


Phones on the Move



**Personal Communications in the 1990s
– a discussion document**



PERSONAL COMMUNICATIONS IN THE 1990s

**– Technology
and competition
in the service
of the user**

**A discussion document
from the Department of Trade and Industry**

January 1989



**Lord Young of Graffham,
Secretary of State for Trade and Industry**

The United Kingdom is a world leader in mobile telecommunications. Our cellular radio network operators have shown a growth unmatched anywhere else. The pager is now commonplace. We are pioneering the exciting new concept of Telepoint. More and more, UK business is coming to rely on mobile communications, and Government has acted as an enabler, making sure they get the services they need.

This discussion document presents one vision of the way in which these markets might develop. In its enabling role, the Government is prepared to make available a considerable block of radio spectrum to meet the developing needs of the market for mobile communications. The paper suggests ways in which this could be used, but it will be for industry to take up the challenge by responding with innovative and practical ideas. In this way, we will ensure that the UK keeps its position at the leading edge into the '90s and beyond.

A handwritten signature in black ink, appearing to read 'Lord Young', with a long horizontal stroke extending from the bottom right.

Introduction

Mobile radio services are experiencing the healthy pressures of both technology push and market pull. The Government's approach has been to create a pro competitive liberalised environment and foster an awareness of the opportunities based on the exploitation of new technology. This has led to the United Kingdom being one of the fastest growing mobile radio markets in Europe.

In cellular radio the UK has the largest subscriber base in Europe. In conjunction with other European countries a pan European digital cellular radio service is being implemented based on the most advanced cellular radio technology in the world. In cordless telephone technology the UK is the first country in Europe to introduce second generation digital technology. This development is now being coupled with the new system concept called Telepoint. It is arousing the interest of many countries overseas.

One of the features of changing technology is the likelihood of better things around the corner. Mobile radio is no exception. A power of the liberal market is the freedom it offers to enterprises to explore around the corner and exploit the opportunities there. One of the impediments in mobile radiocommunications has long been the shortage of radio frequency channels. The hallmark of the Government's approach is its policy of seeking to remove impediments to new market opportunities and supporting European initiatives to complete the internal market in telecommunications.

Around the next corner for mobile radio services will be frequency channels in higher parts of the spectrum, for example in the range 1.7 to 2.3 GHz. This raises the possibility of licensing at least two new public mobile radio operators and the prospect of a new generation of mobile radio systems which will be distinct from cellular radio systems yet will compete with them for the market they will be serving in the 1990s – the market for personal communications.

Technical Trends

The Department has no unique insight into the future. Instead this document sets down what appear to be the main trends so as to stimulate an informed discussion. Already a trend towards digital technology can be discerned. It is also evident that mobile radio products are in the process of changing from professional electronic to consumer electronic items. Cordless telephone products are leading the way.

In the related field of office automation, electronic products are similarly going mobile. Lap top word processors enable office work to be done anywhere. They help to create a demand for the results of that work to be passed back electronically to the main office network. Portable facsimile machines now offer reliable text and illustrations to be sent over suitable radio links. As indicative is the trend towards the 'office in the pocket' with the growth of electronic calculators, dictation machines, electronic diaries and data bases.

For mobile radio systems a trend has been towards radio base stations having smaller and smaller service areas. The main drive for this has been to increase the capacity of the mobile network for a given number of frequency channels in order to support a larger number of subscribers. The further benefit is to make handportable radiotelephones more viable through demanding lower transmitter power levels.

The new Telepoint concept has broken new ground in beginning from the other direction, starting with a radio base station having the smallest practical service range of only 100m or so and then building up the capture area of customers through expanding the number of installed radio base stations or telepoints. See Figure 1. Telepoint has the additional advantage of building upon very low power cordless telephone products for both the domestic and business sector. It will also have at least three years to achieve economies of scale and consolidate its market position before it would be feasible for Personal Communication Networks to become operational.

