

# History of Radio Transmission in the UK

## The Dawn of Radio

The BBC opened the first regular public broadcasting station in the world on 14th November 1922 in London. Stations in Birmingham and Manchester opened the following day, followed by Newcastle on 24th December, Cardiff on the 13th February 1923, Glasgow on the 6th March, Aberdeen on 10th October and Bournemouth on 17th October. These stations all broadcast at 1.5 kW, though London was increased to 3 kW in March 1925 when the transmitter was moved to Selfridges. This is a relatively low power by modern standards, so many cities were left with poor reception. So, from November 1923 to December 1924, 100 W relays were introduced for Bradford, Dundee, Edinburgh, Hull, Leeds, Liverpool, Nottingham, Plymouth, Sheffield, Stoke and Swansea, together with a 1.5 kW transmitter for Belfast. At that time, the medium wave band extended only from 600 to 1000 kHz and each station was on a different frequency.

In October 1926, a 25 kW long wave station was opened at Daventry on 187.5 kHz (1600 metres). This filled in most of the coverage gaps in Central and Southern England, bringing a radio service to Norwich for the first time and improving reception in places like Oxford, Leicester, Cambridge and Ipswich. However, listeners would have had to buy a new radio. In August 1927, the first high power medium wave transmitter was opened, also at Daventry, replacing Birmingham and Nottingham and extending coverage to much of East Anglia.

On 14th November 1926, the first of many international re-plans of the medium wave band was made, extending it up to 1200 kHz and implementing 10 kHz channel spacing. Following this, some of the BBCs relays in different parts of the country shared a common frequency. Two further re-plans were made on 13th January and 30th June 1929, extending the medium wave band to 1500 kHz and abandoning the 10 kHz channel spacing. In this plan, frequencies were allocated to countries instead of to individual transmitting stations.

## The National and Regional Programmes

Through the 1930s, the BBC gradually replaced its transmitter network with new high power stations located outside the cities, broadcasting at powers between 40 and 100 kW. The next station to be opened after Daventry was Brookmans Park in Hertfordshire on 21st October 1929, serving London, the South East and parts of East Anglia, and replacing the 3 kW transmitter at Selfridges. On the opening of a second high power transmitter at Brookmans Park on 9th March 1930, a second programme was introduced for the London and Midland regions. At Daventry, the National Programme was carried on long wave, extending to parts of the south and some northern cities, while the Regional Programme was carried on medium wave. At Brookmans Park, both programmes were transmitted on medium wave, with the lower frequency, giving higher coverage, allocated to the Regional Programme.

The next high power transmitter opened was Moorside Edge on the Pennines, replacing the main station at Manchester and the relays at Bradford, Hull, Leeds, Liverpool, Sheffield and Stoke. The Regional Programme opened on the 17th May 1931, with the National Programme following on 12th July. This was followed by Westerglen in Central Scotland, replacing Glasgow, Edinburgh and Dundee, which opened with both programmes on 12 June 1932. The next year, the Washford transmitter by the Somerset coast was opened, replacing Cardiff and Swansea and also covering much of Western England. The Welsh Regional Programme opened on 28th May 1933, with the National Programme following on 17th July and using the same frequency as that programme from Brookmans Park.

On the 15th January 1934, another international frequency plan was implemented, resulting in more changes to the BBC frequencies, including the long wave transmitter moving to 200 kHz. This plan was to last until 1950. In October of 1924, a new 150 kW long wave transmitter for the National Programme was opened at Droitwich, south of Birmingham, replacing the 25 kW station at Daventry and covering most of England and Wales. The Regional Programme moved to Droitwich on 17th January 1935, which was accompanied by many of the BBCs transmitters exchanging frequencies, including the National Programme at Moorside Edge joining Brookmans Park and Washford on 1149 kHz.

In 1936 and 1937, high power transmitters opened at Lisnargarvey for Northern Ireland, Stagshaw for the North East and Cumbria and Burghead for Northern Scotland, each carrying the Regional Programme only. A smaller 5 kW transmitter was opened at Penmon to bring the Welsh Regional Programme to North Wales and Aberdeen was replaced by a 5 kW transmitter at Redmoss. With the National Programme now available on long wave, the transmitter at Washford was re-allocated to provide a Western Regional Programme, supplemented by the old

transmitters at Bournemouth and Plymouth. In June of 1939, the Western Regional transmitters were replaced by a 100 kW transmitter at Start Point in Devon and a 20 kW transmitter at Clevedon, near Bristol, enabling the last of the original transmitting stations to be closed. Appendix A lists the BBC's transmitters in 1939.

In the 1930s, the BBC was subjected to competition for the first time. From 1931, French station Radio Normandie began broadcasting in English after its local programmes had finished. In 1933, Radio Luxembourg opened a 200 kW long wave transmitter, broadcasting in English from the Grand Duchy in the afternoons and evenings.

