Connected Nations

Scotland Report 2023

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Section

1. Overview

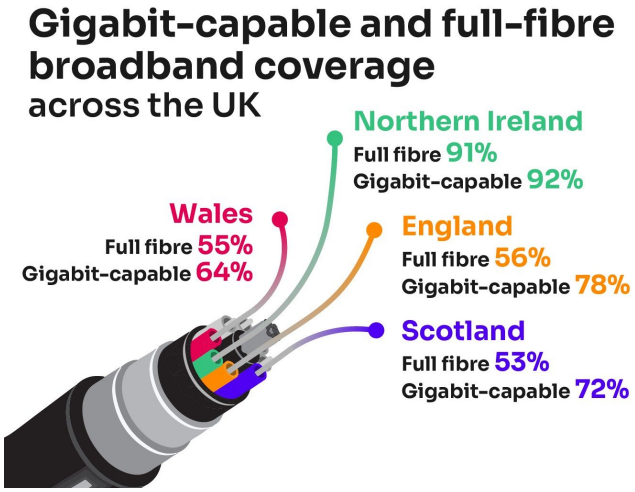
Ofcom's objective is to make communications work for everyone, including to promote reliable, widely available, and high-quality networks. In this annual Connected Nations Scotland report, we measure progress in the availability of broadband and mobile services across Scotland and the UK, including the newest full-fibre, fixed wireless access 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 other nations. Our interactive dashboard allows people to easily access data for specific types of services across Scotland and the UK. In October 2023, Ofcom also published an update on Planned Network Deployments for Very High Capacity networks in the UK for the next three years.

What we have found

Connectivity across Scotland is improving, utilising a range of technologies

Private investment and Government programmes are growing full-fibre and gigabit-capable fixed connectivity

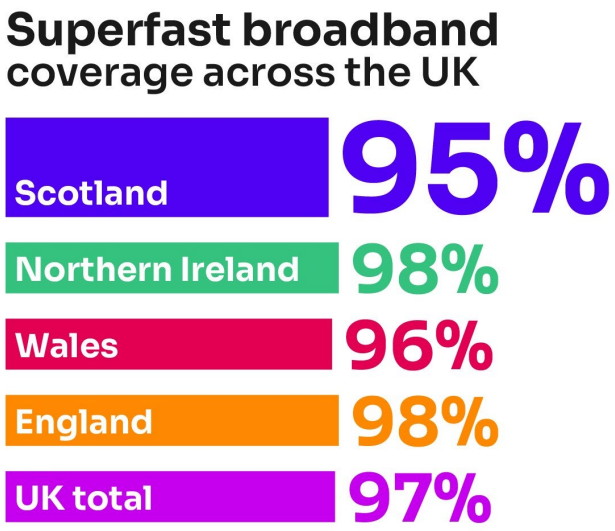


Fifty-three per cent (1.4m) of residential premises in Scotland are now served by a full-fibre connection, an increase of 13 percentage points from 2022. This represents a further 350,000 premises in Scotland which now have access to a full-fibre connection. We estimate that, where available, the take-up of services on full-fibre networks in Scotland is around 28%, up five percentage points from 2022.

Gigabit-capable broadband has also increased to be available at 72% (1.9 million) of residential premises, up eight percentage points from last year.

Full-fibre and gigabit-capable connectivity in rural Scotland has also advanced by eight percentage points, to 32% and 34% of residential premises, respectively.

Our report outlines how there has been progress in delivering this connectivity across Scotland through a range of commercially funded rollout and initiatives led by the Scottish and UK Governments.

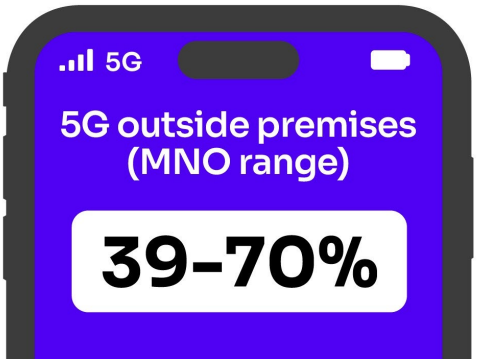


Superfast broadband – defined as a service with download speeds of at least 30 Mbit/s – is available to around 95% (2.6 million) of residential premises in Scotland, an increase of one percentage point (47,000) compared to last year. We estimate that around 73% of premises able to take superfast broadband services do so, representing a two percentage points increase compared to 2022.

Wireless and satellite technologies are being increasingly used

Fixed Wireless Access (FWA) – both from mobile network operators (MNOs) and wireless ISPs – and satellite technologies are being used to provide connectivity, particularly in parts of rural Scotland which are harder to reach through more traditional technologies. This includes the use of Low Earth Orbit (LEO) satellites to deliver low latency services, which can support better performance for applications such as two-way video calling and gaming. We have refreshed our space spectrum strategy to optimise opportunities in helping connect these traditionally hard-to-reach premises.

5G mobile connectivity and 4G geographic coverage are expanding



Deployment of 5G across Scotland has continued to grow at pace in 2023. In Scotland, 5G coverage outside of premises from at least one MNO has reached 88% at High Confidence level and 80% at

Very High Confidence level. Individual MNO coverage in Scotland ranges from 39-70% at our High Confidence level, with a range of 25-60% at our Very High Confidence level.

Scotland is a key centre for taking advantage of opportunities from 5G connectivity, both through utilisation of private standalone 5G networks and to support innovation across local government, industry and academia.

4G still continues to underpin the mobile experience in Scotland, with a small but notable increase in 4G geographic coverage of Scotland's landmass. Eighty-four per cent of Scotland's landmass has coverage from at least one MNO – up from 83% in 2022 – and 48% have coverage from all four operators (up from 46% in 2022). This increase has been driven by enhancements to mobile connectivity in rural areas, with geographic coverage from all four MNOs up by two percentage points to 47%. This was aided by both industry and UK Government investment in the Shared Rural Network (SRN) and Scottish Government 4G Infill (S4GI) programmes.

For a small number of premises in Scotland, accessing decent broadband remains a challenge

The number of premises not able to access decent broadband (defined as providing 10 Mbit/s download and 1 Mbit/s upload speeds) has decreased. We estimate that 73,000 (3%) of residential and commercial premises in Scotland cannot access decent broadband – a decrease of around 14,000 since last year.

Of those premises that do not have decent broadband via fixed lines, some will be able to access decent broadband via FWA through MNOs or Wireless ISPs (WISPs). Accounting for coverage from FWA networks, we estimate that around 18,000 (0.6%) premises in Scotland are currently without a decent broadband service and therefore may be eligible for the broadband Universal Service Obligation. This is down from 21,000 last year.

The switch-off of legacy technologies in Scotland is underway

Advancements in technology and adoption of newer technology means that legacy systems are being replaced by modern alternatives.

The legacy public switched telephone network (PSTN) is scheduled to be switched off by the end of 2025, with customers increasingly migrating to managed voice services delivered over broadband. This process will be getting underway in Scotland in 2024.

Meanwhile, all MNOs have committed to switching off their 2G and 3G networks by 2033 at the latest, which will result in improved network efficiency and enable more spectrum to be used for 4G and 5G services. Vodafone commenced its switch-off of 3G services in Glasgow in July 2023.

In both cases, Ofcom has issued guidance to operators, and advice to consumers, in order that customers – particularly those in vulnerable circumstances – do not face undue disruption or harm from the changes.[1] Further information on both of these processes can be found below and in our Connected Nations 2023 report for the UK as a whole.

