Opinion: The Future of DAB Radio

England, Scotland, Wales and Northern Ireland

1. Introduction

As of 2023, DAB (including DAB+) is the most popular single platform for radio listening with a share of listening of about 42%. However, although DAB's share of in-car listening continues to rise, home and workplace listening is moving online (apps/websites and smart speakers).

Online listening has several advantages. It enables commercial broadcasters to target different advertising at different listeners to the same radio service and to provide subscription-funded "radio" (as Bauer is now doing). Radio programmes can be listened to on-demand, instead of live, which particularly suits a lot of BBC content. Most UK broadcasters also offer higher sound quality online than on DAB/DAB+. Finally, there is no technical limit to the number of services that can be offered online.

However, online listening requires listeners to pay for broadband and/or mobile data, which not everyone can afford. DAB and DAB+ provide a free-to-use platform with more than 70 radio services available in most places and the cheapest receivers are only about £20. It is also included in all new cars and many commercial vehicles.

There is thus a clear case for maintaining the DAB/DAB+ platform into the medium term and the UK government and major broadcasters have agreed to maintain the current national and county multiplexes until at least 2035. However, the case for significant expansion of the DAB/DAB+ system is much weaker.

This article will discuss the lively development of the DAB system between 2023 and 2035, considering choice and capacity, sound quality and coverage. It will then briefly discuss the long-term future after 2035.

2. Choice and Capacity

From the early 2000s, the DAB system in the UK has been built on four layers of multiplexes. Initially, two national multiplexes, a local network and a regional network. In the mid-2010s, most of the regional multiplexes were closed and an additional national multiplex launched. Coverage of all layers was also improved. Thus, until the recent introduction of small-scale DAB, the capacity of the DAB system hadn't changed much in 20 years. However, the number of radio services has increased massively since 2010. Initially, this was done by broadcasting more services in mono and using slightly lower bit rates for many of the stereo services. In recent years, the more efficient DAB+ standard has been used to increase the number of services per multiplex.

As of early 2024, more than three quarters of the services on the two national commercial multiplexes use DAB+, while the BBC national multiplex and most of the county-level local multiplexes only use the original DAB standard. However, the vast majority of services on the new small-scale multiplexes use DAB+. It has been reported in online discussion forums that all remaining DAB multiplexes will soon be able to support DAB+, but the date for this keeps slipping.

Over the next few years, there will almost certainly be a further move towards DAB+. For example, the BBC plan to introduce national DAB+ services from 2025. However, many older (and some newer) portable DAB radios are not compatible with DAB+. Thus, switching a service to DAB+ will result in a loss of listeners which may not be compensated by the listeners to the new service(s) that use the freed-up capacity. Consequently, some of the more popular radio stations in the UK may continue with the original DAB format for several more years.

Increasing the number of services available from the national and county multiplexes in most locations above about 120 will require more multiplexes. This would require more radio spectrum to be allocated to DAB in the UK by closing the remaining analogue private mobile radio (PMR) channels, which would need to be planned years ahead and coordinated with neighbouring countries. However, this would require major additional investment in DAB from the broadcasters, which is unlikely to happen given the gradual move to online listening.

The introduction of small-scale DAB is increasing choice. However, it is not yet clear whether these multiplexes will be financially viable everywhere and many of the services carried are aimed at small minorities and/or offer poor-quality programming. There are also factors limiting the coverage available, which are briefly discussed later.

Thus, overall, a gradual increase in the choice of radio services available on DAB/DAB+ in most areas from about 70 to about 120 is predicted for the next 10 years.

3. Sound Quality

Sound quality on the DAB/DAB+ system is not fixed. There is a choice of different bit rates for audio channels with higher bit rates generally offering higher audio quality. Audio quality is also affected by the level of dynamic range compression applied prior to encoding. Excessive dynamic range compression, making the audio sound "loud" both distorts the audio directly and makes it more difficult to encode. Commercial services tend to use more compression than the BBC.

The UK uses much lower bit rates for DAB+ than most other countries (Australia being the exception), which limits the audio quality. Table 1 below summarises the subjective audio quality at bit rates commonly used in the UK. A "generally acceptable" quality sounds acceptable to most people on a portable radio (where the speaker quality is a limiting factor) or in a car (where there is background noise), but the limitations are noticeable on hi-fi speakers and headphones. Whether this sounds better or worse than FM is a matter of personal opinion. A "slightly degraded" quality may have audible distortion, reduced bass and/or reduced treble, depending on how the broadcaster processes the audio; it generally sounds inferior to FM, but is good enough for speech-based programming. The major UK broadcasters generally use "generally acceptable" and "slightly degraded" bit rates, but small independents use a wider range. This is unlikely to change.