## The War Years

When war broke out, enemy bombers using radio transmitters for navigation became a potential problem. To combat this, the long wave transmitter was closed and the medium wave transmitters grouped into three synchronous groups of four on the same frequency. Initially, two frequencies were used to broadcast the Home Service, which replaced the National and Regional Programmes, to northern and southern Britain, whilst a third frequency was used to broadcast the European Programme at night. By October 1941, Start Point had been converted to horizontal polarisation to prevent its use for direction finding and the Droitwich long wave transmitter converted to a high power medium wave station. These took over the broadcasting of the European Programme, freeing up transmitters for a new Forces Programme.

The synchronous transmitters not only interfered with each other in areas where the signal strengths were similar, but had to be switched off during air raids. To improve reception of the Home Service, a synchronous network of 61 low power transmitters, known as Matrix H, was constructed on 1474 kHz. As the war progressed, further transmitters were opened to boost reception of all three services, including extra European Programme transmitters at Crowborough in Sussex and Ottringham, East Yorkshire.

## Home, Light and Third

The BBC returned to peacetime broadcasting a few weeks after the war. The Home Service was split into 7 regions, taking over most of the old Regional Programme frequencies. The former North East and Cumbria frequency, however was allocated to the European service, so this region had to share a frequency with Northern Ireland, broadcasting a common programme until the start of 1963. New transmitters at Londonderry, Norwich and Bartley (for Southampton, Portsmouth and Bournemouth), opened during the war, were added. The Forces Programme became the Light Programme, taking over the old National Programme long and medium wave frequencies, but with 9 rather than 3 medium wave transmitters, giving full national coverage. For a few years, the UK operated a second long wave service, broadcasting the European Programme from Ottringham.

In October 1946, a new classical music and cultural service, the Third Programme was added, broadcasting from 8 to 11 in the evenings. Initially 583 kHz was used from Droitwich, but, as this was not an internationally cleared frequency, coverage was limited. Therefore, 22 of the old Matrix H transmitters were brought back into service to supplement coverage outside the Midlands. Appendix B lists the BBC's transmitters in 1946.

In March 1950, a new international frequency plan was implemented, with the band extending from 530 to 1600 kHz. The UK was formally allocated a frequency for the Third Programme and an additional frequency for the European Programme (now part of the World Service). The frequencies that were used are within 1 or 2 kHz of the UK's current high power allocations. Radio Luxembourg's English service moved to medium wave, broadcasting only in the evening and subject to fading. In the late 1940s and early 1950s, a number of low power transmitters were opened to improve Home Service reception, particularly in coastal areas. On its new frequency, the Third could be broadcast at the full 150 kW, with further improvements in coverage when the transmitter was moved to Daventry at the beginning of 1952. However, this transmitter did not give national coverage, so some of the low power fillers had to be retained. In 1957, the BBC launched Network 3, broadcasting educational programmes in the early evening on the Third Programme transmitters, plus Saturday afternoon sport and test cricket. On 30th August 1964, they were joined by the Music Programme, broadcasting classical music during the daytime. The article *UK and Ireland Radio Stations in 1966* includes a list of the BBC's AM transmitters from 1950 to 1967. Until 1964, a joint Northern Ireland/ North East England home service was broadcast on 1151 kHz from Lisnagarvey, Londonderry, Stagshaw and Scarborough.

## The Birth of FM

By the middle of the 1950s, television was becoming popular and it was becoming noticeable that the sound quality was better than that offered by AM radio. Increasing the bandwidth on AM was not an option because of interference to and from foreign stations. There were also a number of places that didn't receive good reception of the BBC's radio stations, though AM reception was much better than it is now as there were much fewer stations.

Therefore, the BBC invested in a new radio transmission system in the very high frequency (VHF) region of the spectrum, using frequency modulation (FM). The system was originally designed for use with a roof or loft aerial and VHF radios were commonly built into TV sets until the UK switched over to the 625 line TV system on UHF at the end of the 1960s.

The BBC's first FM radio station opened on 2nd May 1955 at Wrotham in Kent, broadcasting all three networks to London and the South East of England. Pontop Pike for the North East and Wenvoe for South Wales and the West of England followed on the 20th December. Development of the FM radio network was relatively quick as most of the transmitters shared masts with BBC television. Seven transmitters opened in 1956: Divis for most of Northern Ireland, Meldrum for the Grampian region of Scotland, North Hessary Tor for Devon and East Cornwall, Blaenplwyf for West Wales, Holme Moss for North West England and Yorkshire, Sutton Coldfield for the Midlands and Tacolneston for East Anglia. Rowridge for Central Southern England and Kirk o'Shotts for Central Scotland were opened in 1957. By 1961, there were 27 VHF-FM transmitters on air and extra regional programmes were carried on FM only for the North East, East Anglia and South West regions. With a few exceptions, the Home Service broadcast on the frequencies currently used by Radio 4, the Light Programme on those used by Radio 3 and the Third Programme on the current Radio 3 frequencies. The article *UK and Ireland Radio Stations in 1966* lists the BBC FM transmitters at the 62 sites in use by the end of 1966. This had been extended to 79 sites by the beginning of the 1970s.