Scotland's changing climate is adding to resilience challenges for telecoms networks

As with all sectors, climate change has implications for the telecoms sector. For the first time, our Connected Nations report for the UK as a whole contains a section examining the opportunities and challenges which arise.

According to the Met Office, the effects of climate change on local weather will likely result in more frequent and intense weather extremes. Following the named storms of 2021/22 – discussed in last year's reports – work has continued in partnership with telecoms providers, and particularly MNOs, to understand their winter preparedness. The aim was to recognise what they can do to resist, absorb, and recover through the winter, while working to understand what adaptions and transformations will be required moving forwards.

This year, in comparison to last, has seen a lower incidence of outages in Scotland related to extreme weather. However, in February 2023, Storm Otto had a pronounced effect across Scotland and Northern England, with the most significant impact felt in the Aberdeenshire area.[2] Debris from the storm had some direct impact on telecoms networks, though the main cause of telecoms outages was the loss of the key input of power. More recent events such as Storms Babet, Ciarán and Debi had relatively limited impact on the UK mainland. Openreach has told us that during Storm Babet it deployed the five-step process which it developed following Storm Arwen to reduce recovery times.

Further information on this, and on our approach to monitoring industry compliance with the Telecoms Security Act, can be found in our Connected Nations 2023 report for the UK as a whole.

[1] Ofcom, Moving landline phones to digital technology: what you need to know ; Ofcom, 3G and 2G switch-off: Our expectations of mobile providers

[2] BBC, Power cuts and schools closed as Storm Otto hits - BBC News, 17 February 2023.

2. Fixed broadband and voice services

Introduction

High-speed networks are continuing to expand across Scotland, bringing high-quality, secure voice and broadband services to homes and businesses. In this section, we provide an update on the rollout of these networks over the last year, the increasing use of innovative fixed wireless and satellite technology (including in rural areas), as well as outlining the remaining numbers of premises that still do not have access to decent broadband.

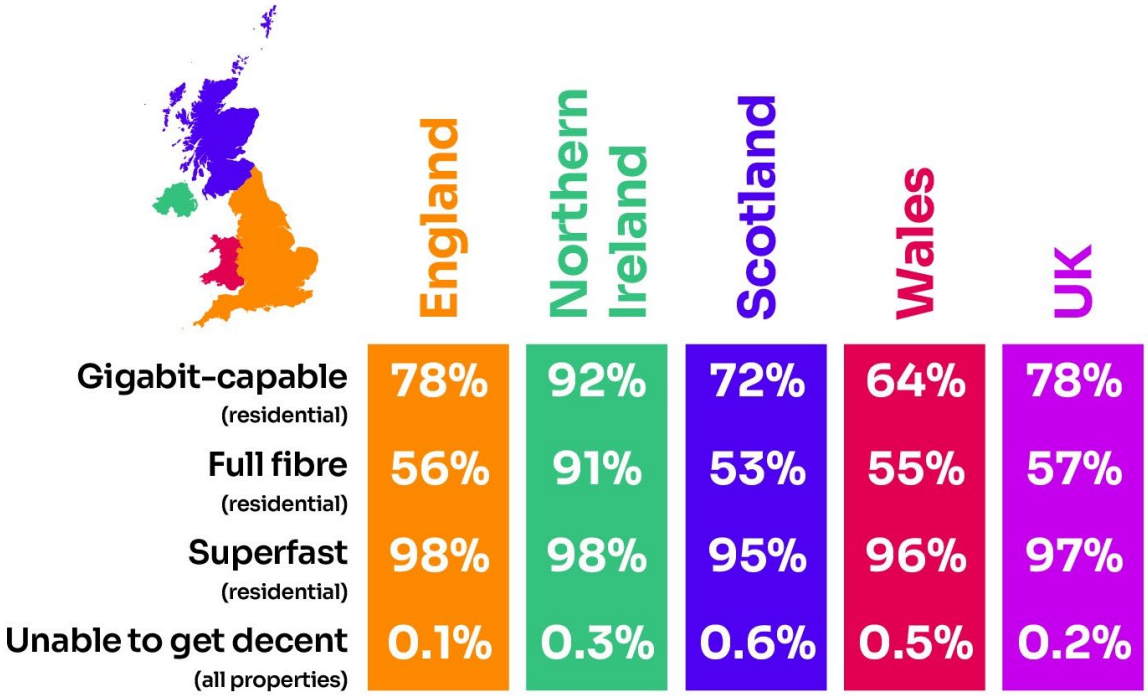
This section also covers the take-up of fixed broadband services and the migration away from traditional voice services ahead of the scheduled switch-off of the public switched telephone network (PSTN) by the end of 2025. Further information on broadband networks can be found in our Connected Nations 2023 report for the UK as a whole.

Key highlights

- **Rollout of full-fibre and gigabit-capable coverage continues to expand across Scotland.** Full fibre is now available to 1.4 million (53%) of residential premises in Scotland, an increase of 13 percentage points from 2022. Gigabit-capable broadband is also now available at 1.9 million (72%) of residential premises, an increase of eight percentage points.
- **Take-up of services on full-fibre networks is also rising in Scotland.** While take-up lags growth in coverage, we estimate that, where available, the take-up of services on full-fibre networks in Scotland is around 28%, up five percentage points from 2022.
- **Superfast broadband coverage remains widespread.** Speeds of 30 Mbit/s are available to 95% (2.6 million) of residential premises in Scotland, an increase of one percentage point (47,000) compared to last year.
- **Access to decent broadband has once again increased.** Factoring in coverage from fixed and fixed wireless networks, there are around 18,000 (0.6%) premises in Scotland that are still without a decent broadband connection, down from 21,000 in 2022.
- **Average monthly data use over fixed networks has grown** to 542 GB per connection in Scotland, compared to 482 GB last year. This is above the UK average of 535 GB per connection.

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

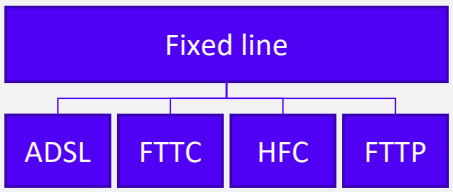
Figure 2.1: Summary of broadband coverage at a fixed location across the UK and nations



Source: Ofcom analysis of provider data (September 2023).

Background to fixed line broadband technologies

Fixed connections provide broadband access at specific locations, such as residential or business premises. Fixed line broadband technologies can be broken down into different technology types.



