The future of radio

Final report

The future of radio

The Swedish Radio and TV Authority 2008

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Preface

The Swedish Radio and TV Authority has followed the developments in the digital distribution of sound radio from a wide perspective for three years by a commission from the Government. The aim was to produce a basis on which to make an ongoing assessment of different technologies, and the commission was carried out in consultation with the radio industry. This report shows the final results.

During the time the Swedish Radio and TV Authority worked with the commission, the starting point was that radio is very important for preserving and developing freedom of expression, diversity, association activities, integration and accessibility to mass media in society. The fact that radio is a significant medium is clear from the large number of listeners, among other things. For a long time radio was the largest of the mass media but in recent years its position has fallen back somewhat, particularly among the younger generation. The role of radio should be developed with a broadened and differentiated range of programmes to meet listeners' demands to be able to choose from a wider selection of programmes and services.

The Swedish Radio and TV Authority's commission is to produce a report as the basis for evaluating different technologies, but not to propose how radio should be distributed in the future. However, the Authority is able to state the importance of Sweden choosing future radio technology that is of benefit to listeners and harmonised with Europe in general.

Many developments have taken place in the field of radio during the commission, both in Sweden and internationally. The future of radio is also being investigated in a public service investigation and a commission on the conditions for commercial radio. The programme companies SR, UR, SBS and MTG have recently stated that they intend to cooperate on issues of technology and distribution in order to give the radio public

access to more channels and thereby create an expanded and broadened diversity for listeners in the whole country. They believe that DAB+ is the technology that currently appears appropriate for digital radio.

Teracom and the National Organisation of Community Radio have indicated to the Swedish Radio and TV Authority that they share the assessment that DAB+ is the most appropriate technology for digitalisation. In summary, thus, there is a broad consensus within the radio industry about the technology for the digitalisation of radio.

We would like to thank everyone who has contributed with materials and viewpoints during the Authority's work with this commission.

Stockholm-Globen, June 2008

Björn Rosén
Director General

Summary

On 19 January 2006, the Government gave the Swedish Radio and TV Authority the commission to monitor the development of digital distribution of sound radio from a wide perspective and to produce reports as the basis of an ongoing assessment of different technologies. The Authority has already presented two progress reports. With the publication of this third report the commission is completed.

For a long time radio was the largest mass media but in recent years it has lost a number of listeners. In contrast, total media consumption has increased. Young people are abandoning traditional media and want to decide on where, when and how they receive media content, for example via Internet and mobile telephones. A consumer survey from spring 2008 shows that 45% of radio listeners want to have more and new functions in their radios. Listeners are most interested in easily being able to select radio stations, to have better sound quality and audibility and to increase accessibility for people with visual and auditory impairments. Listeners also want a wider range of radio channels over the whole country.

Radio needs to be developed to meet consumers' needs, but it is difficult to develop the media of radio in today's FM network. The Swedish Post and Telecom Agency (PTS) shows in their report *Frequency planning the FM band* from 2008 that development would demand a costly and time-consuming re-planning of the FM network, and even that would not be sufficient. Re-planning the frequencies would not release as much space as required and the number of new channels and services could only be marginally increased. New technology creates the necessary conditions for improvements. Players in the radio industry have agreed that a main digital platform for the distribution of radio broadcasts is needed, and are seeking clear and unambiguous rules for licences. They are also in agreement that the FM network should not be abandoned too early but be used instead for parallel broadcasts and more local and community radio broadcasts, for example.

There are several different technologies for digital radio which make it possible to broadcast through the digital TV network, over the Internet, via mobile telephone networks and also, in the long term, via the FM network. Most European countries have introduced various digital radio technologies or are carrying out tests. A nationwide digital radio network in Sweden would be created most rapidly, simply and cheaply in the frequency space intended for digital sound radio. PTS was given the commission by the Government to bring about the conditions for digital radio in Sweden, and the frequency area is already planned and harmonised with the rest of Europe. There have been test broadcasts using the digital radio technology Digital Audio Broadcasting (DAB) since 1995. Large parts of the DAB network are already in place.

The largest players in the radio industry believe that DAB+ is currently the most suitable technology for nationwide digital sound radio in Sweden. DAB+ is an upgraded version of the tried and tested DAB standard and can provide space for about 80 nationwide radio channels in the planned frequency space. In common with DAB, DAB+ is standardised and harmonised with the rest of Europe. It is important to consider developments in Europe when choosing technology. The technologies that Sweden selects for media distribution should be standardised by European standards organisations and should be used in the frequency spaces that are planned and harmonised with other countries in accordance with international agreements. A common digital radio technology in Europe is also a prerequisite for a wide range of radio receivers at reasonable prices.

Innehåll

1 Commission

1. Commission

The Swedish Radio and TV Authority has been given the commission by the Government to follow the development of digital distribution of sound radio from a wide perspective and to produce reports as the basis of an ongoing assessment of different technologies. The Swedish Radio and TV Authority has carried out the commission in consultation with Swedish Radio (SR), Swedish Television (SVT), the Swedish Educational Broadcasting Company (UR), SBS Radio and MTG Radio, as well as other companies and organisations in the radio and television industry, the authorities affected and other relevant players.

The Authority has continuously collected information for the Government about different technologies. It is important to emphasise that the Authority's commission was not to judge or take a standpoint on any single technology that should be used in the future, but to gather information from a wide perspective as the basis for an evaluation of different technologies.

The Swedish Radio and TV Authority started the commission in January 2006 and since then has followed the technical development of digital distribution platforms for radio. The Swedish Radio and TV Authority has submitted two progress reports to the Government and the commission will be completed with this final report.

The final report summarises the development of different digital technologies for distributing radio and provides a description of how players in the industry view future developments for radio.

The future of digital radio has previously been the subject of a two-stage investigation. In April 2002 a special investigator submitted an interim report *Digital Radio, survey and analysis* (SOU 2002:38). This interim report was the factual basis for the parliamentary committee given the commission to consider the future

of digital radio. The committee submitted its final report *Digital Radio* (SOU 2004:16) in February 2004. The committee proposed a stage-by-stage expansion of DAB (Digital Audio Broadcasting), with the option for private radio to start broadcasts. Since spring 1995, SR and UR have been granted licences to carry out trial broadcasts using DAB technology. During spring 2008, MTG Radio conducted trial broadcasts for two weeks using DAB technology.

2

Method

2. Method

Since the Swedish Radio and TV Authority was given the commission in January 2006, the authority has continuously studied the development of digital distribution of radio.

The starting points for the final report are the Swedish Radio and TV Authority's first and second progress reports on the future of radio, published on 30 June 2006 and 30 June 2007 respectively.

Progress report 1 describes different radio technologies, while progress report 2 evaluates and compares the different technologies. The final report summarises the development of digital technologies over the three years during which the commission has been carried out. It also illustrates opinions within the radio industry about how radio should be distributed in the future.

In February 2008 AB Stelacon was given the commission by the Swedish Radio and TV Authority to make an in-depth survey and analysis of the latest developments. Stelacon has collected data partly from generally accessible sources, partly from questionnaire surveys, about 20 in-depth interviews and a number of supplementary interviews with relevant players. Stelacon has also carried out a consumer survey with questions about digital radio to 1000 households. Read more about the results of this survey in Chapter 6 *Consumers' habits and wishes*.

The Swedish Radio and TV Authority carried out a second workshop with players from the radio industry and interested parties in spring 2008. The aim of the workshop was that the radio industry as a whole would be given the opportunity of discussing the digital distribution of radio, and if possible to reach agreement on certain issues. Results from the questionnaire surveys, interviews and workshops are found in each respective section of this report.

Players interviewed and/or participating in workshops were:

- Programme companies: MTG Radio, SBS Radio, Swedish Radio (SR), Swedish Educational Broadcasting Company (UR), Swedish Television (SVT), Radio development in Sweden
- Companies and organisations: Teracom, National Organisation of Community Radio, SES Sirius, Factum Electronics, Ericsson, Boxer TV-Access, Digital Radio Express/Broadcast Partners, iBiquity Digital Corporation, The DRM Consortium, Swedish Media Services, Network of Community Radio in Sweden, Community Media Forum Europe
- Other players: Mitsubishi Electric, Elektronikbranschen, the Swedish Post and Telecom Agency, the Swedish Performing Rights Society, Handisam, the National Board for Psychological Defence, the Public Service Commission.

In its work with this commission, the Swedish Radio and TV Authority has had contact with media authorities in different European countries. The Authority is a member of the international organisation European Platform of Regulatory Authorities (EPRA). In EPRA meetings members discuss and exchange experiences and ideas about radio and television licensing among other issues, but cooperation also includes sharing information about the development of media in different countries. The Swedish Radio and TV Authority has received valuable information at these meetings about digital radio in other European countries. The Authority also participates annually at meetings with the Nordic content and licensing authorities in the media area, which has provided information for the report about conditions in our neighbouring countries. This information has been supplemented through contacts with the responsible media authorities in each country.

The Swedish Radio and TV Authority has had continuous contact with the 2007 investigation on commercial radio and the public service investigation *Radio and TV as a public service*. The reports from these investigations will be submitted to the Government on 13 November 2008 and 30 June 2008 respectively.

3

Starting points

3. Starting points

Radio currently exists in many different forms and utilises many different distribution platforms. Such will no doubt be the case in the future, too. But one important issue to consider before any possible shift of technology is whether radio needs one particular main form of distribution or whether it should be distributed via several supplementary digital technologies.

The Swedish Radio and TV Authority has chosen to evaluate the different technologies on the basis of the following questions:

- How well does the technology satisfy consumers' needs?
- What functionality does the technology offer?
- How efficiently does the technology utilise the available spectrum?
- What financial conditions are available for the technology?
- How will the technology reach the Swedish public?
- When can the technology be put into operation?
- What do plans look like for the technology in the rest of Europe?

The commission will also illustrate the following aspects that are important to consider in the digitalisation of radio:

- security and preparedness – important public announcement (VMA)
- accessibility for disabled people and groups belonging to linguistic minorities
- frequency aspects, as well as possibility of local and regional divisions

- environmental aspects
- copyright issues.

One of the most important criteria is whether the technology in question is standardised in Europe. Technologies that are not standardised or that will not be standardised in the near future are considerably less significant as a form of distributing radio. It is not appropriate that Sweden, with its relatively small population, acts differently from other European countries. Manufacturers of radio receivers need to know that they have a sufficient number of potential buyers for their products before they can start production of a certain type of receiver. Technologies that Sweden chooses for the distribution of media should therefore be standardised by European standards organisations so that the technology can be implemented in frequency spaces planned and harmonised with other countries in accordance with European agreements. The standardisation process for a technology may take several years.

The time factor is also an important criterion, since many players in the radio industry believe that a development of the radio medium must start more or less immediately. Experience from previous shifts of technology in Sweden show that it takes many years before they are completely implemented; 10–20 years is not uncommon.

How well a technology can satisfy consumers' needs is assessed by how portable the radio receiver is, what selection of radio channels and what functions the technology can offer, and accessibility for listeners. The radio receiver needs to be portable since the option of taking it along and listening while moving are important functions for the consumer. The number of channels and functions are an overall appraisal of the possibilities for programme companies to increase their range of programmes, the ability to develop new functions in the radio and broadcast programmes with high audio quality. Radio must be accessible for all listeners, including people with impairments and those belonging to linguistic minorities.

The ability to reach the public of Sweden over the entire country, the degree of coverage, is an important criterion – especially if a digital radio network is to be capable of replacing the analogue FM network in the long term. The different technologies must have a high surface coverage without too large investment costs. Financial conditions for each technology are based on costs for broadcasting and costs for the consumer. Costs for broadcasting are the estimated costs for coverage to the same number of Swedish people as the present FM radio per radio channel, including costs for constructing and operating the network. The costs for the consumer are what the consumer pays for a radio receiver to be able to listen to programmes that utilise different technologies, and possibly subscription and traffic charges. The ability to send important public announcement (VMA) depends on how good the conditions are for each technology to reach the entire population with important messages in extraordinary circumstances.

4

Radio in change

4. Radio in change

The role of radio in society

The aim of the Government's media policy is to support freedom of expression, diversity and the independence of and accessibility to mass media, as well as to combat harmful elements in mass media.

The role that radio will play in Sweden in the coming years is an important issue to consider in discussions about which technology can best distribute radio in the future.

The fact that radio has an important role in society can be clearly seen by the number of listeners. According to the SIFO Research International public survey in spring 2008, about 74% of Swedes between 9–79 years old listen to the radio at least five minutes every day. If we compare the time that Swedes spend on different media, radio now shares first place with television, after having been the largest mass media in the past. Radio has lost a number of listeners over a long time period at the same time as the total consumption of media is increasing. Read more about consumers' radio habits in Chapter 6, *Consumers' habits and wishes*.

The medium of radio has many positive characteristics for listeners. It is

- free from subscription charges
- simple to use
- possible to listen to everywhere, including sparsely populated areas and while in movement in cars and trains
- possible to listen to while doing something else
- important as a channel of information, especially in crises and catastrophes
- an important medium for traffic information, shipping and mountain rescue.

The media habits of consumers are changing. Today's media consumers increasingly want to influence what information they consume, as well as where and when. They are used to being able to choose among a large selection of subjects, formats and channels, whether it concerns television, radio, printed media or the Internet. Young people listen to and use traditional media less and less, to the benefit of social media. The term "prosumer" is used, meaning those who both produce and consume media. Read more about media developments in the The Swedish Radio and TV Authority's report *Media developments 2008*.