	Original DAB standard		DAB+	
Quality	Stereo	Mono	Stereo	Mono
Higher	160, 192 kbit/s	96 kbit/s	48, 56, 64 kbit/s	40, 48 kbit/s
Generally acceptable	128 kbit/s	80 kbit/s	40 kbit/s	32 kbit/s
Slightly degraded	112 kbit/s	64 kbit/s	32 kbit/s	24 kbit/s
Poor	96 kbit/s	48, 56 kbit/s	24 kbit/s	16 kbit/s

Table 1: Correspondence between bit rates and audio quality

4. Coverage

DAB and FM reception characteristics are quite different. DAB+ either gives perfect reception or doesn't work at all, while, FM reception fades gradually. Thus, where a DAB and FM signal are transmitted from the same transmitter at an equivalent power, DAB will give solid reception in places where FM is a little hissy in stereo while, further out, FM will still give a listenable mono signal in places where DAB does not work at all. Because DAB broadcasts at about twice the frequency of FM, it does not diffract as well around local obstacles, such as hills and tall buildings. Thus, DAB is more susceptible to local holes in reception. Furthermore, national radio is provided to most of the population on FM by a few high-power transmitters, while DAB only uses medium- and low-power transmitters in order to minimize co-channel interference. Thus, it takes many DAB transmitters to replicate the coverage of a high-power FM transmitter and these areas currently incorporate many DAB reception holes, each affecting a relatively small number of households and roads.

As of 2023, indoor DAB coverage is 97.4% of the population for the BBC national multiplex, about 91% for Digital One, 91% for the county-level local multiplexes and 83-84% for Sound Digital. Coverage is slightly better for DAB+ services as they use more efficient error correction so can operate with a 3dB weaker signal.

Some DAB transmitters can be installed much more cheaply than others. The most expensive sites are those that require construction of a new mast. DAB transmitters at the same site usually share the same transmit antennas, so it is cheaper to install a new transmitter where there is an antenna already in place. In practice, a new multiplex operator at a transmission site would be expected to contribute to the antenna and site operation costs, reducing the costs for the existing multiplex operators at that site. In practice, these efficiency savings are being used to fund low-power DAB transmitters at sites where a new transmitter for another multiplex is being commissioned in order to prevent adjacent channel interference (ACI). This occurs where a strong signal blocks reception of a much weaker signal on a neighbouring frequency. The problem is greatest for adjacent DAB channels, but can also affect reception of other channels. The closer a transmitter is to housing and major roads, the more of a problem ACI is. An ACI filler transmitter needs to be at least 1% of the power of the interfering transmitter. However, higher powers are typically being used, providing a coverage boost as well as protection against ACI.

There is also the cost of distributing the multiplex content to the transmitters. Local multiplexes generally use terrestrial distribution, whereby costs are proportional to the number of transmitters. The national multiplexes

use mainly satellite distribution, which is independent of the number of transmitters. It is thus cheaper to add a new transmitter to a national multiplex than to a local multiplex.

Coverage of each type of multiplex is now considered in turn.

A. BBC National Multiplex

The BBC national DAB network now comprises about 400 transmitters. At the moment, the BBC is not planning to commission any further transmitters due to budgetary constraints and its focus on developing online delivery. In the short to medium term, Ofcom (in its 2021 DAB coverage study) identified four areas where coverage improvements are a priority:

- SE Cambridgeshire and Newmarket, served by a new transmitter at the Cheveley local DAB site;
- Fakenham and Sheringham in Norfolk, served by a new transmitter at Holt;
- Framlingham and Wickham Market in Suffolk, served by upgrading the Mendlesham transmitter;
- Parts of Belfast where reception from Divis is blocked, served by a new transmitter at the Black Mountain local DAB site.