Stereo was first tested in January 1958 using the current pilot tone system, with a permanent service opening on the Third programme in the South East the following year. Stereo was rolled out slowly, initially only on the Third/Radio 3, with Radios 2 and 4 following over the 1970s. The original 20 BBC local radio stations were not converted to stereo until the 1980s

## The Pirates

At Easter 1964, UK radio was revolutionised by the opening of Radio Caroline and Radio Atlanta. These commercial stations broadcast American style Top 40 radio from ships in the North Sea off the Essex coast, exploiting a loophole in the law. As they broadcast from ships, they quickly became known as the pirates, a term applied to unlicensed radio stations ever since. In July of 1964, the two stations merged, with Atlanta becoming Radio Caroline North and sailing off to the Irish Sea to broadcast to the North West. They were quickly joined by other stations with as many as 12 different stations broadcasting from ships and offshore forts. Although most stations broadcast Top 40 pop to South East England, Radio 270 broadcast to Yorkshire and the North East, Radio Scotland to Scotland and there were two easy listening stations. The early stations used frequencies at the top of the medium wave band. With a shorter wavelength, a shorter mast could be used, but the coverage wasn't as good. Later stations spread throughout the band. Caroline South broadcast initially on 1520 kHz at 10 kW, while its main competitor, Radio London, broadcast at 50 kW on 1137 kHz, giving much better coverage. Caroline North broadcast at 30 kW on 1187 kHz, whilst Radio 355 and Radio 390 broadcast respectively on 845 kHz at 55 kW and 773 kHz at 35 kW and would have been listenable in the Midlands. The article *UK and Ireland Radio Stations in 1966* lists the main pirate stations.

The offshore pirate era ended on 14th August 1967 when the Marine Offences Bill became law, outlawing these stations. The two Caroline stations continued, however, with Caroline North lasting until Easter 1968 and Caroline South broadcasting on and off until the early 1990s, using 1187 kHz in the early 1970s and 962/963 in the late 70s and 80s. In the mid 80s, Caroline opened a second transmitter, transferring the main service to 576 kHz, later 558, and broadcasting alternative programmes on 963, including the religious programmes it transmitted in the evenings to fund itself. Other offshore pirates included Radio North Sea International in the early 1970s and Laser 558 in the mid 1980s. Caroline was driven off 558 by licensed station Spectrum (which was temporarily given a second frequency) in 1990 and broadcast for a few months on 819 kHz before closing. Caroline now operates legally as a satellite station run by volunteers.

## Radios 1 to 4 and the Start of Local Radio

On 30th September 1967, The Light Programme was split into Radios 1 and 2, the Home Service became Radio 4 and the Third Programme, Network 3 and Music Programme were united under the Radio 3 banner. Radio 1's transmitter network was developed from the Light Programme's medium wave fillers on 1214 kHz (247 metres). The number of transmitters was increased from 12 to 17, with further transmitters at Tywyn and Torbay added a few years later. Radio 2 retained long wave and FM, with new medium wave transmitters opened on 1484 kHz in Scotland to replace those lost to Radio 1. These transmitters are listed in the article *UK and Ireland Radio Stations*

in 1977. Initially, Radios 3 and 4 used the third network and Home Service frequencies listed in the article *UK and Ireland Radio Stations in 1966*.

In 1967, the BBC launched a local radio experiment, opening Radio Leicester on 8th November, Radio Sheffield on the 15th and Radio Merseyside on the 22nd. Radios Brighton, Durham, Leeds, Nottingham and Stoke followed in 1968. Initially, the stations only broadcast local programmes for a few hours a day and were broadcast on FM only at low power. Local radio was deemed a success and the BBC opened another 12 stations in 1970 and 71, all in England, with plans for another 20. Frequencies and powers are listed in Appendix C. However, the government curtailed further expansion until the early 1980s. To circumvent the 20 station limit, the BBC closed down Radio Durham in 1972 so that it could open Radio Carlisle the following year. In 1972, medium wave transmitters were opened for all of the BBC's local radio stations, using a mixture of frequencies taken from Radios 3 and 4, the international low power channel, 1484 kHz, and frequencies allocated to other countries. The UK can broadcast at up to 2 kW per site on frequencies other than those allocated to it, but these frequencies are subject to greater incoming interference. However, most BBC local radio stations did not broadcast local evening programmes until the end of the 1980s, relaying Radio 2 after hours. In 1973, most of the FM frequencies allocated to local radio were changed and some stations received power boosts. The article *UK and Ireland Radio Stations in 1977* lists the post-1973 BBC local radio frequencies.

