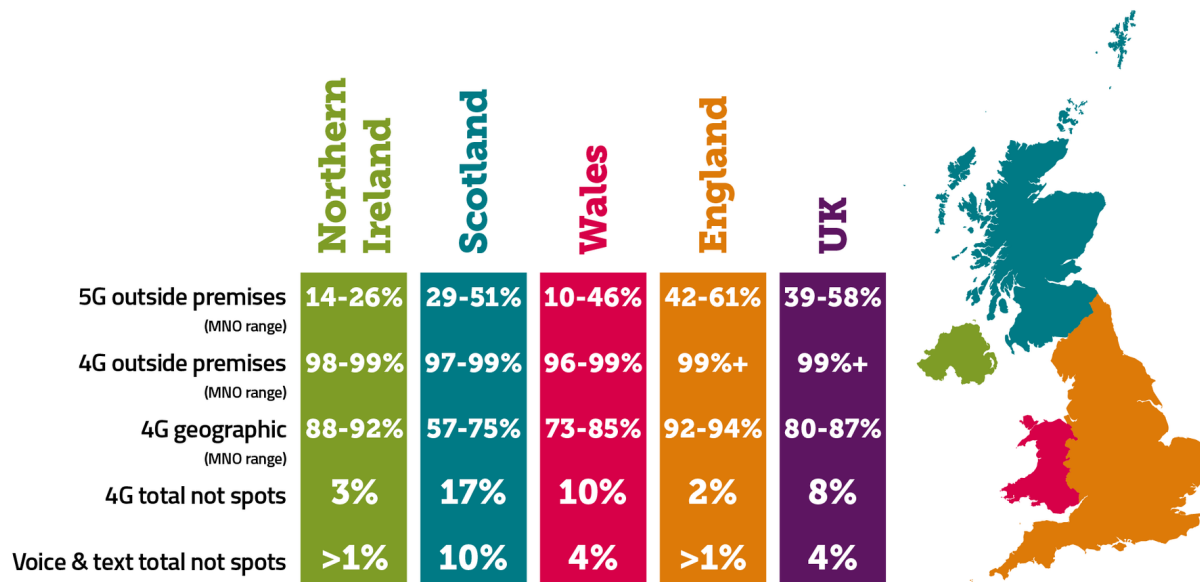
We provide early insights from our work on the quality of mobile network performance, alongside additional information about investment in networks and the continuing growth of mobile traffic in our [Connected Nations UK Report](#). The UK report also includes an update on the availability and use of Internet of Things (IoT) devices and services as well as plans for 2G and 3G switch off.

Key highlights

- **The availability of 5G services continues to grow.** The level of coverage provided outside of premises from individual Mobile Network Operators (MNO) in Scotland now stands at 29-51% (based on our High Confidence level), the second highest of the four UK nations.
- **4G continues to underpin the mobile experience in Scotland.** 83% of Scotland's landmass has 4G geographic coverage from at least one of the mobile operators (up from 82% in 2021) but only 46% has coverage from all 4 operators (up from 45% in 2021).
- **There continues to be a high level of 4G outdoor premises coverage in Scotland.** Individual mobile operator coverage ranges between 97-99%, with a range of 89-97% for rural areas.
- **Over half of Scotland's major roads now have in-vehicle 4G coverage from all four mobile operators.** Coverage now stands at 53%, an increase of 2% from 2021.

Summary of mobile coverage

Figure 3.1: Overview of voice and data coverage across the UK²⁷



Source: Ofcom analysis of operator data (September 2022).

5G coverage continues to grow

5G is now within reach of a growing number of consumers, with around 20% of mobile handsets now 5G capable (up from around 10% in 2021) and coverage increasing significantly across the UK.²⁸

The mobile coverage data in this report is based on predictions provided to us by the MNOs. To evaluate the accuracy of the information provided to us, we undertake regular testing to ensure the predictions provided are suitable for national and regional reporting. The development of 5G predictions has required new approaches from the mobile network operators, and in many cases relies upon new iterations of their modelling tools. We have therefore undertaken a 5G-focused monitoring exercise before publishing these predictions, and we will continue to engage with MNOs, and undertake further monitoring, as networks are rolled out and models are updated.

