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Towards the Personal Communications Environment :

GREEN PAPER

on a common approach in the field of mobile and personal communications in the European Union

(presented by the Commission)

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PREFACE

On 22nd July 1993 the Council of Ministers adopted the Resolution[1] on the Review of the situation in the telecommunications sector and the need for further development in that market. This Resolution set the future agenda for the evolution of telecommunications in the European Union. It identified as a major goal the development of future policy in the field of mobile and personal communications, "to which the publication of a Green Paper on mobile communications will contribute".

Mobile communications has developed over recent years into a key area of growth in the Union. With the broadening of mobile communications into general personal communications, the sector will, before the end of the decade, substantially affect the lives of every citizen of the European Union.

In the light of the potential mass market for personal communications, a coherent policy framework for the sector and for the development of trans-European networks must now be promoted within the context of the Union's global strategy on growth, competitivity and employment.

Such a framework can only result from broad consultation of all parties concerned.

This Green Paper is intended to launch an active discussion involving the Council of the European Union and the European Parliament ; the Economic and Social Committee and the Committee of Regions ; consumers and business users ; fixed and mobile network operators, and service providers ; manufacturers of mobile equipment, fixed network equipment, data processing and multimedia technologies ; together with the trade unions and other organisations representing the social interests in the sector, and bodies in the area of data protection and privacy.

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1 Council Resolution of 22nd July 1993 on the review of the situation in the telecommunications sector and the need for further development in that market (93/C 213/01, OJ C213, 6.8.93)

I INTRODUCTION

Mobile communications is currently the fastest growing area within the telecommunications sector. Over the last few years it has experienced unprecedented growth in subscriber numbers, especially in cellular mobile telephony. Europe has now more than 8 million cellular mobile telephony users, over double the number of three years ago. There are also more than 8 million users of other mobile communications services, in particular, paging and so-called private mobile radio systems. It is forecast that by the year 2000, there could be nearly 40 million users in the European Union, and with the growing expansion into personal communications services (PCS), up to 80 million users by the year 2010.

The market is being driven by rapid advances in technology, by commercial opportunities and by falling prices. Subscriber growth rates during the last few years in Member States with high growth cellular telephony markets (car telephones and hand-held portables) have varied from 30 to 40%. Recent analysis shows that this trend is withstanding the current economic recession.

Society as a whole can benefit from individuals being contactable from any location, and while on the move. The need for mobile communications is becoming a normal part of business life with users ranging from the multinational executive to the local plumber or builder. Over the next few years, as prices continue to fall, and as the latest technologies become well established, mobile communications are expected to make significant inroads into the mass consumer market.

The market potential for personal communications services is huge. While the maximum density for fixed wireline telephones is not expected to exceed substantially an average penetration of some 50% of the population, (i.e. approximately one connection per household, plus business use), personal communications penetration has the ultimate potential to reach near 80% of the population (i.e. up to one connection per adult).

The growth of mobile communications will have a significant impact on the whole of the telecommunications industry. Mobile services themselves will continue to experience rapid growth, both in terms of subscriber numbers and corresponding traffic. This growth will in turn stimulate traffic over the fixed networks, with mobile networks continuing to deliver much of their traffic volumes to the fixed network, thereby increasing the overall use of telecommunications.

Mobility has a particular significance in the broader context of the European Union. On the one hand, mobility is at the very heart of the objective of the Union for the free movement of goods, people, services, and capital. On the other hand, the prospect of European-wide advanced mobile communications services, will support the commercial success of these services on the mass market.

With the pan-European digital mobile system, GSM, the European Union has established a world-leading technology in this key area of the future global communications market. The Union must now build on this success.

Mobile communications also has an important role to play in stimulating massive private and public investment into telecommunications networks and services, and in contributing to maintaining and developing service in the less developed or peripheral regions of the Union.

While the Green Paper on the development of the Common Market for telecommunications services and equipment of 1987[2] (the 1987 Green Paper) set mobile communications to one side for further consideration, the Union has already undertaken specific action in the field of mobile communications within the overall context of its telecommunications policy. This has been a major factor in European success and leadership in digital mobile technologies.