Radio needs to be developed to satisfy the needs of future consumers. Programme companies and other players in the radio industry wish to increase and differentiate what they offer so that consumers can choose from a larger number of programmes and services. This increase will include the broadcasting of sound, text and pictures, and will offer the option of listening to a certain content on demand and the creation of more channels and better audibility.

The majority of these changes require access to a new digital form of distribution.

Radio as a public service

The fundamental concept behind radio and television as a public service is that all citizens can access a broad and diverse range of television and radio programmes of high quality in all genres. SR's current broadcasting licence states that at least 99.8% of the Swedish population must be able to receive its analogue broadcasts. Whether or not this demand on coverage will continue to be a condition for a broadcasting licence has great significance for the platform from which radio will be broadcast in the future.

A commission with the task of looking over the conditions for public service was appointed on 31 May 2007 and will report at the latest by 30 June 2008. The investigating body will have contact with the Swedish Radio and TV Authority, among other organisations.

Commercial local radio

Commercial local radio is completely dependent on advertising revenue for its operation. Commercial conditions are therefore very important to consider when digitalising radio.

Since it started in 1993, commercial local radio has found it difficult to achieve profitability. It has had problems with low transmitter power, which has resulted in certain channels being unable to be heard or only heard poorly in some areas. Licence fees are perceived as being too high. To enable an increase in advertising revenue, commercial local radio wishes to broadcast advertising radio channels in more areas of the country than is currently possible in the FM network.

Advertising radio channels in the USA have been the main financing method since radio broadcasting started in the 1920s and it has gradually grown in Europe since the first broadcast was financed through advertising in 1933.

Commercial local radio has an interest in digitalisation if there is a clear commercial advantage. Advocates of local radio are keen on all players in the radio industry, both commercial local radio and public service, having the same conditions for

- the number of channels
- national broadcasts
- transmitter power
- costs.

The drawbacks of digitalisation are the initial investment costs, costs for parallel broadcasts and the uncertainty of revenues.

An investigation (the 2007 investigation into commercial radio) with the commission of looking over the conditions for commercial radio will submit its final report in autumn 2008.

Non-profit community radio

In Sweden there are about 1000 associations with a licence to broadcast non-profit community radio divided between 160 areas. The main rule for community radio is that broadcasts must cover one municipality, but The Swedish Radio and TV Authority may decide on larger broadcasting areas if there are special reasons for doing so. Several of the digital distribution technologies treated in this report are not adapted to transmission networks that are locally divided with areas of coverage as small as one municipality, but the L band, with frequencies around 1.5 GHz, can be used for broadcasts to smaller areas. In the changeover of technologies, community radio would be mainly affected by the size of the broadcast area, since a terrestrial digital radio frequency would probably not be divisible into such small areas as one municipality. Community radio broadcasting areas would therefore need to enlarged and adapted to the digital broadcasting area.

According to representatives of community radio, association activities in Sweden have changed during the last 10 years and associations now have members beyond the borders of one municipality. In rural areas the movement of people towards urban areas has resulted in associations being too small for one municipality, and in the major cities there are many members of associations that are spread over several municipalities, since they work in one municipality and live in another. The Swedish Radio and TV Authority proposed in the report *Community radio and Community Television in Focus* that it must become easier than at present to have expanded transmission areas for community radio.

According to advocates of community radio, it will require the following elements when it is digitalised:

- a common set of rules and regulations for all parties working in the radio industry
- a division of areas that reflects activity areas of associations
- a financing solution that will enable community radio to change to a digital platform.

5

Important aspects in the choice of distribution platform

5. Important aspects in the choice of distribution platform

Security and preparedness

Radio and television are part of society's warning, alarm and information systems. In times of crisis and catastrophe radio is extremely important for alarms and handling crises, both in terms of spreading information to the public and the general process of decision-making in society. In the case of the storm named Gudrun in 2005, radio news was important for those households without electricity that were physically inaccessible. Many of those affected listened to news on SR's local channels and to the broadcast of important public announcements (VMA).

SR and SVT are both obliged by their licence conditions to transmit messages of importance to the general public without cost if an authority so requests. The most important warning and information systems are important public announcements, messages from authorities and nuclear power plant alarms. In addition to public service radio and television, commercial local radio and several private television channels have made agreements to transmit important public announcements. To enable these messages to be broadcast rapidly and efficiently, SOS Alarm centres and SR have important key roles.

In 2007 the Swedish Rescue Services Agency (SRSA), the authority responsible for important public announcements, carried out an overall review of the messaging system. This review is summarised in an investigation which proposes that the system be retained in general terms but that its use should be widened.

SRSA has also looked into the possibility of supplementing the current messaging system with text messages (SMS) via the mobile network so that subscribers can

receive them in their mobile telephones. However, there are a number of technical limitations in the current SMS system that make it less suitable for broadcasting important messages. The greatest of these is the problem of reaching many subscribers simultaneously, and it is difficult to send one message to all mobile telephones that are in a clearly defined geographic area.

The SRSA investigation proposes that a supplementary texting system be introduced for registered services for people with impaired hearing or others with limited prospects of receiving warnings by radio or television or warning signals outdoors. The investigation proposes that at some point in the future a nationwide warning system be introduced via mobile telephones as a complement to the current important message system. The technology known as Cell Broadcast should be further investigated for this purpose. Cell Broadcast is a technology that enables a message to be sent to all mobile telephones within a certain area. Cell Broadcast is suitable for sending warning and information messages without delay, since it does not have the technical limitations that conventional SMS technology has.

SRSA also proposes an overall investigation of the warning system from the wider perspective. For example, the possibility of distributing warnings via Internet should be investigated. At present there are no warnings transmitted through SR or any other radio company's Web radio broadcasts, which is an increasing drawback since more and more people listen to Web radio stations.

SRSA believes that all distribution forms for radio should transmit warnings. At the same time, SRSA points out the importance of considering the different levels of technical suitability that different distribution forms have. Forms of distribution vary in their capabilities of broadcasting warnings and in their controllability from an access and security perspective. The new forms of distribution should therefore be seen primarily as a complement to the present system for warnings, messages from authorities and nuclear power plant alarms.

The FM network operates very well from a warning and security perspective since it is a robust network with high reliability that can reach many people over a large area. Long-term power cuts or disruptions in electronic communications are examples of threats that media companies take into consideration when they plan for security and preparedness in the transmission network. A decisive factor for high readiness is access to reserve power and redundant connections, i.e. switchable reserve paths. It is important to plan for continued high security and preparedness before any changeover of technology is made.

Accessibility

One fundamental principle for radio and television in public service is that the programmes must be able to be received by the whole population on equal conditions. Different types of support services are required if people with impairments are to be able to understand radio and television broadcasts to the same extent as others. Digitalisation of radio, irrespective of the technology used, provides more space and the possibility to continuously develop accessibility. Development of the FM network is strictly limited as a result of capacity shortage. Digitalisation would therefore improve the options for people with various impairments to have access to radio programmes and services.

It is important that any person who requires support is able to choose, at the same time as nobody is forced to accept support unwillingly. General radio solutions should offer as many useful functions as possible for people without impairments too, for example good audibility and texting of speech.

Between 40 and 45% of radio listeners in Sweden are quite or very interested in radio functions that will increase accessibility, such as text for radio programmes and spoken information about radio settings. Stelacon's consumer survey

from 2008 shows the extent to which radio listeners are interested in different functions on the radio.

Here are a number of possible support services for people with physical impairments:

- Good audibility and clear reading are important for people with impaired hearing, but also for listeners with good hearing that listen to the radio in noisy environments. Background noise is one of the most difficult barriers to listening to a programme. To improve sound quality it is necessary to use adequate technique and planning in the production stage, as well as technology to filter out unwanted noise. Some technologies, such as DAB, are able to "3.1 sound filter" a special speech channel with improved audibility as a result.
- Text interpretation of sound that is not normally texted is important for people that have become deaf as adults and cannot use sign language. Text interpretation means that all speech is texted, and that sounds that are not normally texted are also texted or described in text with another colour. New technologies for converting speech to text are under development.
- Sign language interpretation of sound on radio and television is important for deaf people. Sign language interpretation means that all sound that is heard is interpreted to sign language, which in turn requires the facility of showing pictures. One precondition is that the image is sharp and that it is able to show fast hand movements and the interpreter's changing facial expressions movements in a clear fashion.
- The reading aloud of Swedish text for texted TV broadcasts is important for dyslexics and the visually impaired. Reading of texted TV broadcasts means that everything texted is read aloud and could be broadcast on a radio channel.

- Visual interpretation of TV content is important for the visually impaired. Visual interpretation means that information that is only conveyed graphically is read aloud or explained so that the content could be broadcast on a radio channel.
- Functions that allow a programme to be saved and moved for later consumption, including support functions, are something that many listeners ask for.

Digital radio can provide conditions that facilitate using a radio for the visually disabled and visually impaired through voice feedback technology, which means when a channel is selected by the user a voice message gives information about the channel selected and the programmes it contains, for example.

For disabled people to have access to radio and television channels, it is necessary that

- all programmes are supplied with text
- audibility is improved
- conditions are created that will enable the widespread use of support functions such as visual interpretation, sign language interpretation, text interpretation and reading aloud of text directly to the programmes being broadcast.

The accessibility of radio for linguistic minorities is limited at present by channel space. Digitalisation, with more possible radio channels and services as a result, means that the interests of the entire population can be better satisfied.

Frequency space

The radio spectrum is divided into different bands for different areas of use according to the regulations of the International Teleunion. PTS then allocates frequency licences based on the Act on Electronic Communication, with the starting points being the regional agreements that exist such as Genève 84 for the FM band. Radio channels are allocated different frequencies in different broadcasting areas after due consideration to frequency planning and agreements with Sweden's neighbouring countries. This is to prevent different radio channels from interfering with each other.

Analogue sound radio has been broadcast on the AM band since the 1920s. In the 1960s most radio broadcasts were changed to the FM band. The reason for this change was to improve sound quality and add more possible channels. In the mid-1980s the FM band was re-planned in accordance with Genève 84, a regional agreement on analogue allocation within the FM band. Frequency planning has not been significantly changed since then.

The Government decided at the beginning of the 1990s that the Swedish Post and Telecom Agency (PTS) should also make plans for digital radio. In accordance with European harmonisation and the regional agreements Wiesbaden and Machstricht, in 1995 PTS planned for digital radio in band III, i.e. the frequency area of 174–230 MHz which was later expanded to cover 230–240 MHz as well, and some years later in the L band, i.e. around 1.5 GHz. Since 2006 the regional agreement Geneve 06 applies to band III.

There is space for four digital radio networks (multiplexes) in band III and one network in the L band. The digital radio networks in band III are planned as national or regional networks with 20–34 transmission areas. The L band is planned for 93 areas and is suitable for community radio. Another division would demand re-planning these agreements, or alternatively that the neighbouring countries

affected approve deviations from agreements. The EU Commission has recently earmarked the L band as suitable for use by multimedia services. They are able to influence the chances of using this band for community radio.

The radio industry wants access to more frequency space for more radio channels and more national networks. On commission from the Government, PTS investigated the possibilities of releasing frequencies for further nationwide sound radio broadcasts on the FM band in 2007–2008. The report *Frequency planning the FM band, PTS-ER-2008:6*, shows that there are some possibilities for a new nationwide network. To create the extra space required however, detailed and resource-intensive frequency planning must be made in Sweden which is also harmonised with neighbouring countries affected. The investigation also shows that large investments will be necessary to introduce one further nationwide network, even for existing players.

Both PTS and players in the radio industry consider that the frequency space in band III should be sufficient for an increase in public service broadcasts, commercial local radio and community radio. Using the digital radio technology DAB, between 6 and 9 channels can be broadcast per multiplex and with DAB+ this figure goes up to 24 channels. Frequency space is already allocated and trial broadcasts using digital radio have been ongoing since 1995. This means that ordinary digital radio broadcasts could be started almost immediately. But depending on the coverage to be achieved, it may be necessary to make certain adjustments to the utilisation of frequencies. PTS and Teracom believe that there is no problem in providing coverage to 98% of the population, but that a review of frequency planning and an extension of the transmission network will be required to achieve coverage for 99.8% of the population. Depending on which broadcasting areas commercial local radio and community radio want to have, some adaptation of the frequency planning will be required. The European organisation for cooperation, the European Conference of Postal and Telecommunications Administrations (CEPT), is discussing a possible

future digitalisation of the FM band, which in the longer term could lead to re-planning. CEPT is expected to submit a report about this in autumn 2009.

Environmental aspects

A digital transmission network for radio consumes considerably less energy than the equivalent analogue network. Only one third of the output power is required for digital broadcasting. But the environmental gains or losses of digitalisation depend on how long radio programmes are transmitted simultaneously in analogue and digital form, and how many channels are transmitted in the digital network.

According to calculations by Teracom in 2002, a DAB network consumes as much energy as an FM network with one channel. Theoretically, energy savings of 75% are possible compared with current electricity costs for the FM network, and still there would be space for more channels. The difference in annual energy consumption according to Teracom's calculations would be about 16–17 GWh, which is the equivalent of the Swedish consumer agency's standard for 8,500 apartments (3 rooms and kitchen). But to achieve an absolute gain in energy, one of today's four national FM networks must be closed down.