We report on 5G availability across a confidence range of “High Confidence” and “Very High Confidence”, which reflects the likelihood of coverage predicted by the mobile operators matching up to the coverage on the ground for consumers.

Our approach to reporting on 5G coverage is set out in more detail in our [Connected Nations UK Report](#).

²⁷ Note that the MNO range for 5G outside premises presented here is based on our ‘High Confidence’ measure.

²⁸ We note that not all 5G capable devices may be enabled with 5G subscriptions.

Outdoor premise coverage of 5G

Across the UK, we find that coverage outside premises from at least one operator has now reached around 77% at our High Confidence level, and 67% at our Very High Confidence level. For Scotland, 5G coverage outside of premises from at least one operator ranges from 68% at high confidence to 57% at very high confidence. This represents a considerable increase from 2021. Table 3.2 below, shows the range of outside premise 5G coverage across individual MNOs in Scotland, which, based on our High Confidence level, is 29% to 51% - the second highest of the four UK nations. The range of coverage across the UK varies considerably with England at 42-61%, Wales at 10-46% and in Northern Ireland at 14-26%.

Table 3.2: Range of 5G coverage outside of premises in Scotland across individual mobile network operators, by year

	2022	2021
High Confidence	29-51%	8-37%
Very High Confidence	20-41%	8%-28%

Source: Ofcom analysis of operator data (September 2021 and September 2022).

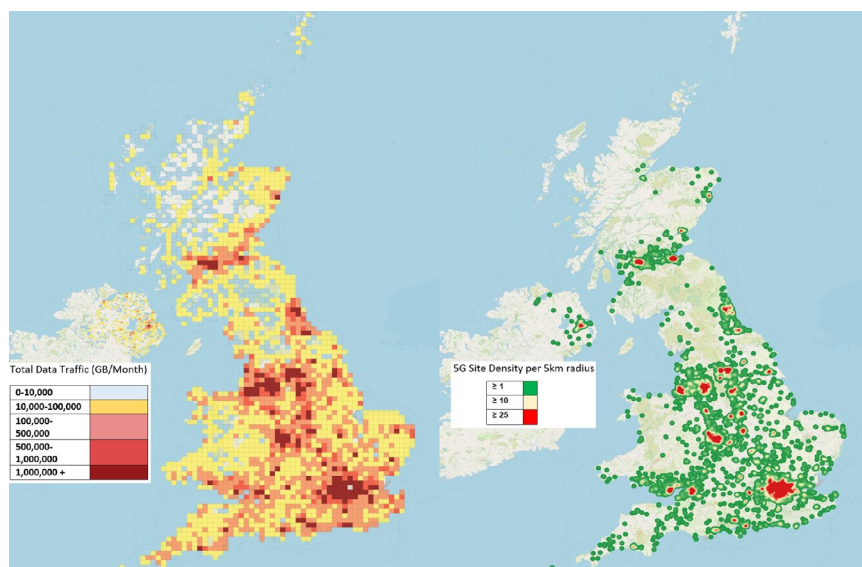
These increases have been driven by additional 5G deployments, with over 12,000 MNO 5G deployments across the UK, up from the 6,500 we reported in 2021.²⁹ Of these, 86% of sites are located in England, 8% in Scotland, 4% in Wales and 2% in Northern Ireland.

Whilst 5G deployments continue to be focussed around more densely populated areas, including across the Central Belt of Scotland, it is increasingly available beyond city centres and can be found in smaller towns and along busy transport routes. The total 5G capacity provided in these areas will vary and is a product of both the site density shown on the right-hand side of Figure 3.3 below, and the available bandwidth.³⁰

²⁹ It should be noted that these deployments do not necessarily equate to a total of individual sites across all MNOs. For example, 2 MNOs may be offering coverage from the same site.