There are four primary types of **fixed line connections** for fixed broadband access:

- **ADSL**[3] – Copper (telephone) cables are used to connect the exchange to each premises. Maximum download speed is up to 24 Mbit/s. Actual speeds delivered diminish with length of cable to the premises.
- **Fibre to the cabinet (FTTC)** – FTTC involves fibre to the street cabinet, with copper cables connecting the cabinet to the premises. FTTC uses 'very high-speed digital subscriber line' (VDSL)[4] technology. As with ADSL, speeds diminish with length of cable, but as cabinets are generally located close to premises, maximum download speed is normally up to 80 Mbit/s.
- **Hybrid fibre coaxial (HFC) cable** – With HFC, there is fibre to a street cabinet and coaxial cable from the cabinet to the premises. Because there is decreased signal loss compared to copper, HFC can deliver higher speeds over longer distances. Cable broadband in the UK is provided by Virgin Media O2, and its cable network can deliver gigabit speeds.[5]
- **Full fibre or 'fibre to the premises' (FTTP)** – The connection from the exchange to the premises is provided entirely over fibre. Generally, distance to the premises does not affect the speed delivered. Full fibre can deliver gigabit speeds.[6]

We categorise fixed broadband connections based on the download speed they can provide:

- **Decent** – can provide at least 10 Mbit/s download and 1 Mbit/s upload speeds.[7] It can be delivered by ADSL, FTTC, HFC cable or full fibre. Decent broadband provides sufficient speeds for making a high-definition video call. Over minimum decent broadband, downloading a one-hour HD TV episode (1 GB) would take almost 15 minutes.
- **Superfast** – can provide download speeds of at least 30 Mbit/s and can be delivered by FTTC, HFC cable or full fibre. Superfast broadband provides sufficient speed for one person streaming 4K/UHD video. Downloading a one-hour HD TV episode would take under four and a half minutes and several devices can work simultaneously.
- **Gigabit-capable** – are able to offer download speeds of 1 Gbit/s and above. It can be delivered by HFC cable or full fibre. With gigabit-capable broadband, it is feasible to download a full 4K film (100 GB) in under 15 mins, or a one-hour HD TV episode in eight seconds.

[3] ADSL: Asymmetric Digital Subscriber Line.
[4] Another technology known as G.fast is also sometimes deployed at, or near, a limited number of cabinets offering higher speeds than VDSL.
[5] Cable broadband access networks are shared between a large number (usually hundreds) of premises.
[6] Most full-fibre access networks utilise Passive Optical Network (PON) approaches where capacity in the downstream and upstream direction is shared between around 30 to 60 users.
[7] The UK Government defines the characteristics of Decent broadband. This is the level of connection currently deemed necessary for consumers to participate in a digital society.

Coverage from full-fibre and gigabit-capable networks has continued to increase across Scotland

Full-fibre broadband is now available to 53% of Scotland's residential premises

There has been continued investment in full-fibre broadband in Scotland which has resulted in notable improvements in coverage over the past year.

Our data shows that 53% (1.4 million) of residential premises in Scotland are now served by a full-fibre connection, an increase of 13 percentage points from 2022. Gigabit-capable broadband coverage has also increased to be available at 72% (1.9 million) of residential premises, up eight percentage points from last year. This is broadly in line with the increases seen across the UK.

Scotland continues to have the lowest coverage of the UK nations, but availability is increasing

Table 2.1 highlights the availability of full-fibre and gigabit-capable networks for residential premises across the four nations of the UK. Coverage in Scotland remains below the UK average. Northern Ireland continues to have the most widespread availability of full-fibre networks across the UK.

Table 2.1: Residential gigabit-capable and full-fibre coverage by nation

Nation	Gigabit capable	Full fibre
Scotland	72% (1.9m)	53% (1.4m)
England	78% (19.6m)	56% (14.1m)
Northern Ireland	92% (0.8m)	91% (0.7m)
Wales	64% (0.9m)	55% (0.8m)
UK	**78% (23.2m)**	**57% (17.1m)**

Source: Ofcom analysis of provider data (September 2023).

Table 2.2 shows the continued differences in coverage of full-fibre and gigabit-capable networks between urban and rural areas of Scotland.

Full-fibre networks are available at 32% of residential premises in rural Scotland, up eight percentage points from last year. Full-fibre coverage in UK rural areas is still higher at 43%. Similarly, gigabit-capable networks are available at 34% of premises in rural Scotland, up eight percentage points from last year. Gigabit-capable coverage in UK rural areas is also higher at 45%.

Table 2.2: Residential gigabit-capable and full-fibre coverage in Scotland by rurality

	Gigabit capable	Full fibre
Urban	80%	58%
Rural	34%	32%

	Gigabit capable	Full fibre
Total	**72%**	**53%**

Source: Ofcom analysis of provider data (September 2023).

There is substantial private investment in full-fibre rollout

Increases in availability are primarily driven by the continued investment in full-fibre networks by the large operators (Openreach, Virgin Media O2 and CityFibre) and many smaller operators. There is further investment from the UK Government's Project Gigabit and the Scottish Government's R100 Programme, which are discussed in more detail below.

In October 2023, Openreach's full-fibre network reached over one million premises in Scotland (up from approximately 800,000 in March 2023).[8] Virgin Media O2's full-fibre rollout is continuing, including the completion of investment in Stirling, connecting 6,900 homes.[9] CityFibre's network also continues to grow, and they expect to complete their Glasgow rollout by the end of 2025, investing around c.£270m.[10]

Smaller, more localised operators are also making progress, including GoFibre's ambition to connect 8,000 premises around Hawick in the Scottish Borders.[11] Lothian and Highland Broadband have announced that they are on track to reach 100,000 rural premises by the end of 2024,[12] including network development in the County of Ross.[13]

However, some smaller operators have experienced challenges from factors including the recent period of high inflation, and labour and supply chain issues. Broadway Partners, a fibre broadband operator building a network in Scotland and Wales, announced that it had been put into administration in June 2023, and has since been acquired by Voneus, a rural broadband operator.[14]

Government initiatives are also supporting full-fibre rollout

The Full Fibre Charter for Scotland was launched in 2020 and consists of a series of pledges that both the Scottish Government and industry have signed up to with the aim to extend full-fibre broadband across Scotland. There are currently nine industry signatories to the Charter. The most recent Ministerial Forum took place in September 2023, with Ofcom attending in an observer capacity.[15]

In addition to the Charter, the Scottish Government's Reaching 100% (R100) programme – with over £600m of funding – is an initiative to ensure every home and business in Scotland can access superfast broadband, defined as of at least 30Mbit/s.[16] R100 is being rolled out through ongoing commercial coverage, contracted builds and the R100 Scottish Broadband Voucher Scheme (R100 SBVS). As of 30 September 2023, over 42,000 connections have been delivered through the R100

[8] Openreach, Openreach names Scotland's ultrafast broadband hotspots, 10 October 2023.
[9] Virgin Media O2, Virgin Media gigabit broadband now available to 6,900 homes in Stirling, 14 September 2023.
[10] CityFibre, CityFibre rollout brings full fibre broadband to Glasgow residents, 2 October 2023.
[11] GoFibre, GoFibre and Emtelle partner to transform Hawick's digital connectivity, 17 August 2023.
[12] ISPreview, Lothian Broadband Boost Funding for Highlands Full Fibre Rollout, 4 April 2023.
[13] ISPreview, AltNet ISP Highland Broadband Expands Rural FTTP Rollout Plan, 17 October 2023.
[14] Macquarie, New funding and consolidation positions Voneus as UK rural broadband market leader, 25 September 2023.
[15] As of October 2023, the Full Fibre Charter industry signatories are: Openreach, CityFibre, Axione UK, Cloudnet, GoFibre, Hyperoptic, Lothian Broadband Networks Limited, Virgin Media O2, Gigaloch.
[16] Scottish Government, Reaching 100%: superfast broadband for all, 12 August 2019.

Programme, with over 3,500 of these connections delivered through the R100 SBVS.[17] The Scottish Government reaffirmed support for R100 in their Programme for Government 2023/24.[18]

The UK Government's Project Gigabit is a £5bn programme to enable hard-to-reach communities across the UK to access gigabit-capable broadband, with a focus on premises that are not commercially viable to connect. Similar to R100, the programme is largely being carried out by contracted partners alongside a voucher scheme, the Gigabit Broadband Voucher Scheme (GBVS). As of September 2023, 3,900 GBVS vouchers have been delivered in Scotland.[19] The programme also includes a £110m investment into GigaHubs that will connect 7,000 rural public sector buildings.[20]

Case Study: Jura – a connected island

Connectivity has undergone a sea change on the Hebridean island of Jura during 2023. All the pieces in a complex jigsaw are now in place, transforming how people work, socialise and visit the island.