Telepoint Concept
(There will be an option to supplement the service with wide area paging)

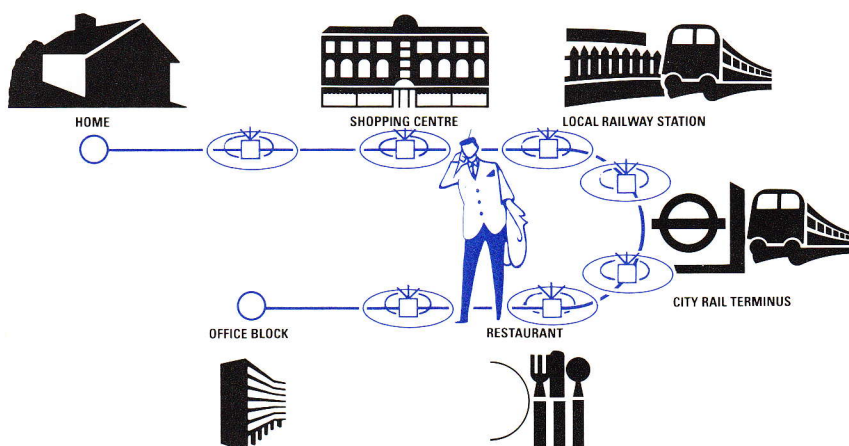


FIGURE 1

Technical Trends

The system trend on radio base service areas is illustrated in Figure 2. One of the beneficial outcomes of networks comprising radio base stations with small service areas is to make feasible very small light pocket radiotelephones capable of relatively long periods of use without the need to re-charge batteries. Indications are that these pocket radiotelephones will be the battleground for the public mobile radio telephone markets in the 1990s. This implies that the cellular radio operators will be shifting much of their focus away from car phones as such towards pocket radiotelephones in order to sustain their growth through to the year 2000 and beyond.

Geographical mobility differentiates markets for different mobile radio systems

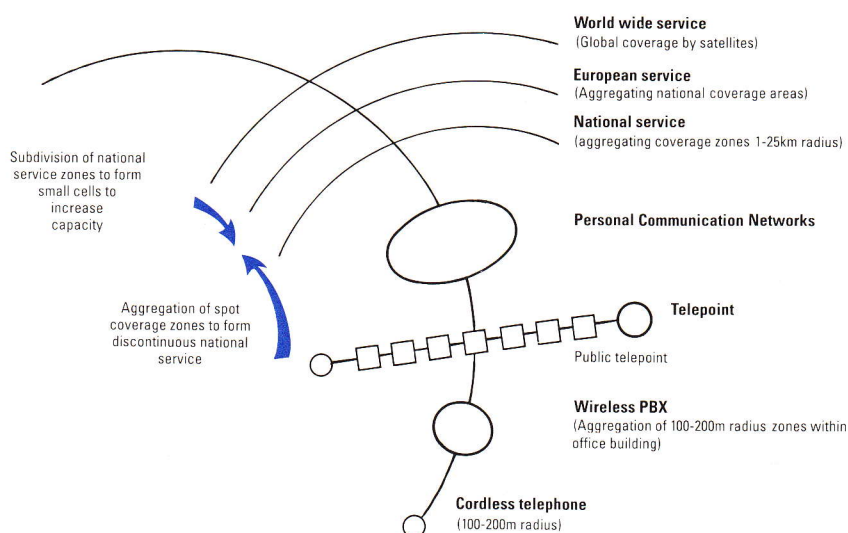


FIGURE 2

Developments such as these open up possibilities for new competitive public mobile radio operators to invest in innovative Personal Communication Networks targeted at the pocket radiotelephone. One such possible network is illustrated in Figure 3. The market opportunity for pocket radiotelephones has great potential. The UK has more than 20 million telephone subscribers who access the public telephone network through a copper wire link.