The purchase of new digital radio receivers by each household will also lead to an environmental load that should be taken into consideration.

Copyright issues

Copyright issues have great importance in the digitalisation of radio, particularly when a programme company makes music available on several parallel platforms. The digitalisation itself has no significance for copyright since the same rules apply whether a radio programme is transmitted in digital or analogue form.

Copyright is the right that an author, composer, artist or other creator has to his works. Copyright also applies to certain associated rights, among which there are artists' rights, phonogram producer's rights and radio company's rights. The fees that programme companies pay to broadcast music protected by copyright must be paid separately per platform, such as when the main broadcast on the FM network is also broadcast via the Internet or to 3G mobile phones.

Programme companies are very critical towards paying several times for the same transmission. According to the programme companies, they offer listeners the same content on several different distribution platforms to enable listeners to decide where and when they listen. From the viewpoint of the programme companies there is no difference between the same listener having access to several different FM receivers or several different distribution platforms. Many of the players interviewed see copyright proprietors' demands for multiple compensation as a threat to the growth of new digital distribution platforms.

The organisations that represent authors, artists and record companies consider that copyright is very clear for parallel broadcasting by media. Copyright demands that a separate agreement is made and that compensation is paid for every form of distribution that makes music accessible to the public. Organisations believe that the issue that should be discussed instead is compensation levels. The Swedish Performing Rights Society (STIM) represents authors and publishers and has the task of spreading music to as many listeners as possible. Their ambition is also to assess every medium's commercial value, the music on offer (the amount of music) and the number of potential and real listeners, and then set a reasonable level of compensation based on these factors. The International Federation of the Phonographic Industry (IFPI), which represents record companies, reasons in a similar way.

6

Consumers' habits and wishes

6. Consumers' habits and wishes

The radio public in Sweden

For almost a century, radio has been the largest and most important mass media for the people of Sweden. Technology has moved forwards and it is now possible to receive radio, television and daily newspapers at any time of the day or night. Yet there are slightly fewer radio listeners and readers of daily newspapers than in the past, at the same time as more and more people use Internet.

According to SIFO polls, about 74% of Swedes from 9–79 years old listen to the radio for at least five minutes every day. SR reaches 46% and commercial local radio reaches 33% of the population, while about 3% listen to community radio. At the same time, people's media consumption is changing slowly. During the last 10 years the number of Swedes who listen to the radio for at least five minutes per day on average has decreased by about 5%. Swedes also listen for a shorter time now compared with 10 years ago.

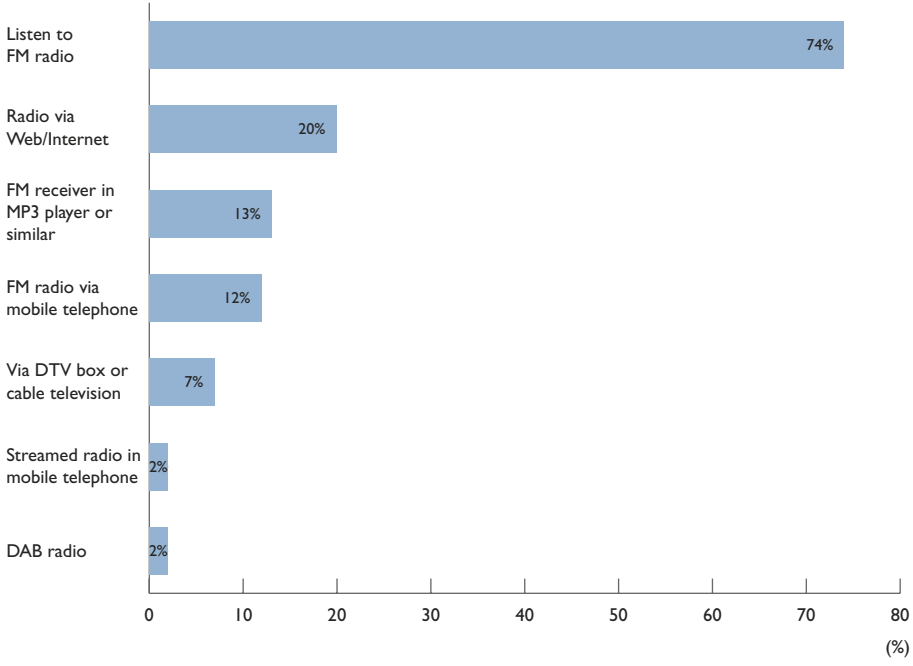
Radio habits depend mainly on age rather than gender, education or income. According to SIFO polls, a larger proportion of people under 35 listen to commercial local radio, while SR attracts most of the older radio listeners. It is mainly younger people between 20 and 34 that have reduced the time they spend listening to the radio. Ten years ago 81% of the population listened to the radio whereas the corresponding figure today is only 68%. This decline affects SR channels and commercial local radio alike. Most people listen to the radio at home and in the car, but people listen longest at home and at work. Listening to the radio in the car has increased steadily in recent years.

The number of FM radio stations varies in Sweden with geographic location. There are the highest number of stations in the major cities while there are fewer in sparsely populated areas. On average, Swedes listen to fewer than two radio channels in one day and no more than three radio channels per week. Radio stations can be consumed through several new methods of distribution: Internet, cable, terrestrial and satellite television and the mobile telephone network. It is becoming increasingly important for radio companies to use parallel distribution technologies.

Despite the development of distribution, traditional FM technology still dominates the picture (figure 1). Next comes listening to the radio via Internet. From programme companies' point of view, the Web is seen as an important second distribution method for their broadcasts, but the growth of Web radio in terms of streamed live radio has reached a plateau. Every week approximately 20% of Swedes listen to Web radio. According to SIFO listener polls, 3.5% of Swedes listen to Web radio on an average day. The number today is the same as two years ago.

References in this section to the *Stelacon survey* refer to the investigation *Individbussen 2008*.

Figure 1. Listen to the radio at least once a week via different distribution and reception methods, 2008.



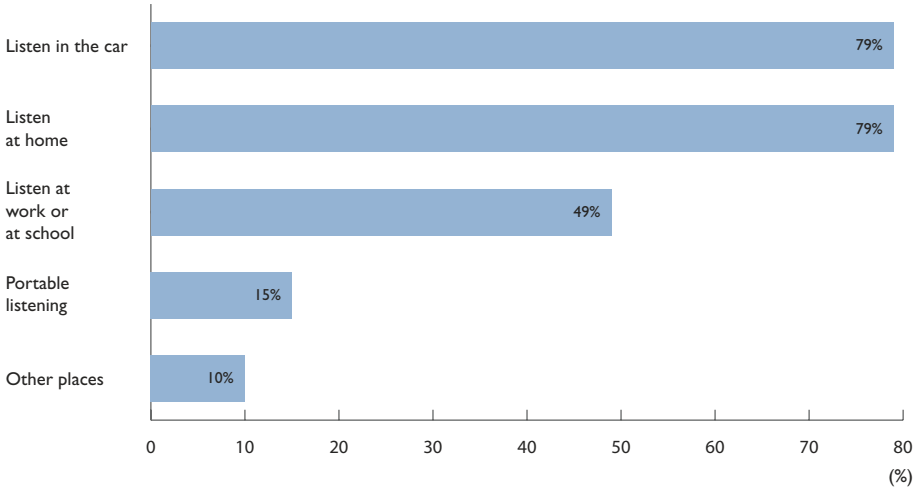
Basis: 1000 people, 16–74 years old.
Source: *Individbussen 2008*, Stelacon

In recent years the number of mobile telephones with inbuilt FM radio receivers has increased. This means that an increasing number of people constantly carry a radio receiver with them. An FM receiver as a function in a mobile telephone is valued highly among purchasers and is the most widely used function after telephone calls and messaging services.

Streamed radio in mobile telephones is based on the same technology as Web radio and makes possible a similar range of live and recorded radio programmes. Listening to streamed radio in a mobile telephone means that consumers are generally paying for the amount of information transferred, and this probably limits the interest of consumers. SR has achieved their highest number of listeners when they have had specially produced live broadcasts of sporting events.

It is estimated that 2% of Swedes listen to DAB radio during any one week, according to the Stelacon survey, but the information is uncertain. The coverage of DAB broadcasts has been limited to Stockholm, Göteborg, Malmö and Luleå for a number of years and the uncertainty of the future of DAB technology has hardly encouraged more people to purchase DAB receivers.

Figure 2. Proportion of people who listen to the radio at least once a week, by place, 2008.



Basis: 1000 people, 16–74.
Source: *Individbussen 2008*, Stelacon

Listening to a programme after the broadcast has become far easier thanks to digital technology. For example, it is possible to listen afterwards on Internet or save a programme as a file in a computer or MP3 player, so-called pod radio. According to programme companies an increasing number of people listen to radio programmes after broadcast, and in the Stelacon survey 6% say that they listen to downloaded radio programmes at least once a week.

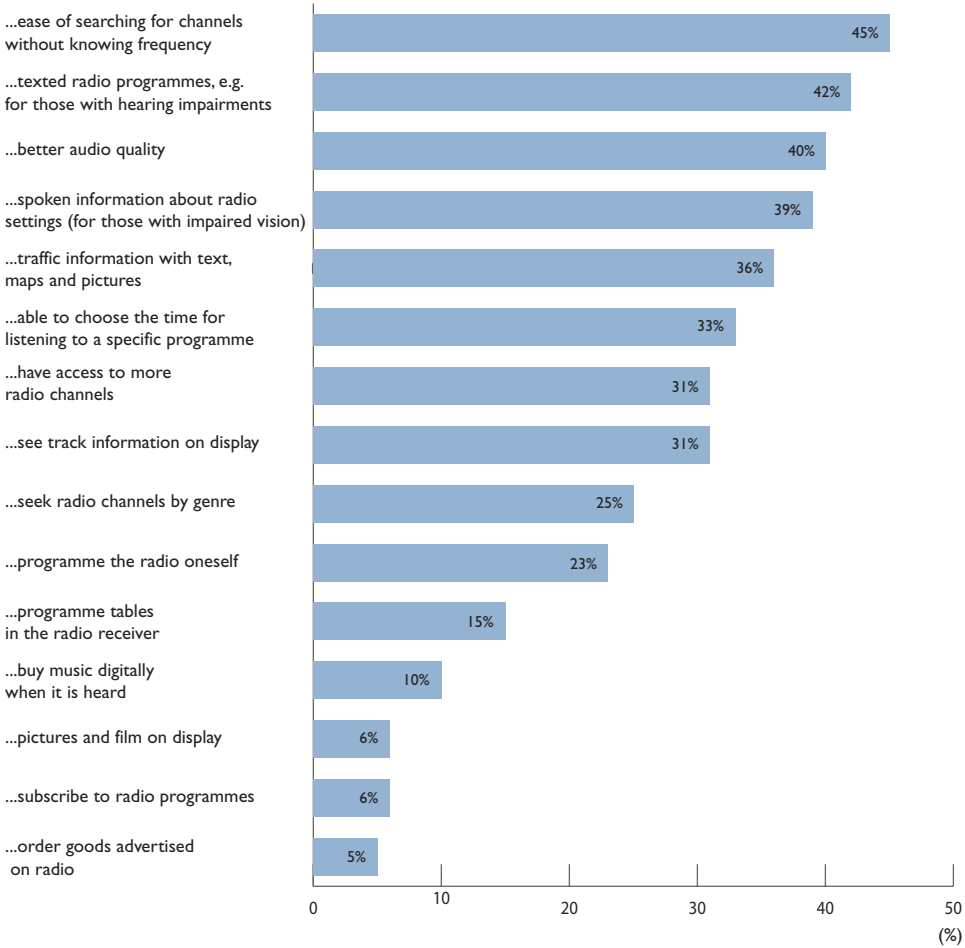
Interest in new radio functions

New technologies for radio distribution enable new technical functions for the radio medium. The Stelacon survey showed that there is generally a large interest in new, improved functions in radios. Radio needs to be even simpler to use and more accessible for consumers. Everybody who participated in the survey greatly valued improved accessibility for people with impairments. There is also a great demand for improved sound quality and a larger number of radio channels.

The survey shows that the digital functions most highly appreciated are to

- be able to search for a station without knowing the frequency
- receive texted radio programmes (for those with impaired hearing, for example)
- receive better audio quality
- hear spoken information about radio settings (for those with impaired vision, for example)
- receive traffic information with text, maps and pictures
- be able to choose the time for listening to a specific programme
- have access to more radio channels
- see track information on display.

Figure 3. Proportion of people quite or very interested in different radio functions, 2008.



Basis: 1000 people, 16–74.
Source: *Individbussen 2008*, Stelacon

The Stelacon survey shows that Swedes want simplicity. The most important thing for radio listeners is the ease of searching for and finding radio channels. Similar results have been noted in English studies, which have also shown that DAB radio users very much appreciate access to more channels, audio quality and better reception. Most people see radio as a self-evident medium, which should not be more than the press of a button away and not cost anything extra. Several studies, both Swedish and international, show that consumers' common perception is the importance of being able to listen to radio wherever they are, and that it should be free.

There are over one million people in Sweden with some form of hearing impairment and about 180,000 with impaired vision. The survey shows that functions such as texted radio programmes, better audio quality and spoken information about radio settings are important for consumers in all age categories, whether they have impairments or not. These functions become more important the older people are. Better accessibility has a great significance for people with impairments so that they are able to receive programmes. Better accessibility may also mean that radio programmes are texted, for example, or that more channels can be used to satisfy needs among ethnic and linguistic minority groups. Read more about accessibility in *Accessibility for people with impairments* (Chapter 5).