Legal commercial radio started in the UK in 1973 with the launch of LBC in London on 6th October 1973 and Capital Radio on the 16th. Radio Clyde followed on 31st December, with Piccadilly Radio, Metro Radio, Swansea Sound, Radio Hallam, Radio City and BRMB launching in 1974. By the end of 1976, there were 20 independent local radio stations in the UK. However, the government suspended the launch of further stations until the beginning of the 1980s. All commercial stations launched on both medium wave and FM, though Capital and LBC broadcast on temporary frequencies for their first 18 months, using 557 and 719 kHz, respectively. This was because the high power transmitter at Saffron Green was not ready when they launched, so they broadcast at low power from Lots Road in Central London, requiring the use of lower frequencies to get the required coverage. The permanent frequencies are included in the article *UK and Ireland Radio Stations in 1977*.

## The Splits and AM Re-shuffles

When the Open University started in 1971, it needed radio airtime. To minimise disruption to regular programmes, it was given airtime on Radio 3 and Radio 4 FM, whilst their regular programmes continued on AM, though most of the Radio 3 airtime was outside regular broadcast hours. The FM/AM splitting was quickly extended through the early seventies. Radio 4 transferred its schools programmes to FM only in 1973, whilst Radio 3's adult education programmes and test cricket became AM only. Radio 2 also split, with Radio 1 borrowing its FM network late at night from 1971 and sports programmes confined to long wave from 1973, with FM carrying Radio 1 on Saturday and Bank Holiday afternoons and Radio 2's regular programmes during evening and Sunday afternoon sport.

To make way for local radio on medium wave, Radios 3 and 4 sacrificed some of their frequencies on 2nd September 1972. Radio 3's relay frequency of 1546 kHz was lost, with some transmitters transferring to the main 647 kHz frequency and others re-allocated to BBC local radio. Radio 4's English frequencies were reduced from 6 to 3: 1457 and 1151 kHz were transferred to local radio, though the latter was retained for a year, and 1088 kHz was allocated to the World Service to enable two different programmes to be broadcast to Europe at night. The Radio 4 transmitters were re-grouped on 692, 908 and 1052 kHz and English regional programmes ended. However, regional news and weather was retained on FM only, with regional breakfast programmes for East Anglia and the South West, which didn't have local radio. Radio 4 South West was later given a separate medium wave network. Regional opt-outs in Scotland, Wales and Northern Ireland continued as before. Using fewer frequencies degraded night-time reception because of sky-wave interference from other transmitters on the same frequency. Consequently, Radio 4 was given a handful of new medium wave relays in 1975. At the start of 1975, Radio 4's Northern Ireland transmitters were taken over by Radio Ulster and Radio 3's Belfast AM relay handed over to Radio 4 on a new frequency. The article *UK and Ireland Radio Stations in 1977* lists the AM frequencies used by Radios 3 and 4 following these changes.

The original plan, published in the BBC's *Broadcasting in the Seventies* report in July 1969, was to put all of the educational programmes on Radio 4 FM, with Radio 4 AM in England allocated Radio 3's 647 kHz frequency in addition to the three frequencies it ended up with so that near universal night-time coverage could be obtained, noting that Radio 4's night-time coverage had been diminished by the opening up of East German transmitters on 692 and 908 kHz in the 1960s. Radio 3 would then have broadcast either on FM only, like similar stations elsewhere in Europe, or with a reduced coverage network on 1088 kHz, possibly confined to daytime only so that the World Service could use the frequency in the evenings. However, protests from vociferous Radio 3 listeners put

an end to that plan. Plans to improve Radio 1's daytime coverage were stopped by the Government allocating 1151 kHz to independent local radio.

In 1978, a new international frequency plan was implemented for the AM bands in Europe. Unlike previous changes, the UK's medium wave allocations were only shifted by 1 or 2 kHz to multiples of 9 kHz to get rid of night-time whistles caused by inter-carrier interference from transmitters in Asia and parts of Africa using different carrier frequencies. However, power allocations for all countries were increased. This would increase night-time interference, but would also let the UK increase its transmission power. The UK was also given a second long wave frequency of 227 kHz (now 225 kHz), though this has never been used due to incoming interference from Poland. There were a number of problems with the BBC's AM networks. Radio 1 reception was very poor in many places due to interference between overlapping transmitters on the same frequency. Night-time reception of Radios 3 and 4 had been reduced when the number of frequencies were cut and Radio 4 had lost both AM and FM frequencies in much of Wales to new regional stations, with a regional station in Scotland ready to start. In addition, the World Service shared Radio 4 Scotland's frequency during the day to transmit to Europe, but had to switch to other frequencies at night. The fundamental problem was trying to provide too many services using a limited number of frequencies. In the 1950s and 1960s, three networks were broadcast on AM within the UK, all with relatively good coverage. By the mid 1970s, six services were provided with much poorer reception. No other European country attempted to provide this many services on AM – two or three services was the standard.