³⁰ We note that where 5G and 4G are sharing the same spectrum, 5G is currently accounting for less than 4% of the total traffic in these shared bands.

Figure 3.3: Intensity of mobile traffic per 10 km² (left) and density of 5G site deployments (right)



Source: Ofcom analysis of provider data (May 2022).

These differences in deployment strategies are reflected in the different coverage levels across the UK nations reported in the coverage ranges set out above. In Table 3.4 below we highlight the coverage levels of individual MNOs within those ranges for premises in Scotland.

Table 3.4: 5G outdoor premises coverage in Scotland by mobile operator

	Very High Confidence	High Confidence
EE	41%	51%
Three	26%	50%
Virgin Media O2	28%	29%
Vodafone	20%	32%

Source: Ofcom analysis of provider predictions (September 2022).

Scotland 5G Centre

As well as commercial MNO 5G rollout, we are also seeing new initiatives spearheaded by industry and government aimed at developing, and providing insights into, different 5G use cases. The Scotland 5G Centre (S5GC) is the national centre for accelerating the deployment and adoption of 5G connectivity in Scotland’s Industry and Public Sectors. Funded by the Scottish Government, the Centre works with industry, communications providers and academia.

The S5GC Connect Programme is delivering a national network of 5G Innovation Hubs which are working with SMEs to embrace 5G, develop use cases on a private 5G testbed network, and give them the skills they need to use 5G technology as business enabler. The Hubs will work closely with key local sectors, communities and businesses to help develop skills needed to use 5G technology as

a business enabler. Hubs are now active in Dumfries, Dundee, Forth Valley, Kilmarnock and Aberdeen, with others in development.³¹

Other projects, such as the 5G New Thinking project continue to work with rural communities, including the Orkney Islands, to aid local communities and businesses to build and operate their own local mobile and wireless networks.³²

5G and private networks

Private networks are playing an increasing role in the mobile market due to their potential to provide tailored connectivity solutions. These networks can take advantage of additional 5G capabilities and play an important role enabling digital transformation in the wider economy, including in the agricultural sector.

We have issued around 900 shared access licences since new rules were introduced in 2019, up from the 550 we reported in 2021.³³ We continue to estimate that around half of this increased number can be considered as supporting private network type solutions. Around 91% of shared access licences are found in England, 4.5% in Wales, 3.5% in Scotland and 1% in Northern Ireland. We expect to hold a wireless innovation event in Scotland in the coming year.

Geographic coverage

Geographic 4G coverage

As shown in Table 3.5 below, there remain significant differences in geographic 4G coverage across the four nations of the UK. Individual operator coverage across Scotland’s landmass ranges from 57% to 75%, an increase of 2% to the top range compared with 2021.

Table 3.5: 4G geographic coverage ranges by UK nation

	Range of 4G geographic coverage
Scotland	57% to 75%
England	92% to 94%
Northern Ireland	88% to 92%
Wales	73% to 85%
UK	80% to 87%

Source: Ofcom analysis of MNO predictions (September 2022).

Most mobile operators have made small but notable improvements in their geographic coverage this year. EE has the highest levels of 4G coverage across Scotland’s landmass at 75% (up by around

³¹ [Scotland 5G Centre](#).

³² The [5G New Thinking project](#) is part funded by the Department for Digital, Media, Culture and Sport.

³³ Including legacy licences, there are over 1,600 active licences in the shared access bands.

2% from last year), whilst Virgin Media O2 has increased its coverage by around 3% to 66% (up from 63% last year).

Table 3.6: 4G geographic coverage in Scotland by MNO

	2022	2021
EE	75%	73%
Virgin Media O2	66%	63%
Three	57%	57%
Vodafone	67%	66%

Source: Ofcom analysis of MNO predictions (September 2022).

Table 3.7 below highlights the differences in 4G geographic coverage from all operators across the UK. It shows that 4G geographic coverage across Scotland from all mobile operators slightly increased this year to 46%, up from 45% in 2021, in line with broader trends across the UK.