The radio is a rapid information source for motorists in the case of accidents or congestion. Many people feel that more information in the form of text, maps and pictures would be positive. As more and more people listen to the radio in their cars, the value of traffic information is probably rising.

Players in the radio industry believe that radio needs to be developed and more channels made available. In the Stelacon survey roughly one third of Swedes say that they want more radio channels. The greatest interest is in Göteborg and the least interest in Stockholm, which currently has the most radio channels in Sweden.

Interactive functions such as buying music and subscribing to radio programmes attract a small number of Swedes. Such functions are interesting for people under

30. Interest in the new functions decreases with age, and interest drops rapidly among those over 50.

There are no great differences between SR listeners and commercial local radio listeners in terms of interest in new functions. However, if radio listeners and non-radio listeners are compared, non-listeners are considerably less interested in new functions for radios. It may well be premature to believe that new functions will immediately attract new groups of listeners to the radio. It is more often active radio listeners that are interested in new radio services.

The market for receivers

On average there are six radio receivers in every Swedish household. The Stelacon survey shows that approximately 13% of the population is interested in buying a new radio with digital functions. The interest is greatest in the age group 30–39 and among men.

All technologies for the digital distribution of sound radio require that listeners purchase new receivers that are adapted to the specific technology.

Today there is a large number of DAB receivers in different price brackets on the world market. In May 2008, the least expensive cost around SEK 400. The average price that interested consumers are prepared to pay for a new digital radio receiver is SEK 1,200, which translates to a market value of approximately SEK 650 million.

Only a few receivers could handle DAB+ in May 2008 according to the World DMB forum. At the same time, the British radio manufacturer Pure claims that their new models will be upgradeable to DAB+ at the end of 2008, and that all DAB radio receivers launched in 2009 will be able to receive DAB+ broadcasts.

At present there are no radio receivers for the technologies of HD radio, FM-eXtra or DRM on the Swedish market and the range of products available is very small in the rest of Europe. Receivers for DRM+ are estimated to be available in 3–4 years' time.

Today there are radio receivers that can also be connected to the Internet and receive a large number of Web radio stations. There are an increasing number of new radio receivers that can receive several different forms of broadcast, such as FM and DAB.

In summary, then, the Stelacon survey shows that

- every second Swede wishes to have a radio receiver in their next mobile telephone
- more people listen to FM radio than use Internet on their mobile telephone
- the interest in streamed live Web radio is not growing as rapidly as earlier
- younger people use newer platforms and receivers
- 45% want more, new functions in their radios
- 13% are interested in buying a new digital radio receiver
- purchasing interest is greatest among 30–39 year olds
- those that are interested are prepared to pay on average SEK 1,200.

7

Sound radio-based technologies

7. Sound radio-based technologies

Four categories of distribution systems for radio are presented in this and the following sections: sound radio-based technologies, television-based technologies, mobile telephone-based access technologies and broadband-based access technologies.

Analogue FM broadcasting

Analogue FM radio covers virtually the whole of Sweden. 99.8% of Sweden's population is able to listen to the radio and the analogue FM network covers 90% of the area of Sweden. But the network does not have sufficient space to develop radio, to add many more channels and new functions/services.

The great advantages of the FM network are that it can reach almost the whole population, cover large parts of Sweden and is robust and has high reliability. Thanks to these characteristics, people in sparsely populated areas are able to listen to the radio, as are people travelling over long distances on roads and along the coast. The FM network also functions well for the purpose of transmitting important public announcements.

Consumers are generally satisfied with analogue FM radio as its operates today. It is cheap, has good coverage and mobility and gives access to traffic information and warning messages. It is also easy to access radio receivers.

The disadvantage of the analogue FM network is above all its lack of capacity and thus its inability to develop, add more channels and new services. Some players in the radio industry believe that re-planning the FM network would provide more channels so that the medium of radio can continue to develop pending digitalisation. But according to PTS this would be both costly and time-consuming. Read more about frequency planning in the section *Frequency space* (Chapter 5).

The FM network must be continuously upgraded and Teracom is making ongoing investments into this area. Large parts of the network have already achieved their technical and financial lifespan of 15–20 years. SR has a broadcasting licence for four sound radio channels which must be able to reach 99.8% of Sweden's population, of which one is regionally divisible. The analogue FM network has been successfully expanded since 1955 to cover 90% of Sweden's area. Very few of the digital transmission technologies will be able to achieve this coverage rate without great investments.

Digitalisation of the FM band

Digital technology utilises a given frequency space more efficiently than analogue technology. This means that more players can transmit radio using digital technology, and existing programme companies can increase their broadcasts by using more channels.

One possible solution for increasing the capacity of the FM band is to use one of the technologies that is available to digitalise the FM network parallel with analogue FM broadcasts, but this may require that the frequency space is re-planned and its use coordinated with all the neighbouring countries affected. Read more about frequency planning in the section *Frequency space* (Chapter 5).

One drawback in digitalising the FM network parallel with analogue broadcasts is that digital broadcasts will be dependent on analogue technology. This means that the number of channels can be increased but not to the same extent as using some of the other digital technologies.

HD radio

HD radio is a technology for partially digitalising FM broadcasts. For HD radio to be relevant in Europe, a standardisation process would be required and a re-negotiation of interference levels and frequencies in the FM band in accordance with the regional agreement Genève 84.

HD radio (Hybrid Digital radio) is equivalent to a digital supplement to existing analogue FM radio. The technology used is called IBOC (In Band On Channel) and makes it possible to add more channels and services by broadcasting one digital and one analogue sound radio programme from the same FM transmitter and frequency.

HD radio is a North American technology that is standardised in the USA but not in Europe. HD radio is a proprietary system and the system owner, iBiquity Digital Corporation, requires licences for others to use the technology. At the moment the regional agreement Genève 84 does not support HD radio. During 2006 and 2007 trials were made using HD radio in Poland, Switzerland, the Czech Republic and Germany.

HD radio requires more space in the FM network, which can be created through synchronisation technology. This means that two FM transmitters can broadcast at the same frequency without interfering with each other. In order to make this function correctly it is necessary to partially re-plan the frequency space, which according to PTS could be both costly and time-consuming. Coverage in theory could be the same as for FM, i.e. 99.8% of the population for public service broadcasts. But if digital and analogue transmissions co exist, the digital signal has poorer coverage than the analogue signal. Thus, it is only after analogue FM radio has been totally shut down that HD radio can achieve the same coverage as today's FM radio, unless it is expanded.

The benefit of HD radio is that the analogue and digital transmissions can function in parallel and that the transition to digital radio can take place gradually for the consumer, who can continue to use his FM receiver until it is time to buy a new one.

HD radio has space for approximately twice as many channels as FM. During the decade or so that HD radio has existed in USA, only about 300,000 HD radio receivers have been sold. One reason for this could be that so far the programme companies have broadcast the same programmes digitally as they broadcast in analogue form. For the consumer this means that no new channels have been added, even though digital broadcasts have started.

No new networks need to be constructed to introduce HD radio and the technology is already in operation in USA. The time perspective for introducing HD radio is probably relatively short in practical terms, but standardisation and agreements on rights and frequencies would probably take several years.

FMeXtra

FMeXtra is a technology for partially digitalising the FM band. It is able to create space for one or two extra digital sound radio channels beside each analogue channel. FMeXtra is not a European standard.

FMeXtra is a technology developed by the American company Digital Radio Express. The technology used is called IBOC and provides space for one or two extra digital sound radio channels beside every analogue channel. The channels are added to the FM signal in roughly the same way as RDS information. RDS stands for Radio Data System and is based on the method of transmitting an inaudible data signal together with the stereo sound in an FM channel. RDS is mainly used to facilitate listening to the radio in the car.

FMeXtra is a cheap and simple method of digitalising radio, but the number of digital channels can be only marginally increased without re-planning the frequency space. Nor is there any space for RDS services, which would limit the capability of some programme companies to transmit warning messages. To extend the number of channels would probably require partial or complete re-planning of the FM band.

Consumers would only be able to listen to FMeXtra using a special receiver, and there is currently only one manufacturer of FMeXtra receivers and transmission equipment. The range of receiver models is therefore very limited at present.

Broadcasts using FMeXtra have been carried out on a small scale in USA, Austria, Holland, Belgium and Italy since 2006. Trials have been carried out in 2007–2008 in France, Germany and Norway. The technology is not standardised in Europe.

DAB and DAB+

Eureka-147 DAB is a European technology for digital radio. A nationwide digital radio network can be created in the frequency space that is already planned for digital sound radio using DAB technology. DAB+ is a standardised further development of DAB. DAB+ is advocated by the largest players in the radio industry.

Eureka-147 DAB (Digital Audio Broadcasting) is a digital transmission technology that was originally developed for sound radio and specially adapted for mobile reception. Over the years the technology has been developed into a transmission system that in addition to digital sound radio can also transfer other services such as mobile television and downloading of multimedia. Some of the latest developments are DAB+, DAB-IP and DMB.

Eureka-147 DAB is an open international overall standard based on European technology and approved by the European standards organisation European Telecommunications Standards Institute (ETSI). Frequencies are planned and harmonised for Eureka-147 DAB in the whole of Europe. Great Britain, Norway,

Denmark, Italy, France, Germany, Switzerland, Belgium and Holland among others have tested the technology and some of these countries use it for regular broadcasts. Australia, India, Canada and China have carried out trials using DAB, DAB+ and DMB.

Sweden has carried out trial broadcasts using DAB technology since 1995, and SR and the Swedish Educational Broadcasting Company have broadcasting licences for digital radio until 2010. The DAB network was built to cover 85% of Sweden's population, but broadcasts were reduced in 2001 to cover only the major city regions of Stockholm, Göteborg, Malmö and Luleå.

DAB technology means that all transmitters send on the same frequency (single frequency network), so that radios can receive signals from several transmitters simultaneously without interference. On the contrary, the signal is reinforced. The technology is called OFDM and provides both a reinforced signal and better reception in areas where transmitters overlap each other. FM transmitters, on the other hand, must use different frequencies to avoid interference in receivers. To fully exploit the DAB network and make broadcasts commercially attractive, it will be necessary to move some of the DAB transmitters to make the network denser. Teracom estimates that the costs for this are relatively low. To fulfil the demand of reaching 99.8% of the population and covering an area of 90%, further extension of the DAB network would be needed.

In 2006 it was made official that DAB Eureka-147 would be supplemented by the new sound coding AAC+. The official name for this supplement to the standard is DAB+. The new sound coding in DAB+ enables a two to threefold increase in transmission capacity compared with the previous system. The bandwidth can be used more efficiently, which results in cost savings per channel and more channels being possible than earlier. Reception of the signal is also better with DAB+ when one further fault protection system is added to the signal. The new sound coding also supports broadcasts using 5.1 multi-channel sound. The first field tests of the

new sound coding in Britain and Australia were completed in February 2007 and the first commercial rollout of a network using DAB+ will take place in Malta in 2008. The first receivers for the new sound coding will probably be commercially available in the same year.

DMB (Digital Multimedia Broadcasting) is a supplementary service within the fundamental standard Eureka-147 DAB. The service is a further development which means that mobile television can be broadcast in the DAB network. Another supplementary service is DAB-IP, which is able to transmit IP-based data to receivers.

There is a large range of DAB radio receivers with several hundred different models. The number increased rapidly when large countries such as England and Germany took the decision to launch DAB. Most of these models also have an FM receiver. The radio industry is following the development of technology and in 2009 all new DAB receivers will probably be able to receive DAB+.

DAB+ receivers will be backwards compatible with DAB, i.e. they will also support reception of the earlier coding. However, current DAB receivers will not be able to receive the new sound coding. To be able to listen to broadcasts in DAB+ or DMB, consumers' receivers must be able to handle the new coding. On the other hand, no new investments will be required for the broadcasting network itself – the same network, radio towers, multiplexes, transmitters, antennae etc. can be used as for DAB. There will be a marginally increased cost for new coding equipment at programme companies. This means that the costs for one digital radio network will largely remain the same, whether the programme company chooses to broadcast DAB, DAB+, DMB or a combination of all technologies.

To be able to listen to radio in the car is important for consumers. There are already DAB receivers for cars in Germany and Britain, among other countries. The European car industry is assuming that DAB+ will be standard in cars from 2012.

The bandwidth for digital broadcasts determines how many radio channels are possible in the same frequency space. DAB is estimated to be up to eight times

more spectrum-efficient than FM. The latest compression technology MPEG 4, which DAB+ and DMB uses, further increases the number of channels possible. It is estimated that there is space for 20 digital radio channels in each multiplex, which in total would be equivalent to about 80 nationwide radio channels.

The advantages of DAB technology are that the DAB network is already constructed to a certain extent, frequencies are available, it is harmonised with other countries in Europe and there are receivers on the market at reasonable prices. DAB+ will enable even more channels and the major players in the radio industry are agreed that it is better to invest immediately in the latest technology rather than needing to upgrade later.

DRM and DRM+

DRM is a technology designed to broadcast digital radio in the AM band. DRM+ is a further development of DRM which could replace the FM network, but that would require access to the frequencies used by FM transmitters. DRM+ is still in the development stage.