With the expansion of mobile communications into the future personal communications market, a coherent policy framework for the sector must now be developed.

It is now opportune to consider the full extension, and where necessary, adaptation of the telecommunications policy of the Union to the area of mobile and personal communications networks and services.

The purpose of this Green Paper is to identify basic principles and action lines for discussion. These are aimed at expanding the opportunities for the sector at a critical moment in its development.

The process must build on the achievements that have been made within the context of the Union's telecommunications policy to create a strategy for the European communications market. The global aims of the positions and proposals in this paper are :

→ to permit the development of a Union-wide market for mobile services, equipment, and terminals ;

→ to identify common principles where required, for achieving this objective, in relation to the provision of mobile infrastructure, the development of mobile networks and services, and the supply and operation of mobile terminals ;

→ to promote the evolution of the mobile communications market into mass personal communications services, with particular emphasis on pan-European services ;

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2 Green Paper on the Development of the Common Market for Telecommunications Services and Equipment (COM(87)290 final, 30.6.1987)

→ to facilitate and promote the emergence of trans-European networks and services in the sector, and to ensure that the sector's development is achieved in a manner consistent with the public interest.

The proposals take into account existing and planned services, technological capability, user demand and the existing regulatory framework in the Member States. They build on the continuing growth of mobile services, whilst at the same time establishing a framework for the introduction of new services and networks ; for greater user choice ; free development of markets and the elimination of existing constraints ; promotion of trans-European networks and services, and full development of the world-wide potential of Europe's mobile sector.

This Green Paper addresses a sector which is undergoing explosive growth and which therefore now needs a common vision as a matter of utmost urgency. It should be seen against the general background set by the White Paper on growth, competitiveness and employment for the future development of the information society in the European Union. It represents a major step within the global phased approach to the telecommunications sector set by the Council Resolution of 22nd July 1993 for the future balanced relationship of fixed and mobile networks and services in the Union and for the maintenance and furthering of universal service in the sector for the European citizen.

II THE APPROACH CHOSEN

The working out of a consistent approach for the Union with regard to mobile and personal communications must be seen against the background of overall policy objectives. The European Union's policy in this sector should :

→ be based on the recognition of the major market and technology trends which are having a dramatic effect on an already innovative sector. These trends are found in both the Union and world-wide, in particular, in the United States and the Pacific area ;

→ build on the policies of the Member States to date which have led in most Member States to a substantially more open and competitive environment ;

→ extend the basic principles of the Union's telecommunications policy and Community law, in particular the balance achieved between liberalisation and harmonisation, to mobile communications ;

→ take full account of the wider international dimension and the existing framework for cooperation which has developed in the sector reaching beyond the European Union.

→ develop further the internal market in this area, as the basis for a strong negotiating position in the bilateral and multi-lateral framework aimed at achieving equivalent and comparable market access in third countries.

These five objectives have determined the approach taken by the Commission in developing the positions and proposals set out for consultation and discussion in this Green Paper.

The Commission has undertaken substantial analysis within its own services, as well as requesting external studies. As regards the latter, four major studies[3] have been carried out for the Commission, and presented and discussed in public workshops[4].

The studies were concentrated on the areas most critical for future policy formulation, in particular, future market and technology conditions to the end of the decade and beyond, to the

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3 "Scenario : Mobile communications 2010 : study on forecast development on future trends and technical development and commercial provision up to the year 2010", Report to the Commission of the European Communities, prepared by EUTELIS Consult, Ratingen, Germany, October 1993 ;
"Licensing and declaration procedures for mobile communications in Member States of the European Community", Report to the Commission of the European Communities prepared by Stanbrook & Hooper and KPMG Peat Marwick, August 1993 ;
"Study on analysis of new methods of frequency allocation in the Member States and comparative analysis of recent developments in this field", Report to the Commission of the European Communities prepared by Coopers & Lybrand, July 1993 ;
"Study on the application of Open Network Provision to mobile telephony, data networks, and paging services", Report to the Commission of the European Communities prepared by PA Consulting Group, November 1992.