A joined-up approach between the Scottish Government, UK Government and their build partners means islanders and thousands of annual visitors now have access to 4G mobile services and fixed full-fibre broadband.

The story started back in 2014, when subsea cables were laid to the west coast islands of Jura and Islay as part of the Digital Scotland Superfast Broadband programme, initially providing hybrid superfast services to some properties.

Those subsea cables are powering new fibre links to 4G masts at Craighouse and Ardlussa, which went live earlier this year as part of the Scottish Government's S4GI programme in partnership with WHP Telecoms, with BT/EE currently providing 4G services to the vast majority of premises on Jura.

Openreach engineers are now building a full-fibre network across the island using those same fibre links, with the two Governments each committing voucher funding alongside investment from the digital network business.

Around 100 properties can upgrade to gigabit services today, with 200 homes and businesses to benefit in total.

The enhanced connectivity means that everyone on Jura can take full advantage of online opportunities while enjoying life, work and holidays on the island.

Take-up of services on full-fibre networks is rising

It is important to understand whether consumers are benefiting from higher speed broadband services when they are available. We estimate that, where available, the take-up of services on full-fibre networks in Scotland is around 28%, up five percentage points from 2022. We expect full-fibre take-up to rise further in the years ahead because, while networks are being deployed at pace, take-up tends to lag behind coverage.

Meanwhile, we estimate that, for those premises that are able to take superfast broadband services (95% of all premises in Scotland), around 73% of them do so. This represents a two percentage point increase compared to 2022.

[17] Digital Scotland, R100 Facts, October 2023.
[18] Scottish Government, Programme for Government 2023 to 2024, 5 September 2023.
[19] Building Digital UK, Project Gigabit progress update, 20 September 2023.
[20] Building Digital UK, GigaHubs: key information, 5 November 2021.

Table 2.3: Take-up of broadband service by technology (as a percentage of all premises where those services are available)

Nation	Superfast and above	Full fibre
Scotland	73%	28%
England	75%	27%
Northern Ireland	74%	39%
Wales	73%	31%
UK	**75%**	**28%**

Source: Ofcom analysis of provider data (September 2023).

Coverage of superfast broadband remains high

Superfast broadband – defined as a service with download speeds of at least 30 Mbit/s – is available to around 95% (2.6 million) of residential premises in Scotland, an increase of one percentage point (47,000) compared to last year. Operators are now largely focused on deploying full-fibre networks to areas that already have superfast broadband, so increases in superfast coverage and take-up are gradually plateauing. As such, we expect future increases to continue to be modest.

Table 2.4: Residential superfast coverage

Nation	Total	Urban	Rural
Scotland	95%	99%	79%
England	98%	99%	89%
Northern Ireland	98%	99%+	93%
Wales	96%	99%	86%
UK	**97%**	**99%**	**88%**

Source: Ofcom analysis of operator data (September 2023).

As with other technologies, there are significant differences in the availability of superfast broadband in urban and rural areas. This is reflected in the varying levels of superfast coverage across Scotland's 32 local authority areas.

Some of the lowest levels of superfast broadband coverage in Scotland are found in the Orkney Islands, Shetland Islands and Comhairle nan Eilean Siar, while the highest levels of residential superfast broadband coverage tend to be found in more densely populated urban local authority areas.

Table 2.5: Highest and lowest levels of residential superfast broadband coverage by selected Scottish local authority area

Rank	Scottish Local Authority	% of premises with speeds ≥ 30 Mbit/s
1	West Dunbartonshire Council	99%
2	Dundee City Council	99%
3	North Lanarkshire Council	99%
30	Comhairle nan Eilean Siar	77%
31	Shetland Islands Council	75%
32	Orkney Islands Council	69%

Source: Ofcom analysis of operator data (September 2023).

Coverage of superfast in rural Scotland has increased in recent years, but it remains considerably lower than in urban Scotland and below the UK average for rural premises. This could be owing to higher connection costs in rural areas. In some cases, rural addresses may be eligible to combine Scottish and UK Government funding through the SBVS and GBVS schemes, respectively.[21] Detailed figures for each Scottish local authority is available in our interactive report.

Broadband is increasingly available over wireless networks

Fixed wireless access (FWA) on mobile networks

Fixed wireless access services from the MNOs are provided primarily over 5G and advanced 4G (LTE-A). Three of the UK's four MNOs currently offer FWA services in the UK (Virgin Media O2 is the exception).

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. There has been an increase of 0.1 percentage points from last year.[22]

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

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

[21] HM Government, Scotland Gigabit Vouchers.
[22] Our reporting here is based on data from EE and Three – see the annex for further information on the methodology.

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.

Some operators have experienced challenges. WeLink Communications UK provided wireless broadband to areas in Central Edinburgh with unique connectivity challenges (including its UNESCO world-heritage status) that made deployment of fixed infrastructure difficult. However, WeLink withdrew from the UK market in July 2023.[23]

We have collected WISP data this year from 21 providers. Based on estimates from these providers, around 2% of residential premises in Scotland have coverage from a WISP network, below the UK average of 7%. See our Connected Nations 2023 report for the UK as a whole for more information on WISPs.

Table 2.6: Coverage of MNO and WISP FWA networks with at least decent broadband (residential)

Nation	MNO FWA	WISP FWA
Scotland	95%	2%
England	96%	7%
Northern Ireland	85%	3%
Wales	93%	31%
UK	**95%**	**7%**

Source: Ofcom analysis of provider data (September 2023).

Satellite services

Satellite broadband services have been available in the UK for some time. The retail market is at an early stage of development; therefore, take-up of these services has remained low compared to traditional broadband services. The technology being used continues to evolve rapidly and can help to serve parts of the UK which are harder to reach through more traditional technologies, especially in rural areas of Scotland. For instance, Papa Stour, an island to the west of the Shetland mainland, was connected to a Low Earth Orbit (LEO) satellite earlier this year to address slow broadband speeds.[24]

Geostationary (GSO) satellites, which orbit the earth at about 36,000 km, have traditionally been the primary way of delivering satellite communication services. LEO satellites operate at lower altitudes of 200 - 2,000 km, which can allow them to deliver lower latency services, which can support better performance for applications such as two-way video calling and gaming.

This year we focused on collecting data from LEO satellite services. Starlink currently offers the only direct to consumer LEO service in the UK through its retail 'plug and point to the sky' product. This delivers nationwide broadband coverage, including in harder-to-reach areas. The data provided to us by Starlink indicates that around 42,000 connections (up from 13,000 last year) in the UK currently make use of LEO satellites for their broadband service.

[23] ISP Review, 1Gbps Edinburgh Wireless ISP WeLink UK to Cease Operations, 15 July 2023.
[24] BBC News, Remote island to get broadband link from space, 12 June 2023.

Meanwhile, we refreshed our space spectrum strategy in 2022 to optimise opportunities and improve use of space to better support businesses and households, including to connect hard-to-reach premises.