Table 3.7: 4G geographic coverage from all MNOs by UK nation

	% of landmass served by all operators (2022)	% of landmass served by all operators (2021)	Percentage points (ppt) change
Scotland	46%	45%	+1%
England	85%	84%	+1%
Northern Ireland	81%	79%	+2%
Wales	62%	61%	+1%
UK	70%	69%	+1%

Source: Ofcom analysis of MNO predictions (September 2022).

Geographic coverage from all operators therefore remains poor in many places across Scotland. Urban areas of Scotland are relatively well served by 4G networks but those in rural areas, particularly in the Western Highlands and Islands, experience much lower levels of 4G geographic coverage.

Table 3.8: 4G geographic coverage from all MNOs by Urban/Rural

Nation	Total	Urban	Rural
Scotland	46%	97%	45%

Source: Ofcom analysis of MNO predictions (September 2022).

People and businesses in rural areas may still have a number of options for accessing 4G geographic coverage when considering that 83% of Scotland's landmass is covered by at least one mobile operator.

Table 3.9: 4G Geographic coverage from at least one operator by UK nation and rurality

Nation	Total	Urban	Rural
Scotland	83%	99%+	83%
England	98%	99%+	97%
Northern Ireland	97%	99%	97%
Wales	90%	99%	89%
UK	92%	99%+	91%

Source: Ofcom analysis of MNO predictions (September 2022).

Table 3.10 below shows the availability of 4G services across Scotland’s landmass by individual mobile operator, with EE having the highest level at 74% (an increase of 1% from 2021).

Table 3.10: 4G geographic coverage change in rural Scotland by MNO

MNO	4G geographic coverage in rural areas (2022)	4G geographic coverage in rural areas (2021)
EE	74%	73%
Virgin Media O2	65%	62%
Three	56%	56%
Vodafone	66%	65%

Source: Ofcom analysis of MNO predictions (September 2022)

As shown in Table 3.11 below, around 17% of Scotland’s landmass has no 4G coverage from any mobile operator, down 1% from 2021. This compares to 8% of the overall UK geographic area. It should be noted that some areas in Scotland without coverage are very sparsely populated and feature rugged terrain.³⁴

This terrain presents challenges for mobile operators who must consider a range of factors when deploying infrastructure, such as proximity to power sources and backhaul or radio links to connect masts to the main network. It can also be difficult to obtain the relevant permissions to access private land and the low population density in rural areas can limit the commercial attractiveness of some of these more remote areas.

Table 3.11: Complete 4G not-spots by UK nation

Nation	% of 4G not-spots
Scotland	17%

³⁴ NatureScot, [Landscape policy: wild land](#).

Nation	% of 4G not-spots
Wales	10%
Northern Ireland	3%
England	2%
UK	8%

Source: Ofcom analysis of MNO predictions (September 2022).

Geographic voice coverage

As with last year, mobile voice services from all four operators are available across 60% of Scotland’s geographic area. The difference between urban coverage (99%) and rural coverage (59%) is consistent with broader trends and gaps in coverage between urban and rural areas of Scotland. However, 90% of Scotland’s geographic area can receive voice coverage from at least one operator, equating to 99%+ of urban and 90% of rural Scotland (up 1 percentage point from last year).

Improving geographic coverage

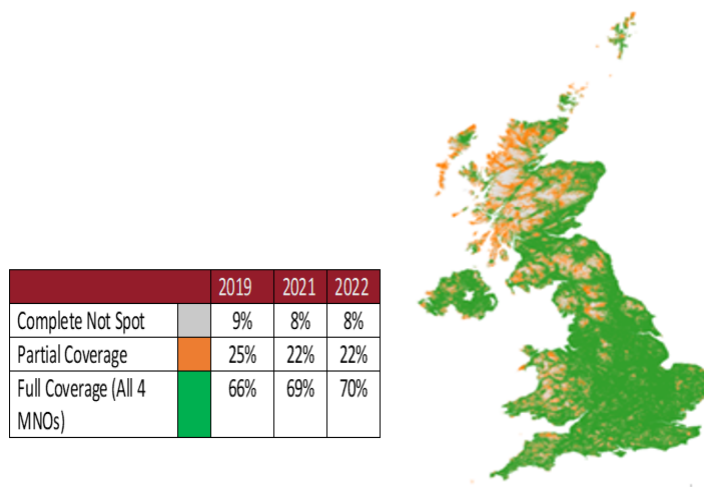
Both the Scottish Government and UK Government have introduced initiatives which should see significant investment in networks and therefore improved geographic coverage over the coming years.