4 Workshops were held on these studies in November 1992 and September 1993. Both workshops were attended by a broad spectrum of representatives of the different interests in the sector, in particular, representatives of fixed and mobile network operators, service providers, manufacturers, and users. The Commission also received a number of written statements and comments concerning the studies, as well as related statements of a more general nature.

year 2010, current licensing and radiofrequency allocation procedures for mobile systems in the Member States and future requirements in this field, as well as interface and interconnection issues between different systems and services and analysis of the application of the Open Network Provision framework to these issues.

The studies should be considered part of the consultation process and will be made available on request.

In parallel, the Commission has examined reports and comments forwarded by major organisations representing a variety of interests which were prepared with a view to contributing to the Green Paper[5]. The Commission also considered reports established in a national context, often based on national consultation and/or extensive hearings[6].

The Commission also received during the preparation period a substantial number of comments by mobile network operators, fixed network operators, service providers, and users which drew attention to specific issues involved.

These contributions have considerably assisted the Commission in its preparation of this Green Paper.

As regards extension of the principles of the Union's telecommunications policy to the sector, account must be taken of the substantial body of European Community law which is already in place, primarily, Directives and Decisions, in addition to positions represented by Resolutions, and Recommendations, but also the principles in the Treaty establishing the European Community ("the Treaty").

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5 Reports were forwarded, inter alia, by the following organisations :
European Committee for Telecommunications Regulatory Affairs (ECTRA), "Review of the requirements for the future harmonisation of regulatory policy regarding mobile communications services", report by ECTRA Mobile Project Team, October 1993 ;
European Telecommunications and Professional Electronics Industry (ECTEL), "An ECTEL contribution for the preparation of a CEC Green Paper on Mobile Communications", May 1991 ;
European Free Trade Association (EFTA), "Considerations and proposals concerning a Green Paper on Mobile Communications", interim working group on free movements of services and capital ;
Furthermore, a number of reports were submitted by national assocations and individual companies.

6 Direction de la Réglementation Générale (DRG), "Les télécommunications à l'âge de la mobilité, consultation publique sur l'introduction en France des systèmes de communications personnelles", November 1992 ;
Committee of experts on basic frequency regulation matters and civil telecommunications for BMPT, "Frequency regulation in the Federal Republic of Germany", June 1991 ;
Department of Trade and Industry, "Phones on the move", 1989
Furthermore, a number of publications by National Regulatory Authorities, regarding in particular licensing procedures and calls for tendering for licenses were studied.

These positions include Recommendations on the development of key mobile systems such as the pan-European digital mobile system (GSM - the Global System for Mobile communications), the new digital cordless system (DECT - Digital European Cordless Telecommunications), and the digital Europe-wide paging system (ERMES, the Pan-European Digital Paging System)[7] and the related Frequency Directives[8], as well as Decisions in fields of direct relevance to the future development of mobile communications, such as in numbering[9].

It also concerns significant Council Resolutions[10] and Resolutions of the European Parliament[11] which have set the political framework for the Union's telecommunications policy and the development of a common market in telecommunications services and equipment. This framework has developed on the basis of the 1987 Green Paper, the Green Paper on satellite communications of 1990, and the Telecommunications Review concluded in April 1993[12]. It has been expanded through the Council Resolutions setting the framework for coordination in the fields of frequencies and numbering[13], and Resolutions covering related fields, such as the Council Resolution on satellite-based personal communications[14].

Equally, the Directives central to Union's telecommunications policy have been taken into account, either where they are of direct application to the sector, or otherwise by extension of the principles enshrined in them where appropriate.