DRM (Digital Radio Mondiale) is a technology designed to broadcast sound radio on short, medium and long wave within the same frequency band as analogue AM broadcasts, i.e. frequencies below 30 MHz. But there are only a few suitable AM frequencies available according to the PTS report from 2006 *Frequency planning for sound radio broadcasts on long wave, medium wave and short wave bands with consideration to new digital technology, PTS-ER-2006:32*.

DRM does not provide the same space for more channels than the present FM band; in fact, it allows fewer. DRM should therefore be seen as a complement to other technologies for distributing radio. The AM channel only has a 9 kHz bandwidth. For DRM broadcasts to be able to offer the same sound quality as current FM broadcasts, more capacity would be required. One possibility is to use two

9 kHz channels, which the DRM system allows. Trial transmissions have shown that there are problems with signal handling – the volume varies in strength. It has also been difficult to define the range of the transmissions.

DRM+ is being developed to adapt DRM to higher frequencies and better audio quality. DRM+ is designed for frequencies between 30 and 120 MHz, i.e. the same frequencies as the FM band. In this way, DRM+ could replace the FM network, but would then require access to the frequencies that FM transmitters use. In contrast to HD radio and FMeXtra, DRM+ cannot be used to transmit a digital signal in parallel with an analogue signal. PTS has not investigated how large the required frequency space is between radio channels to avoid interference when using DRM+. It is therefore unclear how many channels there would be space for if the change were made to DRM+.

Field tests using DRM+ were concluded in Germany in May 2008, according to the international DRM Consortium, which is hoping for standardisation in 2009 if tests go well. Receivers will probably not be available until a number of years later. DRM+ is recommended as the technology to use for transmitting radio over smaller broadcast areas such as community radio. Several European countries, among them Sweden, are making or have made trial transmissions with DRM in the AM band.

DRM and DRM+ are complementary technologies for transmitting radio digitally. There are only a few DRM receivers on the market. Not until standardisation is completed can receivers for DRM+ start to be manufactured, and not until 4–5 years in the future will such receivers be available, according to the DRM Consortium.

This means that DRM broadcasts can be started almost immediately, while broadcasts using DRM+ cannot start until some years in the future when the standardisation process is completed and there are receivers available. DRM is standardised according to the European standards organisation ETSI, and standardisation of DRM+ may take place in 2009 if field trials go well in Germany.

8

TV-based technologies

8. TV-based technologies

There are a number of different TV-based technologies that also function for distribution of radio. For example, radio can be broadcast using the digital terrestrial TV network, in the cable TV network and via satellite. The advantage of these technologies is that the network already exists and distribution is accessible, not least since an increasing number of households have home cinema systems connected to a digital TV box. The audio quality and functionality is also good. The downside is that TV technologies are dependent on stationary TV equipment and are thus primarily intended for stationary reception.

In addition to these technologies, the electronics industry has developed TV-based technologies that work with handheld receivers.

DVB-T

The network for terrestrial digital TV, also called DVB-T, can also be used to broadcast radio. DVB-T was primarily developed for stationary reception but has some capability for mobile reception. The frequencies are used by TV companies and it should mainly be considered as a complement to radio broadcasting.

DVB-T (Digital Video Broadcasting – Terrestrial) is the technology used in the whole of Europe for distributing terrestrial digital TV. According to the Stelacon survey *Individbussen 2008*, 23% of all Swedish people between 16 and 75 have access to digital TV in the terrestrial network. DVB-T is primarily intended for stationary reception, but tests were carried out last year with mobile receivers.

The development of portable units for mobile reception of DVB-T is underway. Mobile TVs are already available on the market. Tests are ongoing in Germany and

several computer manufacturers are developing portable digital receivers that can receive both analogue and digital TV broadcasts, which will also function as computers.

The terrestrial digital TV network in Sweden for multiplex 1 is designed to cover 99.8% of people with a fixed residence, while other multiplexes are planned for a lower coverage rate. DVB-T has at present poorer surface coverage than the FM network. For this reason DVB-T should be considered as a complement to broadcasting radio. DVB-T is a European standard and radio broadcasting could be started immediately.

If radio were to be broadcast using DVB-T in the multiplex that currently has the highest coverage rate, it would be necessary to use the space that SVT has at its disposal. The capacity requirement for SVT will probably increase with future high-definition TV broadcasts, or HD-TV. Several players consider there is already a shortage of channel places for digital TV, and if radio also competes for frequency space the result may be a diminished number of TV channels.

Sound coding technology is the same in DVB-T as in DAB (MPEG, Layer 2), and audio quality depends on how many channels are transmitted within the available space. Radio broadcasts using DVB-T can be divided into the same broadcast areas as for television.

SR plans to start broadcasting radio programmes in DVB-T in 2008.

DVB-H

DVB-H is a digital TV standard which is adapted to small handheld receivers for mobile reception. Interest in DVB-H as a national radio distribution platform has decreased in Sweden, partly due to high investment costs for expanding the network.

DVB-H (Digital Video Broadcasting – Handheld) is a development of DVB-T which makes it mobile and portable. DVB-H is primarily designed for mobile

TV, but can also be used for radio broadcasts. The receiver consists of a mobile telephone or other portable device with an antenna and a decoder for DVB-H. In 2006 and 2007 three tests were carried out using DVB-H in Sweden. The results were positive from a technical and functional perspective, but none of the companies that participated in the tests has indicated that they have any further plans for DVB-H.

A DVB-H network requires considerably more transmitters than FM and DAB, and for this reason it is most appropriate in densely populated areas. Constructing a nationwide network for DVB-H to replace the FM network for radio would be out of the question for reasons of cost. The frequency space per radio channel required is more or less the same for DVB-H as for DAB. But to be able to broadcast DVB-H it is necessary to have new transmitters and different cell planning. The number of sound radio channels that can be distributed via DVB-H depends on how much frequency space is set aside for DVB-H and how much of this space is earmarked for sound radio and mobile TV channels respectively.

DVB-H is a European standard in accordance with the European standards organisation ETSI and is recommended by the EU Commission as the standard for mobile TV that member states should choose before others. DVB-H has been tested in Sweden and receivers have been available since 2006. Larger volumes are expected after the DVB-H network is in operation.

Some mobile telephone manufacturers have shown great interest in DVB-H and consider that it is the best technology above all for transmitting TV to mobile telephones, but also radio. Whether or not mobile TV has a large breakthrough will be significant for the possibility of broadcasting radio via DVB-H.

DVB-S

DVB-S is satellite-based broadcasting of digital TV, which can also be used to broadcast radio. DVB-S requires a fixed receiver with a dish antenna. It should therefore be considered as a complement for broadcasting radio.

Radio broadcasts via satellite have been in operation since the end of the 1970s in Europe. DVB-S (Digital Video Broadcasting – Satellite) is a European standard in accordance with the European standards organisation ETSI. Since 1997 both TV and radio channels have been broadcast digitally using the DVB-S standard, and since 2006 the DVB-S2 standard has been in use, which utilises bandwidth of satellite capacity 30% better than DVB-S. Public service companies in Denmark, Norway and Finland have broadcast radio via satellite to the public for several years. Satellite radio is broadcast in the USA on the S band, i.e. at lower frequencies than those used for satellite TV. At present there are no S band satellites in Europe.

Radio via DVB-S requires that the consumer has a dish antenna, a digital box and a stationary TV that can receive radio broadcasts.

At the start of 2007 in Sweden there were approximately 800,000 households that could immediately receive new radio broadcasts via satellites intended for the Nordic market, according to information from the satellite operator SES Sirius. Those households already have access to commercial radio channels, which have been distributed by satellite for more than 10 years. Cable TV networks and SMATV networks (for blocks of flats) are able to receive satellite signals. New broadcasts via satellite radio can be started immediately. It would take approximately two weeks from decision to broadcast start, according to SES Sirius.

The advantage of DVB-S is that everybody who has a dish antenna and receiver equipment can receive all channels that are broadcast, in principle an unlimited number, irrespective of where they live. To achieve national coverage it must be supplemented by terrestrial transmitters and new receivers. Satellite radio does not significantly influence the use of frequency space, and the costs for broadcasting are also low. The disadvantage is that DVB-S requires a fixed receiver with a dish antenna. DVB-S should therefore be considered as a complement for broadcasting radio. Satellite distribution can also be used as a reserve method of distribution for terrestrial transmission.

DVB-C

DVB-C is used to broadcast digital TV via cable networks. Radio channels are already broadcast via cable TV networks, which only allow reception through fixed equipment in households connected to a cable TV network. For this reason DVB-C should be seen as a complementary technology for broadcasting radio.

The benefit of DVB-C (Digital Video Broadcasting – Cable) is that the network already exists and broadcasting can start immediately, that the network has a high capacity and that DVB-C is a European standard. No further investments in infrastructure are necessary to reach existing cable TV customers. As many as 50% of all Swedes between 16 and 75 have access to cable TV according to the Stelacon survey *Individbussen 2008*, and certain operators broadcast radio or music channels as part of their digital TV options. Radio via cable TV network has no effects on frequency space.

The drawback is that DVB-C is not mobile or portable and only households connected to a cable television network have access to radio broadcasts. In addition, consumers will probably have to pay a subscription charge for listening to the radio via DVB-C.

MediaFLO

MediaFLO is an American technology for broadcasting radio, TV and video to portable units such as mobile telephones. MediaFLO is not standardised in Europe, and the technology is designed for frequencies that are already earmarked for terrestrial TV.

MediaFLO was developed by the American company Qualcomm and is a technology for delivering multimedia content to mobile units. MediaFLO can broadcast TV, radio and data in the same frequency band, and in contrast to 3G solutions in which every user decides what content they wish to consume, MediaFLO transmits the same content to everybody.

MediaFLO utilises single and multi-frequency networks and can be broadcast over the entire UHF band and the L band, but is best broadcast in the lower parts of 700 MHz frequencies. The frequencies between 470–790 MHz are mainly earmarked for DVB-T in Sweden.

The benefit of MediaFLO is that it is mobile and portable. The drawback is that the technology is not standardised in Europe, that a completely new network must be constructed and that special mobile telephones or handheld TV receivers are required.

Tests were started in USA in 2005 and MediaFLO was launched commercially in 2007. The operator Sky has tested the technology in Britain. For MediaFLO to be viable as a technology in Europe would require a standardisation process. MediaFLO is standardised by the Telecommunications Industry Association (TIA) in USA. The standards organisation ETSI cooperates with TIA and according to Qualcomm there are plans to standardise MediaFLO in Europe. It would probably take between 5 and 10 years before MediaFLO has a chance of breaking through in Europe.

9 Mobile telephone-based access technologies

9. Mobile telephone-based access technologies

Radio via mobile networks

Radio via mobile networks is already in operation. The disadvantage is that it is expensive for the consumer, who is used to radio being a free service. Nor is coverage complete; surface coverage is particularly poor.

Mobile radio (2G, 3G and GPRS) is streamed Web radio which the consumer can listen to by connecting to the Internet through the mobile network. Sound radio via the mobile network is already in operation, and mobile operators can offer an unlimited number of radio channels. The consumer pays traffic charges to the mobile operator, and in some cases a charge for the service.

The sound quality of streamed radio via the mobile network is still relatively poor. This is due to a high compression rate and disruptions due to buffering. Buffering means that data is temporarily stored to enable as smooth a stream of data as possible. Parts of the material transmitted disappear in the mobile network as a result of interference; so-called packet loss.

Transfer within the mobile network takes place through Unicast technology, meaning that every listener has his own connection from the programme company to the telephone via the mobile network. It is not possible to transfer the same information at the same time to many users.

Capacity is limited in the mobile network and capacity problems can arise if many listeners use the mobile network for radio at the same time. This means that there may be a risk of the consumer being without radio if the mobile network is overloaded, such as in the case of an accident or other extraordinary event when many people use the mobile network simultaneously.

The advantages of radio via the mobile network are that the network already exists and the radio service is in operation. The consumer has greater possibilities of interactivity via the mobile network than most other radio technologies, and is able to use his existing mobile telephone. Other benefits are that it does not require a new frequency spectrum since the operator uses the same frequencies for radio as for all other mobile traffic.

The drawback is that it is expensive for the consumer, who may also be limited to the radio services included in the subscription with a certain mobile operator. The sound quality is relatively poor and coverage is incomplete. The 3G network reaches almost 99% of the population, but only covers 25 to 30% of Sweden's surface. This surface coverage is particularly important for mobile reception during road transportation.

Mobile radio is being developed in parallel with other technologies for transmitting radio, but should be considered as a complement to the distribution of radio. GSM and 3G are European standards in accordance with the standards organisation ETSI.

MBMS

MBMS is a broadcasting service for the mobile network. The technology has been developed by Ericsson, and makes it possible to broadcast TV and radio via the mobile network to many handheld terminals simultaneously. Field tests will be carried out in 2008.

The benefits of MBMS (Multimedia Broadcast Multicast Services) are the same as for radio via the mobile network. The difference is that MBMS uses point-to-multipoint technology, enabling transmission of the same content to many receivers simultaneously via the mobile network, so-called multicast. Multicast means that many users can share the same bit stream, which makes the broadcast

more efficient. The same frequency spectrum is used as for mobile telephones and no new frequencies need to be allocated.

The downsides are the same as for radio via the mobile network. Connecting to the Internet via a mobile telephone is expensive for the consumer, but probably cheaper than unicast without the MBMS service. The infrastructure and broadcasts for radio via the mobile network are more efficient with MBMS in comparison with traditional sound radio to mobile phones. It is also cheaper for the operator to supply radio to mobile phones. This increased efficiency will probably favour the consumer in terms of cheaper mobile radio. Read more in the section *Radio via the mobile network* (Chapter 9).