To mitigate all of these problems, the BBC re-organised all of its AM frequencies, effective from 23th November 1978. Overnight, 11 high power, 4 medium power and 14 low power transmitters were opened, while 1 high power, 1 medium power and 12 low power transmitters were closed, and many of the continuing transmitters changed frequency. Long wave was allocated to Radio 4, with 2 extra long wave transmitters in Scotland, medium wave transmitters in the North East and Cumbria to fill the gap where the long wave transmitters interfered and higher power for the medium wave service in Northern Ireland. Medium wave fillers for London and the South West were added later. This gave Radio 4 full UK coverage during the day and 91% population coverage at night. The regional Radio 4 frequencies in Scotland were given to Radio Scotland. Of the remaining frequencies, the lowest, 648 kHz, was given to the World Service for maximum daytime penetration into Europe. As an exclusive allocation, this frequency could also be used at night. This left 5 medium wave frequencies for Radios 1, 2 and 3. The best network, on 693 and 909 kHz (the latter frequency no longer used by East Germany), was given to Radio 2 and is essentially the current Radio 5 Live network. Radio 1 was given 1053 and 1089 kHz and Radio 3 was given the old Radio 1 network on 1215 kHz.

Coverage of Radios 1 and 4 was much improved by the changes, though Radio 4 listeners without long wave had to replace their radios. Radio 2 reception during the day was improved in some parts of the country, with only a few places losing out. However, night-time reception was diminished, though Radio 2 was available on most BBC local radio stations in the evenings until the end of the 1980s, by which time Radio 1 had stopped borrowing its FM network for part of the evening. Only Radio 3 suffered a major drop in reception quality. However, it had the smallest audience, most of whom used FM where possible. Splitting of the Radio 3 network was cut so that the main service was on FM full-time. The early evening adult education service on medium wave was moved to Radio 4 FM at the weekends, leaving only the test cricket broadcast exclusively on AM. A handful of minor improvements were made all four networks in the early 80s. The article *UK and Ireland Radio Stations in 1984* lists the final configurations of these AM networks.

## Improving FM

At the beginning of the 1980s, local radio expansion resumed with both the BBC and the commercial sector opening stations. 9 BBC and 26 Commercial stations started between 1980 and 1984, though fewer stations opened in the late 1980s. Near universal coverage for both BBC and commercial local radio was achieved in the early 1990s. Regional programmes on Radio 4 FM ended at the beginning of 1983 when Radios Devon and Cornwall opened.

By the start of the 1980s, FM was standard on portable radios and was an option for cars, though it didn't become standard until the end of that decade. However, there were two major problems with FM radio in the UK which meant that it didn't catch on as quickly as in other countries. These were poor reception and lack of spectrum. The FM radio system was originally designed for use in mono with roof aerials, so horizontal polarisation was selected to give directional reception. However, vertical polarisation is more suited to the vertical aerials used for car and portable radios. It also maintains a higher signal strength near the ground. From the 1970s, all independent and some BBC local radio stations had implemented mixed horizontal and vertical polarisation, which gave much better reception. Therefore, from the late 1970s to the early 1990s, the BBC converted its network FM transmitters to

mixed polarisation, doubling the power in most cases. The number of low and medium power relay transmitters was also increased, with new FM transmitters opening up until the end of the 1990s. With these changes to the transmitter network and better receivers, virtually all areas now receive good mono reception in cars and on portables, though stereo reception can still be patchy without a roof aerial.

Until the early 1980s, the FM broadcast band in the UK extended only from 88.1 to 97.6 MHz, providing room for only three national networks and some local radio. Consequently, Radio 1 was only on FM for 23 hours a week, displacing Radio 2 and there was not enough space for both BBC and Independent local radio to broadcast on FM in all towns and cities. Furthermore, Radio 4 was not available on FM in most of Scotland, Wales and Northern Ireland, where the BBC's regional stations had taken over its frequencies, and education programmes displaced the regular Radio 4 and regional programmes for around 20 hours a week. Radio Wales was not on FM at all.

To resolve these problems, it was decided to extend the FM band in the UK to 87.6 to 107.9 MHz. This was done in stages, with the first chunk of spectrum from 102.4 to 104.5 (and later 104.9) allocated to BBC and commercial local radio. This spectrum was brought into use in 1983 with new commercial stations and the BBC expanding some of its city stations into county stations, with name changes where appropriate. In 1984-1985, the whole FM band in Ireland (the North and the Republic) and parts of Wales was replanned to extend the UK's sub-bands to the Republic, enabling both countries to operate more transmitters. Before the changes, there was only space for two national networks (below 97.6) in the Republic. During 1986 and the first half of 1987, more than half of the local radio transmitters in the UK changed frequency as both the upper and lower local radio sub-bands were divided into separate BBC and commercial halves. This re-plan enabled most of the older independent local radio (ILR) stations to increase their transmitter powers, moving from a city to a county model. Many of the new ILR stations planned for the mid to late 1980s were abandoned and coverage of neighbouring stations expanded instead. The article *UK and Ireland Radio Stations in 1984* lists the FM frequencies used just before the changes. Most of the post-1987 FM frequencies are still in use today, though many local stations, particularly in the commercial sector, have changed name.