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7 Council Recommendation of 25th June 1987 on the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community (87/371/EEC ; OJ L196/81, 17.7.87) - concerning introduction of the GSM system;
Council Recommendation of 9th October 1990 on the coordinated introduction of pan-European land-based public radio paging in the Community (90/543/EEC ; OJ L310/23, 9.11.90) - concerning introduction of the ERMES system ;
Council Recommendation of 3rd June 1991 on the coordinated introduction of digital European cordless telecommunications (DECT) into the Community (91/288/EEC ; OJ L144/47, 8.6.91).

8 Council Directive of 25th June 1987 on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the European Community (87/372/EEC ; OJ L196/85, 17.7.87) - the frequency designation for the GSM system ;
Council Directive of 9th October 1990 on the frequency bands designated for the coordinated introduction of pan-European land-based public radio paging in the European Community (90/544/EEC ; OJ L310/28, 9.11.90) - the frequency designation for the ERMES system ;
Council Directive of 3rd June 1991 on the frequency bands to be designated for the coordinated introduction of digital European cordless telecommunications (DECT) into the Community (91/287/EEC ; OJ L144/45, 8.6.1991).

9 Council Decision of 29th July 1991 on the introduction of a single European emergency call number (91/396/EEC ; OJ L217/31, 6.8.91) ;
Council Decision of 11th May 1992 on the introduction of a standard international telephone access code in the Community (92/264/EEC ; OJ L137/21, 20.5.92).

10 Council Resolution of 30th June 1988 on the development of the common market for telecommunications services and equipment (88/C257/EEC OJ C257/1, 4.10.88) ;
Council Resolution of 19th December 1991 on the development of the common market for satellite communications services and equipment (92/C 8/01 , OJ C8/1, 14.1.92) ;
Council Resolution of 22nd July 1993 on the review of the situation in the telecommunications sector and the need for further development in that market (93/C 213/01, OJ C213/1, 6.8.1993).

11 See, inter alia, Resolution of the European Parliament on the Commission Communication of 21st October 1992 concerning the 1992 Review of the situation in the telecommunications services sector, 20.4.1993.

12 Green Paper on the Development of the Common Market for Telecommunications Services and Equipment (COM(87)290, 30.6.87) ;
Green Paper on a common approach in the field of satellite communications in the European Community (COM(90)490, 20.11.90) ;
1992 Review of the Situation in the Telecommunications Services Sector (SEC(92)1048 final) and Communication to the Council and European Parliament on the consultation on the Review of the situation in the telecommunications sector (COM(93)159 final).

13 Council Resolution of 28th June 1990 on the strengthening of European wide cooperation on radiofrequencies, in particular with regard to services for the pan-European dimension (90/C 166/02 ; OJ C166/4, 7.7.90) ; complemented by
Council Resolution of 19th November 1992 on the implementation in the Community of the European Radiocommunications Committee Decision (92/C 318/01 , OJ C318/1, 4.12.92) ,
Council Resolution of 19th November 1992 on the promotion of Europe-wide cooperation on numbering of telecommunications services (92/C 318/02 , OJ C318/2, 4.12.92).

14 Council Resolution of 7th December 1993 on the introduction of satellite personal communications services in the European Community (93/C 339/01; OJ C 339/1, 16.12.93).

This concerns, in particular, the Directives on competition in the markets for telecommunications services and for terminal equipment[15] which set the basic principles for telecommunications liberalisation in the Union ; the ONP framework and specific Directives which establish a framework for open access, interconnection and harmonisation[16] ; the Directives concerning mutual recognition which identify the procedures for implementing free circulation of terminal equipment and, according to current proposals, will apply the principle to licences to provide services[17], as well as Directives concerning the protection of the public interest in this field, such as the proposed Directive on the protection of privacy[18].

Finally, the more general environment of the European Union must be taken into account.

The Treaty on European Union has now added the establishment of Trans-European Networks as an important objective of the Union.

Title XII, Article 129b of the EC Treaty indicates that "*within the framework of a system of open and competitive markets, action by the Community shall aim at promoting the interconnection and interoperability of national networks as well as access to such networks*".

The European Union has undertaken substantial action to promote advanced mobile communications in the framework of its research programmes[19].