Personal Communication Networks Concept

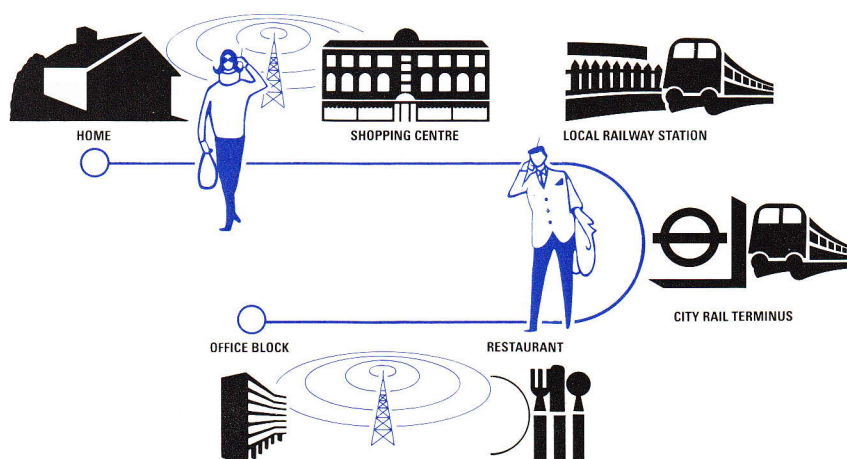


FIGURE 3

Technical Trends

There is no inherent technical reason why these subscribers should not access public telephone networks through mobile radio means. This possibility is sometimes referred to as 'radio tails'. For many purposes it would be a lot more convenient for subscribers. Since the telephone provides the vital means of access to the emergency services for the public, the pocket radiotelephone would also extend the geographical extent of that security. The barriers that prevent this today are the cost of present mobile services, shortages of suitable radio frequency channels and lack of capacity of the present cellular networks. These factors are inter-related since capacity will increase and costs will tumble given sufficient radio channels and the driving force of a competitive market.

Lest an impression is given that advances in mobile radio technology will lead in the future to all telephone subscribers being connected to the public telecommunications networks through Personal Communication Networks, one should add that technology is also advancing on other fronts. Fibre optic links to the home would have the potential to offer wider spread of services such as videolinks and represent another possible manifestation of technology and competition in the service of the user.

Frequency Bands

To accommodate at least two more public mobile telephone operators and support a considerably expanded subscriber base requires many more new radio frequency channels to be brought into use. The available spectrum around 900 MHz has not got the capacity to accommodate such an expansion. There is also no scope at present below 900 MHz. The very high reaches of the radio frequency spectrum offer the capacity but their economic exploitation for consumer mobile radio products is still some way off. Between these constraints the best present location lies somewhere between 1.7 and 2.3 GHz. The DTI believes that within this range the best prospect for making available spectrum in the UK to support at least two operators of Personal Communication Networks lies in the region of 1.7 to 1.9 GHz.

The frequencies between 1.7 and 2.3 GHz are well suited to high capacity personal communications applications in the conurbations based on radio base stations with small coverage zones. Transmission has more line of sight tendencies than at 900 MHz, but this is compensated for in cities to some extent through reflection properties. Studies indicate that these frequencies can be used safely for personal communications at the low transmitter powers envisaged for this application.

Frequency Bands

It is not possible to be precise at this stage about how much spectrum could be made available initially or where in the range 1.7 to 2.3 GHz it would lie. There are some existing uses to be taken into account as well as competing future demands. Much will depend on issues such as whether the spectrum will need to be paired, and if so with what separation. The options can be refined as a result of the consultation process as possible operators and equipment manufacturers give their views on the most appropriate technical solutions, and the demands such solutions would make on the spectrum.

The choice of 1.7 to 1.9 GHz seems to be the most appropriate for the UK if spectrum is to be released quickly. The position in other countries differs, and although it is being foreseen in some quarters that in the early 1990s spectrum could be identified internationally somewhere in the range 1.7 to 2.3 GHz to permit the growth of mobile radio services, there is no certainty that 1.7 to 1.9 GHz will be chosen for the purpose. A lack of international harmonisation carries certain risks and would affect the ultimate economies of scale for subscriber equipment (or at least the radio components). Nevertheless on balance the Department believes it would be better to provide early opportunities to use the band for the exploitation of the market for personal communications.