Shared Rural Network

The Shared Rural Network (SRN) was agreed between the UK Government and the mobile operators in March 2020. Work has continued throughout 2022 towards the delivery of the SRN, with operators’ licence obligations to achieve good quality coverage across 88% of the landmass falling due in June 2024, and 90% of the landmass to be covered by January 2027. The UK Government also expects that as a result of this activity there will be good 4G coverage available across 95% of the UK landmass by the end of 2025 (from at least one mobile operator). Coverage in Scotland is expected to rise to 91% from at least one operator and reach 74% from all four operators.³⁵

³⁵ UK Government, [Shared Rural Network](#).

Figure 3.12: Changes in partial and full coverage over time, and as represented in UK coverage today



Source: Ofcom analysis of MNO predictions (September 2022).

Scottish 4G Infill Programme

Alongside the SRN, the Scottish Government is also investing up to £28.75 million to deliver 4G mobile infrastructure to up to 55 mobile ‘not-spots’ through the Scottish 4G Infill programme (S4GI). The first site in the programme – at New Luce in Wigtownshire – went live in February 2020 and is now delivering 4G services. As of the time of writing in November 2022, 30 sites are currently live with a pipeline of sites to be built and activated through to March 2023. Updates – including timescales for 4G service availability – are being published on the Scottish Government’s website.³⁶

Case study: Building 4G masts in Clova, Angus

The S4GI programme is delivering mobile services across some of the most challenging terrain in Scotland. S4GI infrastructure provider WHP Telecoms delivered a new 4G mast in Clova, Angus which is located in the Cairngorms National Park. This involved extensive consultation and discussion with Angus Council throughout the planning process. Once activated, the mast will provide over 425 sq. km of 4G coverage to the local community and wider area. In order to minimise the impact to both the existing peatland and existing landscape, and improve sustainability, specialist materials were used, and a new access track (over 1,200 meters in length) was built.

³⁶ Scottish Government, [Scottish 4G infill programme: progress update](#), 23 November 2022.

Premises coverage

Outdoor premises 4G coverage

Individual operators continue to provide a high level of 4G coverage outside of premises in Scotland, with coverage ranging between 97-99% of premises. In addition, 96% of premises have outdoor 4G coverage from all four operators, compared with 98% across the UK.

Table 3.13: Outdoor premises 4G coverage by UK nation (all operators)

Nation	Total
Scotland	96%
England	98%
Northern Ireland	96%
Wales	93%
UK	98%

Source: Ofcom analysis of MNO predictions (September 2022).

There continues to be a significant difference between coverage in urban and rural areas of Scotland. Individual operators' 4G coverage outside rural premises ranges from 89-97% (up from 88-96% in 2021), with coverage from all operators up to 84% (up 1% from last year). Individual operators each provide outside coverage of 99+% of urban premises in Scotland.

Table 3.14: Outdoor premise 4G coverage in rural Scotland (by operator)

MNO	% of rural premises with outdoor 4G coverage
EE	97%
Virgin Media O2	94%
Three	89%
Vodafone	94%

Source: Ofcom analysis of MNO predictions (September 2022).

Outdoor premises voice coverage

As with last year, around 99% of premises in Scotland have voice coverage outside from all four operators. This drops to 92% for premises in rural Scotland. Again, almost every premises in Scotland (whether urban or rural) has outdoor voice coverage from at least one operator.