As regards the structure for cooperation in the sector beyond the European Union, key roles are played in the European context by the European Telecommunications Standards Institute (ETSI) ; the European Radiocommunications Committee (ERC), and its associated European Radiocommunications Office (ERO) ; the European Committee for Telecommunications Regulatory Affairs (ECTRA) and its future associated European Telecommunications Office (ETO), which are now developing continent-wide coverage, including the countries of Central and Eastern Europe.

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15 Commisison Directive of 16th May 1988 on competition on the markets in telecommunications terminal equipment (88/301/EEC ; OJ L131/73, 27.5.88)
Commission Directive of 28th June 1990 on competition on the markets for telecommunications services (90/388/EEC ; OJ L192/10, 24.7.90).

16 Council Directive of 28th June 1990 on the establishment of the Internal Market for telecommunications services through the implementation of Open Network Provision (90/387/EEC ; OJ L192/1, 24.7.90)
Council Directive of 5th June 1992 on the Application of Open Network Provision to Leased Lines (92/44/EEC ; OJ L165/27, 19.6.92) ;
Common position on a Council Directive on the application of Open Network Provision (ONP) to Voice Telephony, 1.7.93.

17 Council Directive of 29th April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity (91/263/EEC ; OJ L128/1, 23.5.91) ;
Council Directive of 29 October 1993 supplementing Directive 91/263/EEC in respect of satellite earth station equipment (93/97/EEC, OJ L290/01, 24.11.93)
for services :
Amended proposal for a Council Directive on the mutual recognition of licences and other national authorisations for telecommunications services, to be published ;
Proposal for a Council Directive on a policy for the mutual recognition of licences and other national authorisations for the provision of satellite network services and/or satellite communications services, to be published.

18 Modified proposal for a Council Directive concerning the protection of personal data and privacy in the context of public digital telecommunications networks, in particular the Integrated Services Digital Network (ISDN) and public digital mobile networks, to be published.

19 See in particular Council Decision of 7th June 1991 adopting a specific research and technological development programme in the field of Communications technologies (1990 to 1994) (91/352/EEC ; OJ L192/8, 16.7.91) - the RACE programme.

With all of these organisations, the Union has - or is in the process of developing - close cooperation. Future Union policy in the sector must take full advantage of the possibilities for cooperation which such organisations offer within the framework provided by Community law.

As regards the international environment beyond Europe, action there is influencing the conditions for the future development of the sector in the Union. All Member States have undertaken major commitments within the framework of the International Telecommunications Union (ITU), in particular with regard to the International Radio Regulations.

The World Administrative Radio Conference (WARC'92) held at Torremolinos has led to major commitments with regard to future availability of radiofrequencies for mobile communications. This will substantially affect the development of mobile and personal communications in the Union.

At the same time, the Union is negotiating to achieve, at the international level, a new multi-national trading environment in the context of the General Agreement on Tariffs and Trade. This will also have a major impact on the Union's relations with third countries in the field of mobile services and equipment.

The approach chosen in this Green Paper has aimed at taking into account this evolving and complex environment. Results of the analysis have been grouped according to those factors which represent critical challenges for any approach at a Community level. Detailed consideration of each of these factors is presented in four annexes :

- Review of technological and market developments **(Annex A)** ;
- Analysis of the European environment for future development **(Annex B)** ;
- Review of world-wide developments **(Annex C)** ;
- Analysis of the extension of the principles of the Union's telecommunications policy to the mobile sector **(Annex D)**.

The main results are set out in the following chapter.

III MAIN RESULTS OF ANALYSIS AND CONSIDERATIONS TO BE TAKEN INTO ACCOUNT

The main results of the analysis undertaken are summarized below. For detailed explanation of the various issues, reference should be made to the Annexes and the Glossary of technical terms.

III.1 Major trends and opportunities.

1 The mobile telecommunications sector represents one of the major areas for potential growth in the communications and information sector.

From the studies undertaken mid-range estimates of the use of mobile communications in Europe suggest that there could be nearly 40 million users by the year 2000 and up to 80 million users by 2010 - up from a current total base of around 16 million users (including cellular telephony, paging and private mobile radio).