New Personal Communication Networks will require a supporting telecommunications infrastructure. This discussion document does not address this supporting infrastructure and whether it should be based on lines or radio.

Technology, Standards and System Features

The Department is likely to require any Personal Communication Networks to conform to a publicly available technical standard to increase competition between operators and between equipment suppliers in the interest of users. If an early introduction into service is to be obtained yet the most up to date technology is to be employed – and both would seem highly desirable features – this suggests that pan European digital cellular radio technology or more probably a derivative of it should be a very strong candidate in setting the standard. Such an approach may have the following advantages:

- i) Implementation on a comparable timescale to the pan European digital cellular radio system (which is due to be operational in 1991). Development would only be required for the radio frequency components.
- ii) Cost benefits arising from economies of scale already attainable from the pan European system.
- iii) Greater potential for viable multi application mobile equipment, eg equipment which can be switched to operate either on the Personal Communication Networks or pan European digital cellular radio system.

Technology, Standards and System Features

- iv) Avoiding problems due to overloading manufacturing R&D resources.
- v) Staying with the mainstream of European mobile radio technology and standardisation developments.

However other approaches may be possible and careful consideration would be needed of all the possibilities. Personal Communication Networks can be positioned to address a variety of markets with only relatively minor shifts of emphasis and design. One determining characteristic will be whether Personal Communication Networks feature 'handover' or not. 'Handover' is a feature of cellular radio systems and enables a user to make an uninterrupted telephone call whilst passing from the coverage area of one radio base station to another. For purely personal communication applications, handover is unlikely to be needed. This would permit simplification of the network and potentially lower infrastructure cost. On the other hand handover is likely to be an essential feature if Personal Communication Networks are to address the car phone market. An intermediate solution could be to have the paging feature which is also a characteristic of cellular systems so that a user can be called in whichever radio base station coverage area that user is located but not to have a full handover facility. This would capture some of the benefits inherent in cellular radio networks for those moving over wide areas but not incur the complexity that 'handover' requires. This is a matter needing careful consideration.

Other International Developments

Before considering the way forward there are two relevant European developments which should also be mentioned. The first is called DECT (Digital European Cordless Telephone) and is likely to result in products around 1992. The standard for DECT has not yet been defined but its frequency range of operation is also foreseen as around 1.7 GHz. It would be a matter of international negotiation to achieve synergy between DECT and Personal Communication Networks.

Looking further into the future there has also been some work on mobile communications in the European Community programme called RACE. This has been a relatively modest part of the RACE effort which the UK has sought to supplement with its LINK R&D programme. Whilst some of the work may be relevant to Personal Communication Networks in the 1.7 to 2.3 GHz band the focus of the RACE work has been intended to be somewhat further into the future. It should also be said that in the USA considerable R&D work has been done by Bellcore targeted at a Personal Communication Network concept at around 1.7 GHz.

The Way Forward

This is a discussion document. The main question to which the Department is seeking answers is whether potential operators exist interested in the opportunity to develop, build and operate advanced digital Personal Communication Networks at 1.7 to 2.3 GHz to come into operation around 1992. This leads to a number of questions on which the Department is also seeking views:

- The ability of the UK market to support more public mobile radio operators?
- The improvement over today's networks with the advent of the pocket radiotelephone?
- The date by which new Personal Communication Networks could/should be implemented?
- Is the combination of 1.7 to 2.3 GHz frequency channels and pan European digital cellular radio technology the most effective solution for the early to mid 1990s?
- How much bandwidth is needed for each operator in order to build up and maintain a viable subscriber base?
- Should handover be a feature for Personal Communication Networks?
- Should moving immediately to seize market opportunities be given priority over waiting to see where future international allocations for mobile services will be located?

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Comments on the way forward and views on the questions set out above should be sent to the Department of Trade and Industry by 28 April 1989.