Indoor premises 4G coverage

Several factors can affect the coverage people receive indoors. These include the thickness of the walls, the building materials used in construction, and where in a building people are using their phone.³⁷ As a result, some premises may see differences between the operators' predicted indoor coverage data and the actual coverage experience.³⁸

Indoor 4G coverage from individual operators ranges between 91% and 95% of all premises in Scotland. As can be seen from Table 3.15 below, 85% of premises in Scotland can receive 4G coverage indoors from all four operators, up 3% from 2021. This is 1% higher than the UK average of 84%.

Table 3.15: Indoor premises 4G coverage by UK nation (all operators)

Nation	Total
Scotland	85%
England	85%
Northern Ireland	72%
Wales	76%
UK	84%

Source: Ofcom analysis of MNO predictions (September 2022).

Table 3.16 below shows that indoor premises 4G coverage from individual operators ranges between 72% and 83% in rural areas of Scotland (up from 71% and 81% in 2021). In addition, only 55% of rural premises receive indoor 4G coverage from all four operators (up from 53% in 2021). In urban areas of Scotland, 92% of premises can access a 4G service from all four operators.

Table 3.16: Indoor premises 4G coverage in rural Scotland (by operator)

MNO	% of premises with indoor 4G coverage (2022)	% of premises with indoor 4G coverage (2021)
EE	83%	81%
Virgin Media O2	82%	82%
Three	72%	71%
Vodafone	82%	82%

³⁷ Ofcom's Mobile Coverage Checker provides information on the likelihood of there being indoor coverage in buildings at different locations and explains more about the factors that affect mobile signal indoors.

³⁸ Ofcom determines indoor coverage by applying an average building entry loss of 10dB across buildings. We acknowledge this approach provides only a simplified view of indoor coverage and that the real experience depends heavily on the types of building material and insulation in a specific building.

Source: Ofcom analysis of MNO predictions (September 2022).

However, 4G coverage is available from least one operator in 99% of rural premises and to 99%+ in urban areas of Scotland.

Indoor premises voice coverage

Mobile voice services from all four operators are available to 94% of premises in Scotland (up 1% from last year). Again, urban areas of Scotland are better served with 98% indoor coverage compared to 74% in rural areas. This is illustrated by the difference in all-operator coverage between urban areas, such as Glasgow City (99%+) and more rural areas like Orkney Islands (41%) or Shetland Islands (60%). However, almost every premises in Scotland (whether urban or rural) has indoor voice coverage from at least one operator.

Coverage on roads

The road network in Scotland is hugely diverse, spanning the ten-lane M8 in Glasgow city centre to single carriageway sections in the Highlands. Good coverage is important along this road network to assist with vehicle communications, navigation, infotainment and safety aids. This section focuses on coverage along Scotland's major roads but a detailed breakdown of coverage along A and B roads can be found via our [interactive dashboard](#).

As shown in Table 3.17 below, in-vehicle 4G coverage from all operators along major roads in Scotland now stands at 53%. Whilst this represents a small increase of 2% from last year, coverage has risen from 48% in January 2019. Four per cent of Scotland's major roads are unable to receive in-vehicle 4G coverage. The table below highlights the range of in-vehicle 4G coverage along major roads in Scotland, by individual operator. In-vehicle voice coverage from all operators on major roads in Scotland, stands at 71%, with around 1% of major roads without voice coverage from any operator.

Table 3.17: In-vehicle 4G and voice coverage on major roads in Scotland, by operator

	4G	Voice
EE	83%	86%
Virgin Media O2	79%	93%
Three	68%	82%
Vodafone	81%	92%
All operators	53%	71%
At least one operator	96%	99%

Source: Ofcom analysis of MNO predictions (September 2022).

Mobile traffic

Mobile traffic in the UK grew fastest in Scotland, with significant growth year-on-year. Our monthly sample indicates data growth increased to c62,000 TB, up from c48,000 TB in 2021. Most of this data is from 4G traffic, which accounts for c56,000 TB of this year's total data traffic in Scotland.

Further information about these trends can be found the [Connected Nations UK Report](#).