The next piece of FM spectrum, 97.7 to 102.3, MHz was not due to be released for broadcasting until the beginning of 1990, though a few transmitters started up before this. This was allocated to the BBC for Radio 1 and to a new national commercial station, with 102-102.3 added to the upper local radio sub-band. The Radio 1 FM network was phased in over the late 1980s and early 1990s. See the article *Radio 1 Transmission History* for further details. At the same time, Radio 4 FM coverage was extended to the rest of Scotland, Wales and Northern Ireland. The commercial network, originally intended as a talk-based service was delayed due to changes in radio regulation. Classic FM eventually started in 1992. The top end of the FM band, 105-108 MHz, was finally released for broadcasting in 1995. This was originally intended to be used to provide extra transmitters for the five national networks, but has been allocated to local and regional commercial radio instead. The lower part of the FM band, 87.6-88.0, was released for broadcasting in 1987, but not used until the 1990s when it was allocated to temporary low power stations. By the beginning of the 1990s, FM had become the dominant medium for radio listening in the UK.

## Commercial Radio Expands

In the mid 1980s, the government wanted to expand commercial radio. Privatisation of Radios 1 and 2 was rejected, so to make more spectrum available, it was decided to end the simulcasting of radio stations on both AM and FM. As a result, the AM frequencies then used by Radios 1 and 3 would be used for new independent national radio stations. However, the first stations to split, were the larger independent local radio stations, most of whom launched new oldies services on medium wave, while their existing services continued on FM, targeting a slightly younger audience. Smaller broadcasters were able to launch AM oldies stations by building networks, such as Classic Gold, which expanded from 3 to nearly 20 stations through the 1990s as broadcasters merged. Capital Gold, originally a London station, became a network in 1999. In 1989, the Independent Broadcasting Authority (IBA) licensed 20 new stations, known as 'Incrementals' in areas already served by independent local radio. Originally intended as community radio, these quickly evolved into commercial stations.

The first of the new national stations was launched on 1st September 1989; Atlantic 252 broadcast to about 2/3 of the UK on long wave from the Irish republic until the end of 2001, broadcasting Top 40 hits for most of its lifetime. The first of the new wave of official national stations was BBC Radio 5, which launched on 27th August 1990, taking over Radio 2's medium wave network. Radio 5 combined sport from Radio 2 AM and education from Radio 4 FM with a selection of World Service programmes, children's and youth shows and magazine programmes. It was re-launched in 1994 as a news, sport and current affairs network and renamed Radio Five Live.

The Radio Authority, which replaced the IBA, launched three national commercial stations in the early 1990s. The FM license, reserved for a 'music other than pop' service went to Classic FM after the original winner, an easy listening station, couldn't raise finances quickly enough. Classic launched on 7th September 1992 on 11 FM transmitters, with a further 11 added over its first year. The network was expanded in 1995/6 and again in 2002. Virgin Radio, now Absolute Radio, was launched in April 1993 and has swung between a rock music and adult contemporary music format. It was allocated 1215 kHz medium wave, formerly used by Radio 3 and by Radio 1 prior to that. This network suffered from poor reception, so Virgin opened 17 new low power transmitters on nearby frequencies to improve coverage. Virgin campaigned unsuccessfully for FM spectrum to be allocated to an additional national network, but was awarded an FM license for the London area, which opened in April 1995. The third national license on 1053 and 1089 kHz medium wave was reserved for a speech station and awarded to Talk Radio UK, now Talk Sport. Talk started in February 1995 with fewer high power and more low power transmitters than Radio 1 used. This change gave improved night-time reception at the expense of daytime coverage.

Local licensing by the Radio Authority initially focused on filling the gaps in the local radio network. Once the national music stations were licensed, regional FM stations were licensed to increase choice. The first five regional stations opened in 1994, using spare capacity in the Classic FM sub-band. Between 1997 and 2008, two or three regional stations a year opened in the 105-107 MHz region of the spectrum. A host of small-scale commercial stations, serving smaller towns already covered by city or county stations started over the same period. Many of the smaller stations proved unviable and either closed or merged with neighbouring stations. The last new commercial stations on FM opened in 2010.

In 2001 and 2002, the Radio Authority conducted a new community radio experiment, licensing 16 Access stations, most of which have become permanent community stations, licensed by Ofcom, which replaced the Radio Authority (and other regulators) in December 2003. Licensing of community stations has continued to the present day, subject to frequency availability constraints. There are now over 200 community stations on air. The vast majority use FM frequencies offering reduced coverage compared to those allocated for BBC and commercial stations. A handful use AM frequencies that can offer slightly wider coverage.

The new AM stations that launched in the late 1980s and early 1990s were initially successful. However, although 5 Live and Talk Sport have maintained a strong audience, the music stations on AM have suffered a relentless decline as choice on FM has improved and AM only car radios have fallen out of use. Atlantic 252's successor, Team Talk, only survived a few months and the frequency lay empty for nearly two years before RTE Radio 1 took it over. A number of other long wave proposals were abandoned in the late 1990s and early 2000s. The Radio Authority chose not to launch a national service on 225 kHz, supplemented by medium wave transmitters. Proposals to broadcast to the UK from the Netherlands on 171 kHz, from Norway on 216 kHz and from the Isle of Man on 279 kHz also failed to develop.