A significant coverage expansion is unlikely unless it is decided to switch off the national FM networks. Matching FM coverage would an additional 400-500 extra transmitters, but many of these would serve fewer than 1000 people, which the BBC does not consider to be cost effective. Thus, it is unlikely that DAB will ever reach all of the places currently served by FM. One of the following options is most likely:

- Close all FM transmitters and expand the BBC national DAB network by 100-150 transmitters, leaving many people without any free-to-receive mobile radio reception.
- Reduce the FM network to just the main high-power transmitters and add about 30 DAB transmitters for areas currently served by low-power transmitters on FM only.
- Close FM transmitters where DAB coverage is sufficient and retain FM where it is not.

B. Digital One National Multiplex

Digital One currently operates around 200 transmitters (including low-power ACI fillers). It is a commercial multiplex so how much coverage to offer is a commercial decision balancing the cost of additional transmitters with the additional audience ratings and hence advertising revenue for the broadcasters on the multiplex. There may be some pressure to increase coverage in the run-up to Talk Sport's AM network being switched off, which is likely to be in 2027.

Matching coverage of the BBC national multiplex is unlikely to be commercially viable, but a modest improvement in coverage is feasible. An additional 35 transmitters would increase indoor population coverage by 2% (based on the 2021 Ofcom DAB coverage study). Of these, just two transmitters, an additional transmitter at Geddington, serving East Northamptonshire and a power boost to the Cheveley transmitter, serving South East Cambridgeshire and Newmarket, would boost coverage by 0.55%, so might be added in advance of the others.

C. Sound Digital National Multiplex

Sound Digital currently broadcasts using 64 transmitters, plus a few ACI fillers funded by the multiplexes causing the ACI. It is also a fully commercial multiplex and its business model is to offer a lower cost service than Digital One. Hence, it will always have poorer coverage. A further 20-40 transmitters may be viable, extending coverage and/or reinforcing it in major cities.

D. Local Multiplexes (Large Scale)

The coverage of the county-level local DAB multiplexes has largely been matched to the FM coverage of the first generation of local commercial stations (i.e., those that started between 1973 and 1992). This provides indoor local DAB coverage to about 91% of the population, which is still relatively poor. It does not match the FM (or AM) coverage of BBC local and regional radio or of some of the smaller commercial stations. However, many of the places unserved by local DAB will be served by small-scale DAB (SSDAB) over the next few years. The Salisbury, Kings Lynn, North West Derbyshire and Ludlow multiplexes were on air as of April 2024.

It is likely to be more cost effective for the BBC and the major commercial broadcasters to rent space on the new SSDAB multiplexes than to fund expansion of the county-level multiplexes. Coverage expansion of the county-level local DAB multiplexes may therefore be quite limited, particularly while FM remains operational.

A number of transmitters from the 2015-17 local DAB coverage expansion were never implemented. According to Ofcom (in its 2021 DAB coverage study), the multiplex operators were required to commission these transmitters before the end of their licence terms in order to qualify for automatic licence renewal. However, Ofcom removed this requirement in June 2023 as multiplex operators could have opted for a competed licence renewal to circumvent this and could even have used this to reduce coverage. The requirement for automatic licence renewal was therefore changed to maintaining existing coverage. The transmitters are as follows:

- Somerset multiplex: Egford Hill transmitter, serving Frome;
- West and Mid Wales multiplex: Blaenplwyf transmitter, serving Ceredigion, and Mynydd Sylen, serving Llanelli and Bury Port;
- NE Wales and W Cheshire multiplex: Llangollen transmitter;
- NW Wales multiplex: Deiniolen transmitter, serving Deiniolen and Llanberis;
- Suffolk multiplex: Aldeborough and Sudbury transmitters;
- Lincolnshire multiplex: Boston Wyberton and Scunthorpe transmitters;
- Tayside multiplex: Ardovie Quarry transmitter, serving Montrose, and Tay Bridge transmitter, improving reception in Dundee;
- Inverness multiplex: Grantown transmitter, serving Grantown and Aviemore, Rumster Forest transmitter, serving Caithness, and Thurso transmitter;
- Northern Ireland multiplex: Enniskillen, Larne and Whitehead transmitters.

There are also a few transmitters which may offer sufficient coverage to support a commercial business case for their addition to a multiplex, particularly if there is no SSDAB multiplex in that area. Transmitters at existing national DAB sites are more likely as they should be cheaper to install. The Lancashire multiplex has already added a transmitter at Lancaster. Other possible candidates include:

- Sussex multiplex: East Grinstead transmitter;
- Bradford, Halifax and Huddersfield multiplex: Wharfedale transmitter, serving Ilkley and Otley;
- Lancashire multiplex: Haslingden transmitter, serving Rossendale;
- Northern Ireland multiplex: Tully Quarry transmitter, serving Ballymena.