Access to decent broadband has increased

The number of premises not able to access decent broadband has decreased. We estimate that 3% of premises, residential and commercial, in Scotland cannot access decent broadband, which is defined as connections which provide at least 10 Mbit/s download speed and 1 Mbit/s upload speed, from a fixed line connection. This is around 73,000 premises, a decrease of around 14,000 since last year.

Of those premises that do not have decent broadband via fixed lines, some will be able to access decent broadband via fixed wireless access through MNOs or WISPs. Considering the coverage available from FWA, we estimate that this leaves around 0.6% or 18,000 premises in Scotland without a decent broadband service from either fixed line or fixed wireless networks.

Table 2.7: Approximate remaining premises without access to a decent broadband service from either a fixed or wireless network, 2022 and 2023[25]

Nation	2022	2023
England	40,000	33,000
Northern Ireland	9,000	3,000
Scotland	21,000	18,000
Wales	10,000	8,000
UK	**80,000**	**61,000**

Source: Ofcom analysis of provider data (September 2023).

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).[26]

Where an affordable service[27] 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). In calculating whether the costs are below or above £3,400, the

[25] All figures in the table have been rounded to the nearest 1,000.
[26] In particular these are: a connection 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.
[27] 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.

universal service provider must take into account where costs could be shared by several USO eligible premises.

BT is the universal service provider 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.[28] As of September 2023, BT had received 111 orders in Scotland (compared with almost 2,000 orders across the UK).[29]

For more information on the future of the broadband USO, see our Connected Nations 2023 report for the UK as a whole.

Planned network deployment

We published our second forward-looking report about planned network deployments of full fibre in October 2023. This report is based on the stated deployment plans of network operators as of May 2023 up to three years in advance, and it includes plans that are privately funded as well as those that are supported through public funds or intervention. It does not take account of any aspirations or plans by public authorities, whether national or local, to roll out networks in their geographical areas.

We are estimating that by May 2026, compared to May 2023 (in brackets), in Scotland:

- 93% of urban premises will have access to gigabit-capable broadband (up from 78%)
- 51% of rural premises will have access to gigabit-capable broadband (up from 30%)
- there will be an additional 459 masts deployed capable of supporting FWA in Scotland (up from the current number of 2,300 masts)
- there will be 13 fixed operators in Scotland (up from 12)
- 68% of premises will be covered by two or more operators (up from 27%)
- 5,000 premises will not have decent broadband from a fixed line or FWA connection

For the methodology and further information, see the Planned Network Deployments 2023 report.

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 542 GB per connection, up from 482 GB last year. The UK average is 535 GB.

The retirement of the public switched telephone networks is progressing

Landline phone calls have traditionally been delivered over the old telephone network – this is known as the public switched telephone network (PSTN). BT and Openreach aim to retire the PSTN

[28] BT, USO Reports. KCOM, USO Reports. To date KCOM has not received any eligible USO orders.
[29] While conducting final accuracy checks for the purpose of our report, BT informed us that the implementation of a new data model might have impacted on their reporting of total USO orders and premises passed by resulting build. We are following this up with BT and will publish corrected data if necessary.

by December 2025 and other providers plan to follow a broadly similar timescale. BT announced that Scotland's switch-off will commence in summer 2024.[30]

This means that in future, landline calls will be delivered over digital technology called Voice over Internet Protocol (VoIP), which uses a broadband connection.

We are continuing to monitor the migration closely and engage with providers to ensure that disruption is minimised, and consumers are protected from harm. We published advice for consumers in January 2023 on what the switch-off means for landline and our expectations of providers. For more information, see sections 2 and 4 of our Connected Nations 2023 report for the UK as a whole.

[30] BT, BT announces regional rollout schedule for Digital Voice, 26 September 2023.

3. Mobile, data and voice

Introduction

In an increasingly interconnected world, mobile services continue to play an integral role to our daily lives – whether it's enabling seamless communication on the go, providing internet access, or powering wireless connectivity for devices like smart meters.

In this section, we provide an update on the progress mobile network operators (MNOs) are making with their 5G rollout plans. We also report on the availability of 4G mobile coverage across Scotland – which continues to underpin the mobile experience for consumers – both outside and inside premises, across its landmass and along major roads. The section also outlines efforts to enhance geographic mobile coverage in rural Scotland, and the latest developments in relation to the planned switch-off of 3G and 2G mobile services by MNOs.

We recommend that this section is read in conjunction with the Mobile, Data and Voice section in our Connected Nations 2023 report for the UK as a whole.

Key highlights

- **The availability of 5G services continues to grow at pace**. The level of coverage provided outside of premises from individual MNOs in Scotland now stands at 39-70% (based on our High Confidence level) – up from 29-51% in 2022. Scotland has the second highest 5G coverage levels of the four UK nations.
- **4G continues to underpin the mobile experience in Scotland**. There has been a small but notable increase in 4G geographic coverage of Scotland's landmass, with 84% having coverage from at least one MNO (up from 83% in 2022) and 48% with coverage from all four operators (up from 46% in 2022).
- **Programmes to enhance mobile connectivity in rural Scotland are making progress**. The Shared Rural Network is starting to extend coverage to more rural communities across the country, while the Scottish Government 4G Infill Programme is nearing completion, with 54 of the 55 mast sites activated and providing enhanced mobile connectivity.
- **There continues to be a high and improving level of 4G outdoor premises coverage in Scotland**. Individual MNO coverage ranges between 98-99+%, and from 90-98% for rural areas.
- **The switch-off of 3G networks in Scotland is underway.** Vodafone commenced its switch-off of 3G services in Glasgow in July 2023. 3G will be switched-off by all MNOs across Scotland in the coming years. This will result in improved network efficiency and enable more spectrum to be used for 4G and 5G services.

Summary of mobile coverage

Figure 3.1: Overview of voice and data coverage across the UK[31]

	England	Northern Ireland	Scotland	Wales	UK
5G outside premises (MNO range)	51-81%	26-62%	39-70%	11-69%	48-78%
4G outside premises (MNO range)	99-99%+	98-99%	98-99%+	96-99%	99-99%+
4G geographic (MNO range)	92-95%	88-92%	59-76%	73-85%	80-87%
4G total not spots	2%	3%	16%	9%	7%
Voice & text total not spots	1%	1%	10%	4%	4%

Source: Ofcom analysis of operator data (September 2023)

Background to mobile technologies

Mobile services described in this section include:

- **5G non-standalone (5G NSA)** involves deploying 5G radio equipment alongside existing 4G. This delivers an increase in capacity and allows MNOs to support demand as it continues to grow, without the congestion and degradation of service quality that would otherwise result.
- **5G standalone (5G SA)** involves the deployment of a new 5G core network. This could enable new use cases such as Augmented Reality (AR) /Virtual Reality (VR) and robotics, supported by the broader capabilities of 5G including ultra-low latency, advanced virtual network (slicing) functions, and potentially improved coverage.[32]
- **4G, 3G and 2G** are other generations of mobile standards with specified features. The introduction of 3G supported the use of data applications such as web browsing, while 4G has supported more data intensive activities such as streaming and gaming.

[31] Note that the MNO range for 5G outside premises presented here is based on our 'High Confidence' measure.

[32] Augmented Reality (AR): an enhanced version of the real physical world that is achieved through the use of digital visual elements, sound, or other sensory stimuli delivered via technology. It overlays digital content, which could include a combination of sound, video, text, and graphics, onto a real-world environment using a headset or a device with a camera, such as a mobile phone.
Virtual Reality (VR): use of a headset to access a virtual experience, which could be digitally created or a captured 360° photo or video.