## Going Digital

In September 1995, The BBC launched the world's first digital radio service on DAB in the London area, carrying its five national networks with outdoor coverage extended to 60% of the population by mid 1998 as receivers started to become available. A national commercial network, Digital One, launched with five stations in November 1999 as receivers started to become available, albeit relatively expensive. Further stations launched on Digital One in 2000, together with the first local multiplexes. By 2007, local radio multiplexes covering 40 different areas were on air, each typically carrying 8 to 11 stations. Additional regional multiplexes served Central Scotland, the North East, North West, Yorkshire, the West Midlands, the Severn Estuary region and London (2), while coverage of the BBC and Digital One multiplexes had reached about 80%.

Additional spectrum for DAB was allocated in 2006 and licences were awarded in 2007-8 for 12 new local radio multiplexes for previously unserved areas and a third national multiplex. However, the economic recession reduced advertising income, resulting in a halt in commercial DAB development. Digital One was reduced to four stations in 2008 and none of the new multiplexes launched, though services on the local and regional multiplexes continued. Digital One gradually filled up again by 2011, initially attracting minority broadcasters.

In 2012, a decision was taken to abandon the regional multiplexes and invest in the local and national multiplexes. The local multiplexes licensed in 2007-8 launched between 2012 and 2015, with most of the regional multiplexes closing in 2013 (Central Scotland and London continue, while Yorkshire closed in 2015). Some stations broadcasting on the regional multiplexes moved to local multiplexes or Digital One while others closed. In 2015, the third national multiplex was re-awarded to the Sound Digital consortium, which plans to launch in Spring 2016 and a plan to increase coverage of the local multiplexes to 90% (indoors) by the end of 2016 was agreed. Over this time, coverage of the BBC multiplex has continued to grow and will reach 97% (indoor) by the end of 2016.

Digital One is also expanding coverage to 92% (indoor). In 2016, DAB radios were available from £20 and fitted to about 80% of new cars. DAB accounted for 27% of all radio listening in 2015.

In 2007, an improved version of the DAB broadcasting standard, known as DAB+, was adopted. Multiplexes can carry a mixture of DAB and DAB+ stations and all DAB+ radios can also receive DAB. By 2015, most countries had abandoned DAB in favour of DAB+. However, the UK has stuck with the old DAB standard because there are millions of old DAB radios in use that can't receive DAB+ stations. All new car radios and most new portable radios in the UK are compatible with DAB+, though some cheaper portables are not. The first new services to use DAB+ in the UK launched in 2016. Existing DAB stations will eventually switch to the new format, but this is unlikely to happen before 2020.

Internet streaming of radio stations began in the mid to late 1990s. On 19th November 1999, radio services launched on digital satellite TV, adding digital cable the following year and digital terrestrial television in January 2003. In 2014, 5% of radio listening was via digital platforms and 6% via the internet, including mobile apps.

In the long term, the UK plans to end FM and AM broadcasting for the majority of stations. This is likely to happen sometime during the 2020s, though some music stations may leave AM before.

## Appendix A: BBC Radio Transmitters in 1939

### BBC REGIONAL PROGRAMME

Area	kHz Site	kW
<b>London region</b>		
London and South East England	877 Brookmans Park	70
<b>West region</b>		
Devon, Cornwall and Dorset	1050 Start Point	100
South Wales & West England	1474 Clevedon	20
<b>Welsh region</b>		
South Wales	804 Washford	60
North Dyfed and North Clwyd	804 Penmon	10
<b>Midland region</b>		
The Midlands	1013 Droitwich	70
<b>Northern region</b>		
Yorkshire, NW England & Wales	668 Moorside Edge	70
North East, Cumbria & Borders	1050 Stagshaw	120

### Northern Ireland region

Northern Ireland	977 Lisnagarvey	100
<b>Scottish region</b>		
Central and South Scotland	767 Westerglen	70
Aberdeen and East Grampian	1285 Redmoss	5
Northern Scotland	767 Burghead	60

### BBC NATIONAL PROGRAMME

Area	kHz Site	kW
England, Wales, N Ireland	200 Droitwich	150
London, Herts, Essex, S Beds	1149 Brookmans Park	60
NW England & Yorkshire	1149 Moorside Edge	60
Central Scotland	1149 Westerglen	60

## Appendix B: BBC Radio Transmitters in 1946

### BBC HOME SERVICE

Area	kHz Site	kW
<b>London region</b>		
London and South East England	877 Brookmans Park	140
<b>West region</b>		
Devon, Cornwall and Dorset	977 Start Point	120
Central Southern England	1384 Bartley	10
South Wales & West England	1384 Clevedon	20
<b>Welsh region</b>		
South Wales	804 Washford	60
North Dyfed and North Clwyd	804 Penmon	10
Clwyd	804 Wrexham	2
<b>Midland region</b>		
The Midlands	1013 Droitwich	60
Norfolk and Suffolk	1013 Norwich	1
<b>Northern region</b>		
Yorkshire, NW England & Wales	668 Moorside Edge	60
<b>North and Northern Ireland region</b>		
North East, Cumbria & Borders	1050 Stagshaw	120
Northern Ireland	1050 Lisnagarvey	100
Derry area	1050 Londonderry	0.25
<b>Scottish region</b>		
Central and South Scotland	767 Westerglen	60
Aberdeen and East Grampian	767 Redmoss	2.5
Northern Scotland	767 Burghead	60