Market research predicts that 20 to 30% of the business users can be expected to have personal mobile communications by the year 2000, with slower penetration growth thereafter. By 2010 penetration would be 30 to 50%.

In addition, 30 to 40% of the population would have personal communications for private use by 2010.

With the broadening of mobile communications to full scale personal communications, penetration levels can ultimately be expected to reach near 80% of the entire population. Total user numbers could ultimately substantially exceed 200 million in the European Union - compared to a current total subscriber base for traditional fixed telephony of 153 million.

This makes the future development of mobile and personal communications of key interest to the Union, both in the context of the development of trans-European networks and as a central component of the Union's future communications and information infrastructure.

2 Currently, the overwhelming majority of mobile systems in the Union are still based on analogue technology, composed of three well established services - so called **private mobile radio** (for the use of corporate networks - this Paper will describe this as "own use" - or for the use of closed user groups, e.g. for fleet management,

emergency services, taxi-cab services, single businesses, etc.), **paging** and **public cellular radio services** (carphones, mobile phones, etc.)[20].

The total user base for all mobile services grew over 20 % in 1991, led by an increase in cellular usage of over 40 %. Despite the general economic downturn, 1992 growth in cellular subscriptions remained strong.

As well as accounting for greater than 45 % of the total user base, cellular also accounts for around 90% of the value of the total European market for mobile services and 75% of that for mobile equipment.

3 Digital technologies are now being introduced in both public and private mobile radio communications. This will rapidly determine the pattern of development for the sector.

While the public mobile telephony market is still served mainly by analogue cellular technologies such as NMT, TACs and other systems, the digital technologies now being introduced, in particular GSM 900 (the European Global System for Mobile communications), DCS-1800 (so called Personal Communications Networks - PCN services) and DECT (Digital European Cordless Telecommunications), as well as systems such as CT2, and ERMES (the pan-European digital paging systems) and TFTS (the European digital Terrestrial Flight Telecommunications System) will rapidly overtake analogue systems[21].

Only one year after its effective launch, GSM accounts for over 10% of the installed cellular mobile telephony base in the Union.

As regards private mobile radio, new digital technologies such as TETRA (the European standard for digital trunked systems), mobile data, DSRR (Digital Short Range Radio), wireless LANs and wireless PABXs (including use of DECT in this area) are expected to provide a substantial push in this part of the market.

4 The development of digital mobile systems has been a major success for European industry, the European standardisation system, in particular, the European Telecommunications Standards Institute (ETSI), and for European operators. A number of recently developed European systems are poised to become world standards. Europe is now considered to be the world leader in digital cellular systems. GSM has been adopted - or planned to be adopted - in more than 60

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20 For definition and technical details see Glossary of Technical Terms
21 For details see Annex A

countries, in particular, throughout Europe including the countries of Eastern and Central Europe, and also in the Pacific Area with the exception of Japan, and in a number of other countries in Asia, the Middle East and Africa.

European industry has obtained a strong position in both network and terminal equipment markets in this area, and GSM is having a major impact on ensuring the world position of the global European telecommunications industry, with a resulting positive effect on its growth, competitiveness and employment.

At the same time, GSM is overcoming the market fragmentation in the Community which resulted from the use of incompatible analogue systems in the Member States, and is developing into a major example of a market-led introduction of a trans-European network.

Based on a common development effort from the very beginning, resulting common standards and a consistent Community approach to the area, GSM has established a new model for the development of trans-European networks and systems.

5 The licensing of competitive systems in the majority of Member States has made a substantial contribution to the take off of GSM services.

Competitive provision has also been the basis, in a number of Member States for the development of DCS-1800 services, telepoint services, paging and trunked systems. This is in addition to the liberal licensing policy for private mobile radio generally found in all Member States[22].

6 One of the most dramatic effects in European telecommunications over the recent period has been the substantial price decreases of digital mobile terminal equipment and the reductions and innovative price packages offered for mobile services.