When reporting on mobile 5G availability predictions, we refer to confidence ranges[33] reflecting the likelihood of on the ground coverage for consumers as:

- **High Confidence** associated with a signal strength (-110 dBm), to equate to at least an 80% confidence level.
- **Very High Confidence** associated with a higher signal strength (-100 dBm), to equate to a circa 95% confidence level.

5G coverage is growing across Scotland

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 (including across Scotland) to ensure the predictions provided are suitable for national and regional reporting as earlier mentioned in this section. Our approach to reporting on 5G availability is set across a confidence range covering High Confidence and Very High Confidence, which reflects the likelihood of on the ground coverage for consumers in a particular location.[34] Our approach to reporting on 5G coverage is set out in more detail in our Connected Nations 2023 report for the UK as a whole.

5G is within reach of a growing number of consumers, with significant increases in coverage observed across the UK.

Outdoor premises coverage of 5G

Deployment of 5G across Scotland and the UK has continued to grow at pace in 2023. On a UK-wide basis, coverage outside premises from at least one MNO now stands at 93% (High Confidence) and 85% (Very High Confidence), up from 78% and 67% respectively in 2022.In Scotland, 5G coverage outside of premises from at least one MNO is now at 88% for the High Confidence measure and 80% for Very High Confidence measure. This continues the strong rate of increase in coverage seen in the Connected Nations 2022 report.

Table 3.1 below, shows the range of outside premises 5G coverage across individual MNOs in Scotland, which, based on our High Confidence level, is 39% to 70% - the second highest of the four UK nations. Across UK nations, 5G coverage outside of premises ranges across individual MNOs is as follows: 51-81% for England; 11-69% for Wales; and 26-62% for Northern Ireland (all based on our High Confidence level).

Table 3.1: Range of 5G coverage outside of premises in Scotland across individual MNOs, by year

	2022	2023
High Confidence	29-51%	39-70%
Very High Confidence	20-41%	25-60%

Source: Ofcom analysis of operator data (September 2022 and September 2023).

[33] Signal strengths refer to control channel signals – for further detail see our Methodology annex.

[34] All the 5G mobile coverage reported here is currently provided on a non-standalone (NSA) basis – although trials of 5G mobile standalone (SA) mobile are underway. 5G NSA relies on a 4G core network and uses 4G for signalling and network control functions. 5G SA operates independently of the existing 4G layers.

Landmass coverage for 5G across individual MNOs is steadily increasing. However, it still remains relatively low overall, ranging from 11% to 38% of the landmass at High Confidence, and 6% to 26% at the Very High Confidence level (up from 6% to 16% and 3% to 12% respectively last year).

Additional 5G deployments have underpinned these increases in coverage, with over 18,500 5G deployments[35] now in place across the UK, up from the 12,000 reported in 2022. Of these, 9% are located in Scotland, 85% in England, 4% in Wales and 2% in Northern Ireland, broadly in line with previous trends and reflecting national distribution of all mobile traffic across the UK. Around 34% of sites in urban areas across the UK now have 5G deployed on them, compared with around 20% and 10% in suburban and rural areas respectively.

It is important to acknowledge that there is a diversity of deployment strategies from MNOs, leading to potentially different consumer experiences within this coverage footprint. These differences in deployment strategies are reflected in the coverage ranges outlined above, while Table 3.2 below highlights the coverage levels of individual MNOs within those ranges for premises in Scotland.

Table 3.2: 5G outdoor premises coverage in Scotland by mobile operator

	Very High Confidence	High Confidence
BT/EE	60%	69%
Three	43%	70%
Virgin Media O2	38%	39%
Vodafone	25%	40%

Source: Ofcom analysis of operator predictions (September 2023).

Investment and innovation in 5G in Scotland

Aside from commercial investment and rollout by MNOs in 5G, there continues to be significant interest from governments and wider industry stakeholders in broader 5G use cases, including in Scotland. The Scotland 5G Centre (S5GC) is the national centre for accelerating the deployment of 5G connectivity.[36] Funded by the Scottish Government, the S5GC provides services including facilities and advice to a range of industries, telecommunications providers and academic institutions on 5G innovation.[37]

The S5GC Connect Programme has delivered a national network of 5G Innovation Hubs – currently in seven locations – 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 a business enabler. This programme includes the recently launched 'pop-up' hub at #hellodigital, a digital demonstration centre, hosted by the Highlands and Islands Enterprise (HIE) at An Lòchran, Inverness.[38]

S5GC has created a 5G New Thinking Rural Connectivity Toolkit as a practical guide for rural and poorly connected communities which are considering building and operating their own 5G networks.

[35] It should be noted that these deployments do not necessarily equate to a total of individual sites across all MNOs. For example, two MNOs may be offering coverage from the same site.
[36] Scotland 5G Centre
[37] UK Government, Wireless Infrastructure Strategy: Chapter 6 – Driving adoption in key economic sectors, 11 April 2023.
[38] FutureScot, 'Pop-up' hub showcases 5G technology in the Highlands, June 2023.

The S5GC has also published reports on the application of 5G technologies in economic sectors such as whisky distilleries, both in the distilling process and support of key business functions like warehousing and logistics, potentially saving Scotland's distilleries £30m over five years.[39]

In November 2023, the UK Government announced that two Scottish local authority areas are amongst ten areas across the UK which will share a £36m fund to accelerate 5G-enable innovation. North Ayrshire Council has been awarded £3.8m for new Regional Wireless Strategic innovation hubs, while Glasgow City Region will receive £3.2m to deliver a health and social care focused project that will use advanced wireless technology, such as the Internet of Things (IoT) and smart city applications, to improve public services.[40]

5G and private networks

With their ability to provide tailored connectivity solutions and meet specific quality of service requirements, private networks are playing an increasing role in the mobile market, supporting the digital transformation of many sectors of the economy, spanning from the enhancement of operations in ports and airports to the optimisation of processes in factories and smart agriculture initiatives. Further information on this can be found in our Connected Nations 2023 report for the UK as a whole.

We have issued over 1,500 shared access licences since new rules were introduced in 2019, up from the 900 we reported in 2022. We continue to estimate that around half of this increased number can be considered as supporting private network type solutions. Around 88% of shared access licences are found in England, 6% in Wales, 5% in Scotland and 1% in Northern Ireland.

Case study: Neutral Wireless – King Charles III Coronation

Private standalone 5G networks can support coverage of events of global and historic significance. Neutral Wireless – a Glasgow-founded company and SME spinout from the University of Strathclyde working in the Glasgow City Innovation District in the Technology and Innovation Zone – worked with the BBC and deployed the world's largest single-use private 5G standalone (SA) network to support the news coverage of His Majesty King Charles III's Coronation in May 2023. Utilising Ofcom's Shared Access Licence scheme for radio spectrum in the n77 band, Neutral Wireless worked with BBC News and BBC R&D engineers and the University of Strathclyde StrathSDR team to design and build a 5G standalone network down the length of The Mall. The private network provided wireless connectivity to 16 international broadcasters covering the Coronation for millions of viewers globally – avoiding any negative impact on broadcasts owing to increased congestion on public cellular and WiFi networks from crowds attending the event.

[39] S5GC Industry Reports, 5G Whisky Distillery Report, October 2023.

[40] Department for Science, Innovation and Technology, Public services, transport and creative industries sectors set for £36 million 5G connectivity boost, 16 November 2023.