Ericsson will carry out public tests with MBMS in 2008. There are plans to introduce both infrastructure and terminals in 2009. 3GPP has standardised MBMS.

10

Broadband-based access technologies

10. Broadband-based access technologies

Web radio and IP radio via broadband

Radio via broadband is an operational form of radio. So far Web radio has mainly been stationary and tied to a computer but with wireless broadband Web radio becomes portable. Despite this fact, Web radio should still be seen as a complement since it will be many years before wireless broadband is fully constructed in Sweden.

Web radio is radio distributed via the Internet, either streamed or using IP technology, for which the consumer connects to a Web radio channel. It is mainly traditional radio channels that increase their distribution using Web radio, but there are channels that have Internet as the only form of distribution. The Stelacon survey *Individbussen 2008* shows that one in five Swedes between the age of 16 and 74 listen to Web radio every week. The number of people that listen to Web radio was previously on the increase but has levelled off in the last year.

The number of channels that can be distributed via broadband is virtually unlimited. One large advantage is that programme companies have greater opportunities to broadcast niche channels and adapt programme content to specific target groups. One important aspect is that advertising channels can sell advertising space aimed at selected target groups.

According to *Individsbussen 2008*, 78% of Swedish people have access to Internet. Just over 80% of Swedes who have access to Internet have broadband via ADSL, LAN or cable TV. In other words, almost 40% of Swedes in the age group 16 to 74 do not yet have broadband.

Web radio via Internet using stationary, wired access does not influence the frequency spectrum at all. Web radio via wireless access such as 3G and Wimax has enough space within operators' ordinary frequency spectrum, but then it uses bandwidth which could be used for other services. In 2007, PTS proposed new licences for wireless broadband by municipality. But it will probably take a long time before a wireless nationwide broadband network is fully constructed. Costs for equipment are high and demand from customers relatively small. According to PTS, few players that have so far been granted licences for wireless broadband have actually expanded it to any large extent.

Internet connection in vehicles, offering the possibility of listening to Web radio among other services, may become reality in the near future. But it should be mentioned that the quality of the wireless radio connection with a base station often depends on the speed of the vehicle – the higher the speed, the poorer the quality.

The advantage of Web radio from programme companies' perspective is that a broadband network is already available, there is freedom of establishment, no broadcasting licence is required and there is no shortage of frequencies. Programme companies can offer an unlimited number of channels and programmes, and Web radio offers interactivity in the same way as radio via the mobile network.

The drawback is that most people listen to Web radio via a stationary computer and that the service is neither mobile nor portable. In addition, the consumer pays for an Internet connection. One difference between Internet and the mobile network is that there is no special charge for listening to radio via the Internet. The consumer only pays for the Internet connection itself.

Web radio is in operation at present and will continue to be developed parallel with other forms of distribution for radio. The wireless Internet access technologies Wimax and 3G are standardised by ETSI.

Pod radio

Pod radio and on-demand are a way of listening to downloaded files from the Internet on a computer or an MP3-player. Pod radio is primarily a complement to Web radio and not a technology for broadcasting radio.

Pod radio has been used in Sweden since 2004, and involves the consumer downloading files via a computer to listen to them directly on the computer or on an MP3 player. Normal web radio is continuously streamed to the computer. The benefit of pod radio is that listeners can choose exactly to what they listen to, when and where.

The downside is that the technology is not simple and requires action on the part of the consumer connecting to Internet, choosing files and downloading them. Users are probably mainly people who have an MP3 player or a mobile telephone that can playback files. There are also copyright problems with pod radio that limit the programmes on offer.

Pod radio can also be made available in the digital radio network, which supports downloading of multimedia files. Users do not need to actively search for or request a pod radio file, but can instead save it in a digital radio receiver when it is broadcast and keep it as long as they wish.

11

Financial aspects

11. Financial aspects

It is important that the changeover to digital radio is commercially viable for players on the market and creates conditions for growth and development. Different technologies have different price tags, both for companies that broadcast radio and consumers that listen to it. The FM network is also costly to develop for radio companies.

It is a complex task to calculate network costs. They are influenced by a number of factors such as the proportion of the population a company wants to reach, the surface it wants to cover, reception options to be in place (outdoor, indoor or portable), how many networks need to be built and whether the costs can be shared between several players. Another factor that influences the cost of digital radio is how and to what extent analogue broadcasts should be carried out.

Network and broadcasting costs

FM

Today's analogue FM network needs to be continuously maintained. According to Teracom, SR's costs currently cover the new investments in the FM network that are necessary for ongoing operations and maintenance. According to the report *Digital Radio* (SOU 2004:16) SR's costs for annual operation and maintenance of the four nationwide radio channels in the analogue FM network amount to SEK 240 million, including VAT.

If the FM network is digitalised using technologies such as HD radio or FM-eXtra, there will be costs over and above the annual operating costs for the FM network. Re-planning of the FM network will be necessary to bring in HD radio,

and that will probably be true of FMeXtra too. PTS has not investigated how large the costs will be and how much time is required for re-planning the FM band to introduce digital technology, but a preliminary assessment by PTS is that the costs will probably amount to a similar sum as that required for re-planning the FM band for analogue FM. Refer to the PTS report *Frequency planning in the FM band, PTS-ER-2008:6*.

According to a spokesman for FMeXtra, it is possible to use existing FM transmitters and antennae and only supplement each transmitter with a code translator, which costs approximately USD 8,900. Programme companies are also required to pay a licence charge to Ibiquity to broadcast HD radio.

DAB

To fully utilise the DAB network and to make broadcasts commercially attractive, Teracom believes that some DAB transmitters will need to be moved and placed more densely. Teracom estimates that the costs for this are relatively low. One estimate is that it would cost SEK 2 million to move about 10–20 transmitters (out of 80 in total). That would provide service for 85% of Sweden's population.

SR sees lower distribution costs and decreased power consumption as an advantage of broadcasting in the DAB network. In the digital radio investigation's final report *Digital Radio* (SOU 2004:16) the costs for SR for the digital distribution of four nationwide radio channels in a fully constructed DAB network were estimated at approximately SEK 190 million per year. This may be compared with SEK 240 million annually for the analogue network. The figures were calculated on the basis of SR broadcasts reaching 99.8% of the population and include investment costs, operating costs and the introduction of security measures and raised levels of readiness. But information from the investigation must be revised since costs for a digital network are constantly decreasing.

Broadcasting in DAB+ means above all that consumers must invest in new receivers that can handle the new coding. The transmission network in itself does not require any new investments, however. The same network, radio towers, multiplexes, transmitters and antennae are used as for DAB. There will be extra costs for the programme companies for new coding equipment. This means that the costs for a digital radio network are more or less the same whether a programme company chooses to broadcast using DAB, DAB+, DMB or a combination of these.

SR has made their own calculation of the costs of a nationwide network for DAB and DAB+. These calculations indicate considerably lower costs than those suggested by the final report of the Digital Radio Investigation. According to new estimates, a digital network that can provide 10–20 radio channels with DAB+ would cost approximately SEK 180 million per year. One digital radio channel, then, could in the best case cost SEK 9 million per year, which may be compared with current costs for one of SR's FM channels of SEK 60 million per year.

Teracom does not exclude the possibility that costs for a nationwide digital radio network using DAB technology that can reach 99.8% of the population could be less than SEK 180 million per year. The number of radio towers for a network using DAB+ could probably be the same as in the existing FM network. Teracom claims that costs for a digital radio network for SR could be further reduced if more players were able to broadcast from the network.

DRM

Estimates of the cost of starting broadcasts using DRM are divided. According to PTS there are only a few suitable AM frequencies available and only two stations are currently used for AM broadcasts. The cost of starting DRM broadcasts in the existing AM network is relatively low since it is possible to keep the existing AM plants and rebuild them for DRM broadcasts. There will then be extra costs

for the equipment required to convert the outgoing signal from AM transmitters. But according to Teracom, extensive reconstruction will be necessary to reach a larger proportion of the population.

The cost of a nationwide network for DRM+ in the FM band is estimated at as high or higher per channel than a DAB network. One reason is that Sweden already has a transmission network for DAB but not for DRM+. According to Teracom, the annual distribution costs for DRM+ would be as high or higher than analogue FM broadcasts at present.

On the other hand, other players say that it is cheaper to broadcast DRM and DRM+ than DAB. According to these players, this is because DRM and DRM+ are broadcast at lower frequencies than DAB, and that one radio channel requires less bandwidth in DRM+ than in the DAB network.

DVB-T

No further investments in infrastructure are necessary to broadcast radio in the digital TV network since it is possible to use the existing network. There will be extra costs for programme companies for coding equipment.

DVB-H

DVB-H is more expensive than DAB since it requires more transmitters, among other things. To expand the network for DVB-H to achieve the same coverage as the FM network would be very costly. It would therefore not appear to be viable to construct a nationwide network for DVB-H to replace the reception facilities of the FM network for sound radio. DVB-H is most appropriate in densely populated areas. But the goalposts may shift if the development of mobile TV accelerates and radio broadcasts can utilise an existing network built for mobile TV.

DVB-S

The costs for broadcasting radio with national coverage via satellite depends on the number of channels and the capacity allocated to each channel. Distribution costs, according to SES Sirius, will amount to approximately SEK 750,000 per Mbit/s and year. Included in this sum are costs for multiplexing, uplinking and satellite capacity. The cost for broadcasting one radio channel with high technical audio quality in stereo would then be approximately SEK 190,000 per year (256 kbit/s).

Consumers would not need to replace or change any equipment since they can continue to use their dish antennae and satellite receivers together with the TV and audio systems they already have.

Radio in the mobile network

Radio via the mobile network means that those consumers who listen to radio on their mobile telephones pay for the transfer capacity (data traffic) that is used. Prices vary between operators. One example is Telia where consumers pay the same price for surfing and listening to the radio with 3G and GPRS as for data traffic.

The mobile operator 3 also has a service that delivers music via the 3G network. At present its customers subscribe to a package that includes free access to a number of radio channels and the option of downloading 10 tracks per month for a cost of SEK 49 per month (May 2008). It is also possible to buy tracks that are downloaded to their mobile phone and computer for SEK 9.90 per track. One music video costs SEK14.90.

According to the licence conditions for 3G operators, they are obliged to expand their network to reach 97.7% of the population, but there are no conditions for the area to be covered. The mobile network currently covers only 25 to 30% of Sweden's surface area. Its construction has been expensive for operators. An

estimated 11,000 masts would be needed to reach 97.7% of the population with 3G. Each mast costs approximately SEK 1 million for this expansion.

Cost comparison

Comparisons show that the number of transmitters required to cover a certain area varies widely depending on the technology used. FM networks require 140–200 transmitters per network to cover 90% of Sweden's surface area and 99.8% of the population with one radio channel. To achieve the corresponding coverage with digital radio using DAB technology roughly the same number of transmitters would be required as in the national FM network. FM requires more transmitters for each radio station, one for each radio channel, while one and the same DAB transmitter can be used to broadcast 10–20 radio channels. Digital radio using DAB or DAB+ is thus more efficient as a form of distribution.

The 3G networks require about 11,000 transmitters per network to cover 25–30% of Sweden's surface area. The corresponding figure for a network using DVB-H would be roughly 3 000–11 000 transmitters.

Programme companies' costs for the distribution of Web radio is affected by the number of listeners. The need for bandwidth increases for programme companies the more people are listening at the same time, which incurs extra costs. Extra costs for the consumer are for a computer and an Internet connection.

Parallel broadcasts in the FM network and in the digital radio network could cost radio companies hundreds of million SEK with a transition period of 10 years, according to some players in the industry. Cooperation on technology and infrastructure should be able to make the digitalisation of radio distribution less costly.

Costs for receivers

All technologies presented in this report require that the listener has a suitable receiver. Certain technologies also require a subscription or data traffic charges, which increase the cost of listening to the radio.

As long as radio programmes are broadcast in analogue form via the FM network, consumers can continue to listen to the radio with their existing receivers. A gradual introduction of digital radio will give those who wish to receive digital broadcasts the option of investing in new technology at their own pace.

But if the FM network is closed down immediately, the 20 or 30 million analogue FM receivers in Sweden would need to be replaced. If the average price of a radio receiver during the transition period is SEK 500 and half of all the old radio receivers are replaced on digitalisation, the cost for consumers will be SEK 5–10 billion. The cost is comparable with what listeners pay for FM receivers per year in Sweden.

In May 2008 a combined DAB and FM receiver cost about SEK 1,000 in Sweden, while the cheapest DAB receivers cost about SEK 400. It is also possible to connect a DAB receiver or DAB adapter to an existing hi-fi system, like a digital TV box to an analogue TV. The price for this type of adapter is about SEK 1,000. It will probably not cost much more to choose a combined FM and DAB receiver to install in a car.

There are only two models of receiver for FMeXtra in Europe – one stationary model costing about SEK 1,200 and a portable model for SEK 500. FMeXtra is a proprietary technology for which the American owner controls the range and price of receivers.

A DVB-H receiver cost about SEK 7,000 in May 2008.

12

International perspective

12. International perspective

International development and in particular European development is important when making choices of technologies for digital radio. Most countries in Europe are discussing the issue of digital radio.