There may also be a case for improving coverage by boosting the power of some existing transmitters or upgrading the antenna as this will be cheaper than adding a new transmitter. Options from Ofcom's 2021 DAB coverage study include:

- Boosting the Kent multiplex Bluebell Hill transmitter;
- Boosting the Sussex multiplex Eastbourne and Hastings transmitters;
- Boosting the Herts, Bucks and Beds multiplex Zouches Farm transmitter;
- Boosting the Cambridgeshire multiplex Sandy Heath and Seward's End transmitters.

Finally, it is possible that the BBC may fund a few additional transmitters for areas where local radio reception is primarily via AM and no SSDAB multiplex is proposed. West Gloucestershire is the most likely candidate.

In the long term, the BBC is expected to provide the same level of DAB coverage for Radios Cymru, Scotland, Ulster and Wales as for Radios 1 to 4, matching FM coverage. However, providing this level of coverage on the county-level local DAB multiplexes, or even a mixture of county and SSDAB multiplexes, is unlikely to be economic. Therefore, these services are likely to be carried on the BBC National multiplex once that fully switches over to DAB+.

E. Small-Scale Multiplexes

The rollout of permanent small-scale DAB multiplexes begun in 2022 and is likely to continue until 2027 or 2028. It is too early to predict how coverage of small-scale DAB will evolve. There is clear demand for SSDAB in cities and large towns, and in many areas currently unserved by county-level local DAB multiplexes. However, it is not yet clear whether there is demand for SSDAB everywhere. Cost is also an issue with several multiplex launches having been abandoned due to insufficient services signing up to fund the transmission costs, particularly where Arqiva sites were proposed. Ofcom is re-advertising many of these licences.

Universal coverage cannot be provided using the existing spectrum allocated to SSDAB, particularly in parts of South East England and East Anglia where coordination with other countries is needed. It would therefore be necessary for Ofcom to allocate additional Band III spectrum for DAB by closing the remaining analogue private mobile radio (PMR) channels, which would need to be planned years ahead and coordinated with neighbouring

countries. A further problem is the economics of funding additional transmitters to fill gaps in existing SSDAB coverage areas. Finally, artificial constraints are introduced in some areas by Ofcom's rule that coverage must be limited to 40% of the population of the relevant county multiplex's coverage area. More spectrum would also be needed if there was demand for a second SSDAB multiplex in some places.

5. DAB After 2035

It is government policy to maintain the existing DAB multiplexes until 2035. There is a general expectation that the internet will be the dominant method of radio distribution in the future. This offers a number of benefits, including on-demand listening, tailored content and advertising, and the ability to offer subscription-funded services. However, internet distribution relies on listeners being able to afford broadband and mobile data, together with adequate coverage of these. Because of this, internet radio listening is not currently viable for everyone. The rollout of "connected car" technology is relatively slow and will not be complete by 2035, while some people prefer listening to radio on a dedicated device. The need to keep internet-based listening devices up-to-date and the relatively rapid obsolescence (compared with traditional radios) is a further problem. Thus, a substantial proportion of radio listening in 2035 is still likely to be via DAB and FM, maybe around 30%.

There is thus likely to be a need to keep DAB going beyond 2035, but with a significantly smaller audience than at present. Broadcasters will be looking to reduce costs and one way of doing this is to reduce the number of multiplexes. The county-level local DAB multiplexes are the most expensive to run. However, simply closing them would mean that the local services currently using these multiplexes would rely on a mixture of patchy small-scale DAB coverage and FM, which is not likely to be acceptable.

Another way of reducing DAB costs would be to merge the county-level local multiplexes with the BBC National multiplex, creating a single tier of public service broadcasting (PSB) multiplexes. These would need to retain the existing coverage of the BBC National multiplex without increasing the costs to the BBC. This may be difficult with the current county-sized local coverage areas. A regional model with fewer, but higher-power transmitters compared with the current local DAB network would be more cost effective. If current trends continue, the BBC and major commercial broadcasters will have replaced local services with regional services by 2035 anyway.

Paul Groves. January 2023; revised April 2024.