Geographic coverage across Scotland is increasing

Geographic 4G coverage

Overall, 4G geographic coverage across the UK is stable compared with 2022.[41] Nonetheless, as shown in Table 3.3 below, there remain significant differences in coverage across the UK's nations. Individual operator coverage across Scotland's landmass ranges from 59% to 76%, an increase of one percentage point at the top of the range compared with 2022.

Table 3.3: 4G geographic coverage ranges by UK nation

Nation	Range of 4G geographic coverage
Scotland	59% to 76%
England	92% to 95%
Northern Ireland	88% to 92%
Wales	73% to 85%
UK	**80% to 87%**

Source: Ofcom analysis of MNO predictions (September 2023).

Most MNOs have made small but notable improvements in their geographic coverage this year. BT/EE continues to have the highest levels of geographic coverage across Scotland's landmass at 76% (up one percentage point from last year) while geographic coverage for both Vodafone and Three has increased by two percentage points.

Table 3.4: 4G geographic coverage in Scotland by MNO

	2022	2023
BT/EE	75%	76%
Three	57%	59%
Virgin Media O2	66%	66%
Vodafone	67%	69%

Source: Ofcom analysis of MNO predictions (September 2023).

Table 3.5 provides information on the differences in 4G geographic coverage from all operators across the UK. 4G geographic coverage across Scotland from all four MNOs has increased by two percentage points (to 48% from 46%) which is the most significant improvement across the UK. However, Scotland still has the lowest 4G geographic coverage across all four MNOs of the UK nations.

[41] This coverage is reported to the nearest full integer (whole number), consistent with past publications. We note that in the Shared Rural Network section below, we report MNOs progress against their commitments to one decimal place, therefore providing a more detailed view of each MNO's level of progress for that purpose.

Table 3.5: 4G geographic coverage from all MNOs by UK nation

Nation	% of landmass served by all operators (2022)	% of landmass served by all operators (2023)	Percentage points (ppt) change
Scotland	46%	48%	+2%
England	85%	85%	0%
Northern Ireland	81%	81%	0%
Wales	62%	62%	0%
UK	**70%**	**71%**	**+1%**

Source: Ofcom analysis of MNO predictions (September 2023).

4G geographic coverage in rural areas across Scotland from all four MNOs remains poor in many parts of Scotland, particularly in areas like the Western Highlands and Islands. Nonetheless, the levels of rural coverage are improving gradually, including as a result of the initiatives outlined below, with a two percentage point increase in geographic coverage from all four MNOs.

Table 3.6: 4G geographic coverage from all MNOs by Urban/Rural

Nation	Total	Urban	Rural
Scotland	**48%**	**97%**	**47%**

Source: Ofcom analysis of MNO predictions (September 2023).

Levels of 4G geographic coverage (per Table 3.7) by at least one MNO remain stable across both urban and rural areas of Scotland, with a small increase in both total and rural coverage to 84%.

Table 3.7: 4G geographic coverage from at least one operator by UK nation and rurality

Nation	Total	Urban	Rural
Scotland	84%	99%+	84%
England	98%	99%+	97%
Northern Ireland	97%	99%	97%
Wales	91%	99%	90%
UK	**93%**	**99%+**	**93%**

Source: Ofcom analysis of MNO predictions (September 2023).

Table 3.8 demonstrates that the availability of 4G coverage across Scotland's rural landmass increased for most MNOs in 2023, compared to 2022, with BT/EE having the highest level of coverage at 76%, while Vodafone had the largest rate of increase at three percentage points.

Table 3.8: 4G geographic coverage change in rural Scotland by MNO

	4G geographic coverage in rural areas (2022)	4G geographic coverage in rural areas (2023)
BT/EE	74%	76%
Three	56%	58%
Virgin Media O2	65%	66%
Vodafone	66%	69%

Source: Ofcom analysis of MNO predictions (September 2023).

There has been another decrease, following last year's reduction, in the proportion of Scotland's landmass which has no 4G coverage from any operator ('total not spots'), from 17% in 2022 to 16% in 2023. Table 3.9 provides a comparison of Scotland's 4G total not spots against other UK nations, with the overall UK total not spot area having also reduced by one percentage point to 7% in 2023.

It should be noted that some areas in Scotland without coverage feature rugged terrain.[42] This terrain presents additional 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 viability of deployment to some of these more remote areas. According to Scottish Government data, and per its own six-fold Urban Rural Classification system, 5.5% of the Scottish population live in Remote Rural Areas (spread across 16 of Scotland's 32 local authorities).[43]

Table 3.9: 4G total not spots by UK nation

Nation	% of 4G total not spots
Scotland	16%
England	2%
Northern Ireland	3%
Wales	9%
UK	**7%**

Source: Ofcom analysis of MNO predictions (September 2023).

[42] NatureScot, Landscape policy: wild land.
[43] Scottish Government, Scottish Government Urban Rural Classification 2020, 31 May 2022. Defined as an area with a population of less than 3,000 people and with a drive time of over 30 minutes to a settlement of 10,000 or more people.

Geographic voice coverage

Mobile voice services from all four MNOs are now available across 61% of Scotland's geographic area, compared to 60% in 2022. This includes a one percentage point increase – to 60% - in levels of rural coverage, while urban coverage levels remain at 99%.

Geographic voice coverage from one MNO remains flat on last year, equating to 99%+ of urban and 90% of rural Scotland, and at 90% overall.

Improving geographic coverage

Scottish and UK Government initiatives, supported by significant funding from both governments and industry investment, have contributed to the improvements in 4G geographic coverage highlighted above, and are expected to support further improvements in the years ahead. We provide a short update on these programmes below.

Shared Rural Network

MNOs have continued with the programme of work towards their obligations to provide 4G coverage across 88% of the UK landmass (to be achieved by the end of June 2024, with 90% by 2027). [44] 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 MNO). Coverage in Scotland is expected to rise to 91% from at least one MNO and reach 74% from all four MNOs by January 2027.[45]

In total MNOs have now deployed more than 190 new sites since 2020 to meet their SRN targets, with 35 new sites added this year. All four MNOs have delivered additional mobile coverage to rural and island communities across Scotland, including BT/EE in and around Loch Ness,[46] Vodafone in Ae and Loch Head in Dumfries and Galloway,[47] Three in the Isle of Colonsay in the Inner Hebrides,[48] and Virgin Media O2 on the island of Islay.[49] Overall, MNOs have also upgraded thousands of sites with a combination of additional spectrum and higher operating power.[50] Three of the four MNOs have added in the region of 1 percentage point of landmass coverage in the last year, and individual MNOs' 4G geographic coverage now stands as: BT/EE (87.5%), Vodafone (83.3%), Virgin Media O2 (81.7%) and Three (80.5%).[51] As a result, 4G coverage from at least one MNO has reached 92.7%.[52]

Three MNOs still have substantial progress to make to meet their obligations in the coming months. We note reports that three MNOs have approached the UK Government to ask for an extension to their 2024 deadline. However, we continue to prepare to assess MNO compliance with the 88% threshold and associated nations obligations in summer 2024.

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[44] Ofcom, Mobile Coverage Obligations, 27 July 2021.
[45] UK Government, Shared Rural Network.
[46] BT/EE, Press Release, 19 April 2023.
[47] Vodafone, Press Release, 3 August 2023.
[48] Three, Press Release, 7 August 2023.
[49] Virgin Media O2, Press Release, 4 October 2023.
[50] By higher operating powers we mean bringing the transmit power of the site (which can impact both coverage and capacity) nearer to the limits authorised in operator's spectrum licences.
[51] Note that we are providing MNO coverage levels here to one decimal place, given the relevance of this greater granularity to understanding progress against SRN commitments, and that some of these coverage increases are not apparent where we are reporting to the nearest whole number elsewhere in this report.
[52] Note that we are providing MNO coverage levels here to one decimal place, given the relevance of this greater granularity to understanding progress against SRN commitments, and that some of these coverage increases are not apparent where we are reporting to the nearest whole number elsewhere in this report.