DAB is the terrestrial digital radio system that so far has had the greatest breakthrough internationally, if USA and Japan are excluded. Frequency planning in USA prevents the introduction of DAB, and satellite radio has been chosen instead for national coverage. For regional and local terrestrial broadcasts, HD radio and FMeXtra are used, which utilise the existing frequency bands for FM and AM. Japan has chosen its own technology development, Integrated Services Digital Broadcasting (ISDB), for its digital broadcasts.

In Europe there is no common official standpoint as yet on which technology will be chosen for digital radio, but DAB is the most widespread. The first radio broadcasts using DAB were carried out in the mid-1980s within the framework of the European research project Eureka-147.

In 2006 the so-called GE-06 plan was adopted, which governs the use frequency space internationally. The GE-06 plan contains a general allocation of three-layer DAB for national use with a national or regional network layer. Sweden is able to use four network layers, one national and three regional, by including the frequencies between 230–240 MHz. The allocations are internationally coordinated in Europe, Eurasia, the Middle East and Africa. They regulate the number of radio channels at the national and regional level, transmitter power and interference levels. The agreement indicates that many countries believe in a future digitalisation of radio using DAB technology, and are reserving frequencies for national expansion with indoor coverage.

Despite large investments, DAB has found it difficult to break through as a new radio standard and no country so far has changed from FM to DAB. One

explanation is that the efficiency and quality of the original DAB standard has been questioned. But technical developments in the DAB standard with new and more efficient coding provide new possibilities of introducing DAB throughout Europe. In February 2007 the official international standard for DAB+ was approved by ETSI.

Compared with the DAB standard, which has already been introduced in several European countries, the technology of Digital Radio Mondiale (DRM) used for digitalisation of the AM band is still a relatively new phenomenon in Europe. There are currently about 1,894 radio operators in the whole of Europe that broadcast using DRM. Together they broadcast just over 230 hours per day via 28 radio channels. DAB and DRM are considered to complement each other so well that there is ongoing development of receivers that can handle DRM and DAB in parallel with AM and FM. But the selection of receivers for DRM is much narrower than that for DAB.

Several countries have introduced or continue to test different technologies for digital radio in the last year. In 2007–2008 the following countries took a decision on broadcasts using DAB or DAB+:

- France has granted licences for DMB audio and plans a full-scale, gradual introduction starting in December 2008.
- Britain has allocated licences for DAB broadcasts in a third national multiplex.
- Malta plans to launch DAB+ in 2008 and will then be the first European country to launch DAB+ commercially.
- Switzerland is planning for a first commercial DAB+ multiplex in 2008–2009.
- Australia has decided to introduce DAB+ and the launch date is 1 January 2009.

- The Czech Republic and Italy are carrying out tests with DAB and DAB+.
- During spring 2008, Germany started pilot broadcasts (Sachsen-Anhalt) using DAB+.
- The Netherlands has decided to issue combined FM and DAB licences when the nationwide FM licences are to be renewed in 2009.

During the last year, Denmark has started test broadcasts using DRM and Germany has carried out tests using DRM+ which were completed in May 2008.

The European HD Radio Alliance (EHRA) was established in September 2007 to market HD Radio in Europe. The Czech Republic and Germany carried out tests of HD radio in 2007.

In March 2008 the EU commission gave its official support to DVB-H as a standard for mobile TV. The decision means that DVB-H will be on the EU list of standards for mobile TV that member states are to favour above others.

WorldSpace is a private American company that broadcasts digital radio using its own technology via satellite in Africa, India, South East Asia and parts of Western Europe. The company aims primarily at areas with underdeveloped infrastructure with a limited content of programmes.

The situation vis-à-vis digital radio in some European countries is briefly presented below.

Denmark

In the beginning of June 2006 the government of Denmark, with the support of several political parties, adopted a media agreement that included an expansion of digital radio using DAB in Denmark. The decision on the expansion was based on the assumption that the public sector would auction broadcasting options and it would be up to the players in the radio industry to utilise these options. It would

then be the licensees themselves who would finance both programme activities and the establishment and operation of the broadcasting network.

Channels in Denmark are broadcast in two national networks, but a reallocation of capacity in the network is ongoing. In the future, the public service company Danish Radio will only have access to the one broadcasting network while commercial channels will utilise the second network. In autumn 2007 an auction of four new channels was planned, but it was postponed until a decision was made that Denmark would re-plan the FM band along the Dutch pattern. The re-planning will mean more FM channels with national coverage, and if it is carried through the use of capacity in the second broadcasting network is being considered for the allocation of further licences for new FM channels. Danish Radio will retain capacity in both broadcasting networks until further notice.

Outdoor coverage using DAB in Denmark was estimated at approximately 99% in spring 2007. The two regional networks include Jylland, Fyn, Själland and islands in the vicinity, including Bornholm. Outdoor coverage must reach 100% by the end of 2009, according to an agreement with the state.

More than 1.3 million Danish people, or 23% of the population, have access to a DAB radio in their homes according to a survey carried out by the independent polling company Zapera on 1 December 2007. That is 10 times more than on 1 December 2005.

In spring 2008 there were 17 DAB channels being broadcast in Denmark, of which 14 were by Danish Radio and three were broadcasts by the commercial sector (TV 2 Radio, Radio 100 FM and Radio 100 FM Soft). Three DAB channels that are only broadcast digitally are now among the 10 radio channels that attract most listeners in Denmark.

The trade association DAB Denmark is optimistic about the development of DAB in Denmark. This optimism is built on an increased focus on digital radio in 2007 in conjunction with the extensive marketing of DAB by Danish Radio

and Radio 100 FM. The digital radio system in Denmark is based on the original DAB version and the Danish government has not expressed an interest in DAB+. However, test broadcasts using DMB in the L band are planned. Last year Danish Radio started trial broadcasts using DRM, but so far no private players have shown an interest in DRM.

Finland

DAB was introduced in Finland in 1998 by the public service company YLE. The national network reached about 40% of the population in 2002, or about 2 million inhabitants, while the regional broadcast network reached about 1.2 million inhabitants. In November 2003 the company Digita was granted a licence as network operator for both the national and regional broadcasting network, and YLE was given two thirds of the capacity in both broadcasting networks. So far only YLE Radio has broadcast using the DAB network while there have still been several commercial players on the FM band.

DAB has not had any success in Finland yet and YLE decided at the end of 2005 to close down its DAB broadcasts. Among the reasons given were very poor sales of DAB radio receivers in Finland. In addition, the commercial radio stations were no longer interested in broadcasting on FM and digitally in parallel.

YLE has instead increased the nationwide distribution of its channels via the digital TV network (DVB-T). This means that over 99% of Finns can listen to digital radio. Since the end of 2006 it is also possible to listen to YLE's radio channels via the new digital mobile TV network (DVB-H) and commercial broadcasts via the digital TV network (DVB-T). YLE is now investigating which distribution technology for multimedia would be most appropriate for digital radio broadcasts. The new possible technologies include DVB-H and DMB. YLE is also open to resuming DAB broadcasts.

Norway

Norway started trial broadcasts using DAB in the mid-1990s and DAB was launched in Norway in 1998. Players in the radio industry have invested in DAB, with the public service company Norwegian Broadcasting Corporation (NRK) and the commercial channel P4 at their head after political consensus was reached to expand DAB. Parliament assumed that the players themselves would be responsible for the expansion strategy and investments, while the roll of the authority – Medietilsynet – was of a more supervisory nature.

In Norway there are two broadcasting networks under construction, one national and one regional. The regional network is fully at the disposal of NRK, while capacity in the national network is mainly intended for commercial players. In April 2008 these two networks together reached about 80% of the country's population. Norway has a topography which is difficult for terrestrial broadcasts, and NRK did not feel it was able to finance both digital and analogue broadcasting with close to 100% coverage. For this reason NRK foresees the analogue FM network being closed down in 2014. This assessment was shared by a working group appointed to investigate the future of digital radio which presented its report in 2005, *Digital radio in Norway*. Proposals by the working group were then considered by the Ministry of Culture and Church Affairs. The department does not consider that it is relevant to decide on a date by when FM broadcasts should be abolished until half of the households in Norway have bought a digital receiver, or an analogue receiver with an adaptor. The following additional criteria must be fulfilled before the analogue FM network is phased out:

- The whole population must have access to digital radio channels (close to 100% coverage in the national network).
- The radio channels must give listeners added value.

At the end of November 2006, the Norwegian government presented a new allocation plan for digital radio. At the same time Medietilsynet extended the current digital licences for P4 and Moox (Radio 2 Digital) from 2014 to 2020. The third commercial radio player in Norway, Kanal 24 (now called Radio Norway), was granted a licence at the same time to broadcast digital radio during the same licensing period. However, Moox terminated their involvement in DAB and handed back their licence on 1 January 2008. P4 and Radio Norway are now negotiating with the department about the conditions of the licence, and in April 2008 had still not accepted the decision on the licence. In the middle of March 2007 the management of NRK approved 16 new digital radio channels which were launched in the summer of 2007. With the exception of 3 purely network channels, the entire package of NRK channels will be distributed via the DAB network and via Internet. P4 started a new DAB channel in autumn 2006. More new digital radio channels are expected to be added after the announcement of unused frequencies in the national network, but the date of the announcement has not been decided. NRK has made trial broadcasts using DMB and used some of the capacity in the DAB network to broadcast video to handheld mobile receivers.

505 877 Norwegians, or 13.4% of the population, have access to a DAB radio according to a survey by TNS Gallup in January 2008.

Read more about the deliberations of the Ministry of Culture and Church Affairs concerning the report *Digital radio in Norway* in the parliamentary paper no. 30 2006–2007. Item 5.1.7 takes up the issue of radio channels giving listeners added value.

Great Britain

Great Britain is the country which first started broadcasting digital radio based on the DAB standard. The first licence with national coverage was granted to the BBC, which started trial broadcasts using DAB in 1995 and regular national broadcasts in 1997. The second national licence was granted in 1998 to Digital One, a private programme company that started to broadcast regularly in 1999.

National DAB broadcasts currently reach just over 85% of the population. In addition to the three national multiplexes there are almost 50 local and regional multiplexes. Broadcasting licences for 11 new local DAB multiplexes are in the process of being granted.

There are a total of about 400 DAB channels and 80% of these are privately financed.

In 2007–2008 Britain issued licences for DAB broadcasts in a third national multiplex. Ten new national radio channels will be launched in the new multiplex when Channel 4, one of Britain's largest TV companies, will obtain three of the new channels. The other channels will be shared between several of Britain's commercial radio players, including Disney and Sky.

The new multiplex will also include on-demand services such as radio programmes that can be downloaded to a DAB receiver. The downloading services will use DAB+ and will then be the first services to use the new standard in Britain.

At the end of 2007 the British government called different interest groups in the radio industry to the Digital Radio Working Group. The group's proposal will lay the foundation for a second stage of digital radio in Britain. The group includes programme companies (BBC and commercial), authorities, interest organisations, consumer groups, radio manufacturers and retailers. The group will identify barriers to a more rapid development and examine what services are offered, broadcasting coverage and power, current licences and costs, business models and marketing. The

question of whether a changeover to DAB+ is possible within a few years will also be discussed. The report from the group will be submitted in November 2008.

Radio Joint Audience Research Ltd. (RAJAR), which carries out radio measurements in Britain, showed at the start of 2008 that 10.8% of all radio listening in Britain was via DAB, and that almost one third of the population owned a DAB radio. More people listen to digital radio via DAB than all other digital platforms such as Internet and digital TV. Since 2001 almost 7 million DAB receivers have been sold in Britain after massive marketing of DAB and access to inexpensive receivers.

Germany

The DAB network in Germany reaches 85% of the population with over 180 radio stations. The majority of the channels have re-broadcasts of FM radio and 20% of the channels are only broadcast digitally. Regular DAB broadcasts were started in 1999 after two years trial broadcasts.

During 2007–2008 Die Kommission zur Ermittlung des Finanzbedarfs der Rundfunkanstalten (KEF), which makes decisions on financial issues for radio and television companies, decided to wait until 2009 before further funding is given to digital radio. Commercial players and public service players in the radio industry support continued investments in digital radio based on the Eureka-147 standards.

Germany carried out tests in spring 2008 using DRM+ and a pilot broadcast using DAB+ in Sachsen-Anhalt. In 2007 Germany also carried out tests with HD radio. Mobile television using DMB (which can also support radio channels) is currently broadcast in 16 cities, including, Munich, Hamburg, Frankfurt and Stuttgart.

Instead of the German government allotting frequencies, each federal state is responsible for this procedure due to the administrative and political structure in Germany. The result of this structure is that there is no nationwide multiplex. Broadcasts take place regionally in all federal states with a variety of coverage.

Market penetration has so far been rather low, with fewer than 500,000 DAB receivers sold to date. After RRC-06 Germany has had access to a new frequency plan that allows three national layers of DAB in band III and increased transmitter power. In addition to DAB there are plans to start mobile television broadcasts using a concept called DxB. DxB has been developed in Germany and combines DVB-H and T-DMB to achieve national coverage despite the regional handling of frequency space in the country.

France

France has carried out many tests of digital radio. Most of the technologies such as DRM, DAB, DAB+, DVB-T, DVB-H, T-DMB and HD radio have been tested. But at the end of 2007 the French government announced that it had chosen T-DMB and DRM for digital radio broadcasts in France. The authority holding responsibility for radio in France, Conseil Superieur Audiovisuel (CSA), has granted national and regional licences for DMB audio and is planning for a full-scale, gradual introduction starting in December 2008. DRM is planned for the digitalisation of the AM band for frequencies up to 30 MHz.