### BBC LIGHT PROGRAMME

Area	kHz Site	kW
England, Wales, N Ireland	200 Droitwich	200
London, Herts, Essex, S Beds	1149 Brookmans Park	60
Plymouth area	1149 Plymouth	0.5
West Cornwall	1149 Redruth	2
NW England & Yorkshire	1149 Moorside Edge	60
North East, Cumbria & Borders	1149 Stagshaw	10

Central Scotland	1149 Westerglen	60
Aberdeen and East Grampian	1149 Redmoss	2
North Scotland	1149 Burghead	20
Belfast & East Northern Ireland	1149 Lisnagarvey	10
Derry area	1149 Londonderry	0.5

### BBC THIRD PROGRAMME (Evenings only)

Area	kHz Site	kW
Central England	583 Droitwich	40
London	1474 London	2
Brighton and South Sussex	1474 Brighton	0.1
S Hampshire & Isle of Wight	1474 Fareham	1
Bournemouth area	1474 Bournemouth	0.25
Exeter area	1474 Exeter (from 1947)	0.25
Plymouth area	1474 Plymouth	0.5
West Cornwall	1474 Redruth	1
Bristol	1474 Bristol	0.1
Cardiff area	1474 Cardiff	1
Merseyside	1474 Liverpool	0.25
Manchester area	1474 Manchester	1
Preston area	1474 Preston	0.25
Huddersfield area	1474 Moorside Edge	0.25
Leeds	1474 Leeds	0.25
Sheffield	1474 Sheffield	0.1
Hull	1474 Hull	0.25
Cleveland	1474 Middlesborough	0.25
North East England	1474 Newcastle	2
Glasgow area	1474 Glasgow	1
Edinburgh area	1474 Edinburgh	0.25
Dundee area	1474 Dundee	0.25
Aberdeen area	1474 Aberdeen	2
Belfast area	1474 Belfast	0.1

In addition, 167 kHz and 1122 kHz were used for the European Programme

## Appendix C: BBC Local Radio FM Frequencies 1967-1973

Station	Area	MHz	Site	kW	Launched
<b>Radio Birmingham</b>	West Midlands	95.6	Sutton Coldfield	5.5	24/6/1968
<b>Radio Blackburn</b>	East and Central Lancashire	96.4	Hameldon Hill	1.5	24/1/1971
<b>Radio Brighton</b>	Brighton	88.1	Brighton	0.075	14/2/1968
<b>Radio Bristol</b>	Bristol and Somerset	95.4	Mendip	5	4/9/1970
<b>Radio Derby</b>	South Derbyshire and East Staffordshire	96.5	Sutton Coldfield	5.5	29/4/1971
<b>Radio Durham</b>	County Durham	96.8 then 94.5	Pontop Pike	2.6	3/7/1968
<b>Radio Humberside</b>	East Yorkshire and North Lincolnshire	95.3	High Hunsley	4.5	25/2/1971
<b>Radio Leeds</b>	Leeds	94.6	Leeds	0.14	24/6/1968
<b>Radio Leicester</b>	Leicester	95.05 then 95.2	Anstey Lane	0.14	8/11/1967
<b>Radio London</b>	London area	95.3	Wrotham	16.5	6/10/1970
<b>Radio Manchester</b>	Manchester area	95.1	Holme Moss	4	10/9/1970
<b>Radio Medway</b>	West Kent	97.0	Wrotham	5.5	18/12/1970
<b>Radio Merseyside</b>	Merseyside	95.85	Allerton Park	2.5	22/11/1967
<b>Radio Newcastle</b>	Tyneside and Northumberland	95.4	Pontop Pike	3.5	2/1/1971
<b>Radio Nottingham</b>	Nottingham	94.8	Colwick Park	0.14	31/1/1968
<b>Radio Oxford</b>	Oxfordshire	95.0	Oxford	4.5	29/10/1970
<b>Radio Sheffield</b>	Sheffield	88.6	Sheffield	0.03	15/11/1967
	Rotherham	95.05	Rotherham	0.009	
<b>Radio Solent</b>	South Hampshire, E Dorset, Isle of Wight	96.1	Rowridge	5	31/12/1970
<b>Radio Stoke</b>	Stoke-on-Trent area	94.9 then 94.6	Alsagers Bank	2.5	14/3/1968
<b>Radio Teeside</b>	Teeside and North Yorkshire	96.6	Bilsdale	5	31/12/1970

*Paul Groves 2004*

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