Scottish 4G Infill Programme

The Scottish Government's 4G Infill Programme – a £28.75m initiative delivering 4G infrastructure and services to 55 not spots across rural and remote Scotland – is nearing completion. All 55 mast sites have now been built, with 54 of the 55 mast sites activated and providing enhanced mobile connectivity to local consumers and businesses. These are predominantly in areas in which industry investment in the near to medium term would have been unlikely, owing to the economic challenges of doing so. Areas benefitting include the Shetland Islands, Loch Lomond & Trossachs National Park, and Argyll and Bute. Updates on the programme are regularly being published on the Scottish Government's website.[53]

Premises coverage in Scotland is improving

Outdoor premises 4G coverage

Individual MNOs continue to provide a high level of 4G coverage outside of premises in Scotland, with coverage ranging between 98-100% of premises. In addition, 97% of premises have outdoor 4G coverage from all four operators, compared with 98% across the UK. A comparison between Scotland and other UK nations is provided in Table 3.10.

Table 3.10: Outdoor premises 4G coverage by UK nation (all operators)

Nation	Total
Scotland	97%
England	99%
Northern Ireland	96%
Wales	94%
UK	**98%**

Source: Ofcom analysis of MNO predictions (September 2023).

Substantive differences remain between levels of urban and rural outdoor premises coverage in Scotland, but coverage levels continue to increase steadily. Individual operators' 4G coverage outside rural premises range from 90-98% (up from 89-97% in 2022), with coverage from all operators reaching 86% (up two percentage points from last year). A breakdown of coverage by MNO is provided in Table 3.11. Individual operators each provide outside coverage of 99+% to urban premises in Scotland.

Table 3.11: Outdoor premise 4G coverage in rural Scotland (by operator)

MNO	% of rural premises with outdoor 4G coverage
EE	98%
Three	90%

[53] Scottish Government, Scottish 4G infill programme: progress update, Updated 13 October 2023.

MNO	% of rural premises with outdoor 4G coverage
Virgin Media O2	94%
Vodafone	95%

Source: Ofcom analysis of MNO predictions (September 2023).

Outdoor premises voice coverage

In line with previous years' analyses, around 99% of premises in Scotland have voice coverage outside from all four MNOs. This drops to 93% for premises in rural Scotland, a one percentage point increase on 2022. Again, almost every premise in Scotland (whether urban or rural) has outdoor voice coverage from at least one MNO.

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.[54] As a result, some premises may see differences between the operators' predicted indoor coverage data and the actual coverage experience.[55]

Table 3.12 below outlines that indoor 4G coverage from individual MNOs ranges between 92% and 96% of all premises in Scotland (compared to between 91% and 95% in 2022). 86% of premises in Scotland can receive 4G coverage indoors from all four operators, up one percentage point from 2022.

Table 3.12: Indoor premises 4G coverage by UK nation (all operators)

Nation	Total
Scotland	86%
England	87%
Northern Ireland	73%
Wales	76%
UK	**86%**

Source: Ofcom analysis of MNO predictions (September 2023).

Table 3.13 below outlines that, in rural Scotland, indoor premises 4G coverage from individual MNOs ranges between 75% and 85% (up from 72% and 83%, respectively, in 2022). Indoor 4G coverage from all four MNOs is available in 57% of premises in Scotland (up from 55% in 2022 and continuing the recent trend).

[54] 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.
[55] 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.

Table 3.13: Indoor premises 4G coverage in rural Scotland (by operator)

MNO	% of premises with indoor 4G coverage (2022)	% of premises with indoor 4G coverage (2023)
EE	83%	85%
Three	72%	75%
Virgin Media O2	82%	81%[56]
Vodafone	82%	84%

Source: Ofcom analysis of MNO predictions (September 2023).

In urban areas of Scotland, 93% of premises can access a 4G service indoors from all four MNOs. Meanwhile, 4G coverage is available from at least one MNO in 97% of rural premises and in 99%+ of premises in urban areas.

Indoor premises voice coverage

Mobile voice services from all four MNOs remain available to 94% of premises in Scotland. Again, urban areas of Scotland are better served with 98% (2022: 98%) indoor coverage, compared to 75% (2022: 74%) in rural areas. However, almost every premises in Scotland (whether urban or rural) has indoor voice coverage from at least one operator.

More mobile coverage is available on Scotland's major roads

Scotland's road network covers 36,900 miles (15% of the UK total), ranging from major trunk routes to single carriageway sections in remote areas.[57] Good coverage is important along this road network to assist with vehicle communications, navigation, infotainment and safety aids. This sub-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 3.14 below, in-vehicle 4G coverage from all operators along major roads in Scotland now stands at 55%, continuing the trend of recent increases and two percentage points higher than 2022. Four per cent of Scotland's major roads are still unable to receive in-vehicle 4G coverage from any MNO. Individual MNO coverage ranges from 71-84%. In-vehicle voice coverage from all operators on major roads in Scotland is up by one percentage point (to 72%), with around 1% of major roads without voice coverage from any operator.

Table 3.14: In-vehicle 4G and voice coverage on major roads in Scotland, by operator

MNO	4G	Voice
EE	84%	86%
Three	71%	83%

[56] We note a reduction in voice coverage impacting indoor and roads voice coverage percentages, and we are engaging with MNOs to validate figures.
[57] UK Government, National Statistics: Road Lengths in Great Britain: 2022, 23 July 2023.

MNO	4G	Voice
Virgin Media O2	78%	93%
Vodafone	83%	93%
All operators	55%	72%
At least one operator	96%	99%

Source: Ofcom analysis of MNO predictions (September 2023).

Mobile traffic continues to increase

Mobile traffic continues to experience significant year on year growth, although the rate of this growth has been slower. Meanwhile, the dominant share (81%) of mobile traffic continues to be carried across 4G networks.

There was significant year-on-year data traffic growth in Scotland, at c.23%. Of the UK nations, mobile traffic grew fastest in England – by c.26% - with c.22% growth in Wales and c.15% growth in Northern Ireland.

Our monthly sample indicates data growth increased to around 75.7 PB, up from around 61.8 PB in 2022. As above, most of this data is from 4G traffic, which accounts for around 65 PB of this year's total data traffic in Scotland.

Further information about these trends can be found in our Connected Nations 2023 report for the UK as a whole.

The 3G switch-off in Scotland is underway

All MNOs have committed to switching off their 2G and 3G networks by 2033 at the latest, which will result in improved network efficiency and enable more spectrum to be used for 4G and 5G services.

MNOs are now commencing switch-off of their 3G networks, with Vodafone turning off their network in Glasgow earlier in 2023.[58] MNOs are developing their own switch-off timetables for these legacy technologies.

While Ofcom does not have a formal role in the switch-off process, we want to ensure customers are supported. We have set out our expectations to MNOs on how they should be helping customers through the change.

Further information on the 2G and 3G switch-off can be found in our Connected Nations 2023 report for the UK as a whole.

[58] Vodafone, We're Switching Off our 3G Network.