In 1996 and 1998 the CSA granted licences for DAB in different regions. DAB broadcasts take place in different regions including Paris, Lyon, Marseille, Nantes and Toulouse. But in 2005 the development of DAB was brought to a halt, as the technology was not considered to be sufficiently good. In recent years CSA has been

working on a report on which to base decisions concerning digital technologies for radio and has consulted parties on the market, industry and consumers to gain the greatest possible foundation in the issue. The work has resulted in a regulatory set of rules and regulations and a strategy for digital radio in France.

13

Overall comparison

13. Overall comparison

Overall evaluation matrix

In sections 7–11 different technologies for the digital distribution of sound radio were presented, evaluated and compared. To enable overall comparisons of the different technologies, The Swedish Radio and TV Authority has compiled them into an all-inclusive matrix in which they are evaluated according to selected criteria (read more about the different criteria in the chapter Starting points.) The comparison is based on the current situation and how well the technologies fulfil the various criteria. It is only natural that the evaluation statements in a matrix are brief and simplified. In each section there are more detailed descriptions and reasoning.

Figure 4. Evaluation matrix for future radio.

Technologies	European standard	Time to possible introduction	No. of channels and functions	Coverage, surface coverage	Portable, listen in movement	Cost for broadcast	Cost for consumer	Possible to broadcast warnings	Accessibility for all listeners
FM	Yes	Now	Low	High	High	High	Low	High	Medium
DAB	Yes	Now	High	High	High	Medium	Medium	High	High
DAB+	Yes	Soon	High	High	High	Low	Medium	High	High
DRM	Yes	Soon	Low	High	High	Medium	Medium	High	Low
DRM+	Yes	Later	Medium	High	High	Medium	Medium	High	Medium
HD radio	No	Soon	Medium	High	High	Medium	Medium	High	Medium
FMeXtra	No	Soon	Medium	High	High	Medium	Medium	High	Medium
MediaFLO	No	Later	High	Low	High	Medium	High	Low	Medium
DVB-T	Yes	Now	Medium	High	Medium	Medium	Medium	Medium	Medium
DVB-H	Yes	Soon	High	Low	High	High	High	Low	High
DVB-S	Yes	Now	Medium	High	None	Low	Medium	Medium	Medium
DVB-C	Yes	Now	High	Low	None	Low	Medium	Medium	Low
Mobile network	Yes	Now	High	Low	High	High	High	Medium	Medium
MBMS	Not appl.	Later	High	Low	High	Medium	High	Medium	Medium
Web radio	Not appl.	Now	High	Not appl.	Low	Not appl.	Medium	Low	Medium

Opinions from the radio industry

During the three years that the Swedish Radio and TV Authority has followed the development of digital technologies for distributing radio, the Authority has noticed that the opinions of the radio industry have become clearer and more uniform. The majority of people in the radio industry are agreed that

- Radio needs to be developed
- The FM network is short of capacity and therefore development potential
- Radio needs one main form of distribution
- Digitalisation is necessary in the very near future
- Decisions on regulations and licences need to be made
- Space must be created for public service, private local radio and community radio
- Radio is now distributed via the Internet and the mobile network and will continue to develop irrespective of which main form of distribution is selected for radio.

These conclusions can also be described graphically and chronologically as in the figure below.

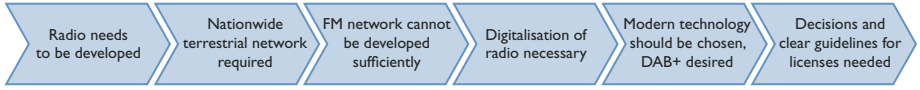


Figure 5. Analysis chart, future radio.

In a joint communication to the Swedish Radio and TV Authority on 28 May 2008, Swedish Radio (SR), the Swedish Educational Broadcasting Company (UR), MTG Radio AB and SBS Radio AB put forward the following viewpoints:

- The programme companies (SR, UR, SBS and MTG) wish to develop radio as a medium and improve the radio public's access to more channels to create an increased and wider diversity for listeners in the entire country. After the digitalisation of TV, it is time for political decisions that enable both public service radio and commercial radio to be given conditions that will enable digital broadcasting.
- The programme companies intend to cooperate in issues of technology and distribution so that a common standard will be provided for users/listeners.
- The companies are agreed on investing in a platform that will give both public service radio and commercial radio optimal conditions for development. The new sound coding called DAB+ is the technology that currently appears to be most appropriate for Sweden.

Teracom AB has proposed that Eureka-147 DAB (DAB/DAB+) is the technology that appears to be most appropriate for the digitalisation of radio. Teracom considers that DAB+ is the most efficient technology to choose, with opportunities for all programme companies – public service, commercial radio and community radio – to develop the medium of radio.

Representatives of community radio have also expressed their support for the viewpoint that DAB+ is the most suitable technology.

Discussions have taken place in interviews and workshops regarding which possible development paths the different players see for radio in the future. Three possible paths have been proposed.

1. One alternative is to continue to broadcast in the FM network at the same time as FM is digitalised, such as via HD radio or FMeXtra. For this alternative to be feasible it will probably be necessary to re-plan frequencies. Some players see the digitalisation of FM as a method of making space for more channels pending a clear European standard. Other players claim that the number of new channels will be too small to be significant. The players are agreed that re-planning of frequency space must be done within a reasonable time period (1–2 years), to avoid listeners leaving the medium of radio. This alternative will allow consumers to wait before buying new receivers since they can continue to listen on FM and purchase a new receiver when it suits them. The drawback of this alternative is that these digital supplements are not European standards and the time needed for re-planning will be longer than 1–2 years.
2. A second alternative is to continue broadcasting in FM without re-planning frequencies and wait until Europe decides on one technology. This will probably lead to large parts of the radio industry putting an increasing emphasis on Web radio. The risk is that FM radio will become less interesting for listeners and that they will decrease in number at an accelerating rate.
3. The third alternative is to switch to digital radio. This is advocated by the vast majority of players as being the best alternative. The technology that most players consider to be the best for Sweden in the current situation is DAB+. At the same time they believe that the FM network must remain in place for a further 10–20 years. If this alternative is chosen, the radio industry wishes to have clear regulations regarding
   - licences
   - costs and licence fees
   - time plan and the future of the FM network.

14

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14. Literature, references and respondents

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SR, Claes-Erik Rundström

SR, Jörgen M Andersson

SR, Malte Lind

SR, Mats Åkerlund

SVT, Anders Nyberg

SVT, Jan-Olof Gurinder

SVT, Per Björkman

Teracom, Lars Backlund

Teracom, Per Gunnarsson

Teracom, Per Werner

15

Glossary

15. Glossary

3G	Third-generation mobile telephony.
3GPP	3rd Generation Partnership Project.
AAC	Advanced Audio Coding. Digital sound coding technology.
AAC+	New sound coding standard.
AM	Amplitude modulation. Modulation technology used for long, medium and short-wave broadcasts.
Bandwidth	Frequency area used in the transfer of signals. Bandwidth is stated in the number of bits per second transferred (Kbit/s or Mbit/s).
Broadband	A link for electronic communication with a real transfer rate of at least 2 Mbit/s in both directions.
Broadcast	Transmission of information from one point to many receivers simultaneously.
BWA	Broadband Wireless Access. According to PTS this covers fixed wireless connection of companies and houses as well as mobile broadband services.
DAB	Digital Audio Broadcasting. Standard for digital terrestrial distribution of sound radio.
DAB+	DAB with sound coding AAC+.

DMB	Digital Multimedia Broadcasting. Standard approved by the European standards organisation ETSI for broadcasts of mobile TV in networks for DAB.
DRM	Digital Radio Mondial. Digital broadcasting system for sound radio in frequency bands below 30 MHz.
DRM+	An extended variant of the DRM standard for broadcasts on frequencies up to 120 MHz. Under development. Finalised standard expected at the earliest in 2009.
DVB	Digital Video Broadcasting. Standard for digital television.
DVB-C	Digital Video Broadcasting – Cable. Technical standards for broadcasting of digital television via a cable network.
DVB-H	Digital Video Broadcasting – Handheld. Further development of the DVB-T standard for broadcasting of television services to mobile telephones and other handheld TV receivers.
DVB-S	Digital Video Broadcasting – Satellite. Technical standard for broadcasting of digital television via satellite.
DVB-T	Digital Video Broadcasting – Terrestrial. Technical standard for broadcasting of terrestrial digital TV.
EPG	Electronic Programme Guide. Programme tables on screen showing ongoing and future programmes.
EPRA	European Platform of Regulatory Authorities.

ETSI	European Telecommunications Standards Institute. Standards organisation, primarily focused on telecommunications, broadcasting and information technology.
FM	Frequency Modulation – the technology used to encode sound on the radio waves on which it is transmitted.
FMeXtra	FMeXtra is a technology developed by the American company Digital Radio Express, which is based on analogue and digital broadcasts in the same transmission.
FWA	Fixed Wireless Access.
GSM	Global System for Mobile Communication. Second generation mobile telephony.
HD-radio	Hybrid Digital radio, also called IBOC (In band On C¬hannel). Analogue and digital broadcasts in the same transmission. Used in USA.
Interactivity	Viewers or listeners being able to influence or participate in the programme being broadcast.
IP	Internet Protocol. Communication protocol that handles addressing and routing of data packages on the Internet and other IP-based networks.
MBMS	Multimedia Broadcast Multicast Service. Mobile telephone-based broadcasting technology.
MediaFLO	FLO is an abbreviation of Forward Link Only. Technology for radio broadcasts of pictures and sound data to portable units such as mobile telephones.

MPEG Layer2	Standard for sound coding used in DAB, among others.
MPEG	Moving Pictures Expert Group. A series of global projects led by industry whose standards are used by the telephone, data and broadcasting sector.
MTG	Modern Times Group
Multicast	Transmission of information from one to many receivers simultaneously using IP technology.
Multiplex	Device for coding information from several different sources to one channel.
Pod radio	Service that enables programmes to be downloaded and listened to on a computer, mobile phone or MP3 player.
Programme company	Player that supplies own or purchased programme content.
SBS	Scandinavian Broadcasting System
Single frequency network	Broadcasting network in which all transmitters use the same frequency.
SR	Swedish Radio
SRTA	Swedish Radio and TV Authority
SVT	Swedish Television
Synchronisation technology	Distribution technology for analogue FM broadcasts that uses several overlapping analogue transmitters over a wide geographic area that broadcast on the same frequency

Unicast	Broadcast of information in which every receiver has its own connection from a transmitter, i.e. point-to-point distribution.
UR	Swedish Educational Broadcasting Company
VMA	Important public announcement.
Web radio	Radio distributed via the Internet.
WiMAX	Worldwide Interoperability for Microwave Access. Standardised technology for wireless broadband.
WLAN	Wireless Local Area Access Network. Broadband-based distribution technology.

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Appendix

Copy
Government decision I:7

19/01/2006

U2006/342/Me

Ministry of Education and Culture

The Swedish Radio and TV Authority
Box 123
136 22 HANINGE

Uppdrag till Radio- och TV-verket att följa utvecklingen av tekniker för digital distribution av ljudradio

Government decision

The Government commissions the Swedish Radio and TV Authority to monitor the development of technologies for digital distribution of sound radio from a broad perspective and to produce a report as the basis of the ongoing assessment of different technologies. The commission is to be carried out in consultation with Swedish Radio (SR), Swedish Television (SVT) and the Swedish Educational Broadcasting Company (UR), other companies and organisations within the radio and television industry, authorities affected and other relevant players.

In particular, the Swedish Radio and TV Authority shall report on how different technologies fulfil demands on quality and security of broadcasts, as well as their potential to maintain requirements with respect to the broadcasting of important public announcement (VMA). Furthermore, the report shall show how different technologies can satisfy the needs of physically disabled or impaired people and for groups that belong to linguistic and ethnic minorities. The authority shall also report on the advantages and disadvantages of different technologies from the perspective of consumers.

The Swedish Radio and TV Authority shall present the final report by 30 June 2008 at the latest. The progress reports are to be submitted by 30 June 2006 and

30 June 2007 at the latest. The commission shall be discharged within the current budget for the Swedish Radio and TV Authority.

Background

On 20 December 2005 the Government decided to present the paper Digital distribution of sound radio (paper 2005/06:66) to the Riksdag. In this paper the Government states its opinion on the proposal from the Digital radio committee concerning the expansion in stages of digital sound radio broadcasts using DAB technology (SOU 2004:16). The Government's assessment is that there is no reason at present to select one particular technology for future sound radio distribution and that it is not relevant to make a decision on an expansion of DAB broadcasts. It is stated in this paper that several technical solutions exist or are being developed for the digital distribution of sound radio. It also states that technical solutions other than DAB have not been fully tested, such as cooperation between radio and television.

This assessment by the Government does not mean that any form of distribution is excluded. Continued testing operations using different digital broadcasting technologies will instead bring about flexibility and the chance of monitoring and being at the leading edge of technical developments..

The Government intends to follow in detail the developments in the digital distribution of radio and, should there be a need for a political decision or standpoint, to return to the issue. In its paper the Government has announced that the Swedish Radio and TV Authority will be given the commission of producing a report as the basis of an ongoing evaluation of different technologies for the digital distribution of sound radio.

On behalf of the Government

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