According to the studies carried out, it appears that the development towards mass-market use of mobile communications and the evolution towards mass-distributed personal communications services will accelerate substantially once terminal handset prices fall below 250 ECUs.

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22 For further details see Annex B
As regards GSM, eleven out of twelve Member States have either licenced - or announced their intention to licence - two operators (in the field of analogue cellular telephony, two Member States have licenced competitive providers; in the rest of the Community analogue cellular services are generally provided by the existing telecommunications organisations, as far as such systems are available).
As regards DCS-1800 (so-called PCN operators), systems have been licenced to date in two Member States with licensing procedures underway or being considered in other Member States.
As regards telepoint services based on CT2 (or in future DECT), five Member States have awarded licences or launched pilot projects, however some of the licensees have subsequently withdrawn from the market.
As regards so-called trunked (Public Access Mobile Radio - PAMR) systems, six Member States have allocated national or regional competitive licences to date.

While handset prices are in general still a factor of 2 to 3 times higher, the current rapid price decreases seem set to accelerate the development towards personal communications.

7 Europe's role as a technology leader provides a favourable starting point for the evolution towards the emerging personal communications environment. Personal communications will ultimately allow person-to-person calling independent of location and the terminal used, the means of transmission (wired or wireless) and/or the choice of technology.

As the analysis and recent reports show[23], personal communications services are likely to be based initially on combinations of existing systems such as GSM, DCS-1800 and DECT, together with intelligent network functions in the fixed network providing for mobility via the fixed network, and will include satellite-based personal communications systems, in particular, to provide coverage in peripheral or thinly populated regions[24].

This trend will be further reinforced by the move towards portability. After desktop work stations and PCs have shown strong growth rates, demand shifted first to laptops, notebooks, and pen-books and now towards full-scale Personal Intelligent Communicators (PICs) or Personal Digital Assistants (PDAs), which may develop into a mass market tool operated by use of a keyboard, touch screen or pen pointer[25].

Tomorrow's communicator will integrate the features of telephone, agenda and organiser, combined with PC functions. Industry has already introduced very small PCs ("palm-tops"). Ultimately these devices are likely to integrate all features that modern telephony offers. This will include video-phone and fax features, as well as the possibility to "plug" into office or private computers. They will integrate multimedia and telecommunications applications.

8 The person-to-person calling concept, personal and portable numbers, and the combination of mobility in both fixed and mobile networks will lead, once such innovative service combinations are allowed, to a gradual blurring of distinctions

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23 See, inter alia,
Eutelis "Scenario Mobile Communications 2010 - future trends in technological development in commercial provision up to the year 2010", Report to the Commission of the European Communities, October 1993, and
Direction de la Réglementation Générale (DRG) "Les télécommunications à l'âge de la mobilité, consultation publique sur l'introduction en France des systèmes de communications personnelles", November 1992.

24 See also Council Resolution of 7th December 1993 on the introduction of satellite personal communications services in the European Community (93/C 339/01; OJ C 339/1, 16.12.93)

25 Such applications are currently investigated interalia in the Community R&D programme in the field of telematics (Council Decision 91/353/EEC, OJ L192/18, 16.7.91) where e.g. on-line traffic data, navigation maps and planning of personal trips are combined on the same mobile communication terminal. In addition, new services are evolving in markets such as transport, health care, education and training where the use of mobile communications offer flexibility for new applications.

which now exists between fixed and mobile services, in parallel with the development of Intelligent Networks. *"Mobile services are then likely to become more integrated with the fixed networks. The regulatory regime must therefore make provision for these changes"*[26].

Personal communication services, allowing person-to-person calling based on a concept of full mobility will create a completely new telecommunications environment.

9 Ultimately, personal communications services are likely to be carried most economically via a single integrated technology concept - the so-called UMTS (the Universal Mobile Telecommunications System).

The strong European position in digital mobile communications has made the Union a major actor in the work towards this future "third generation" system, building on the strengths of the current second generation digital mobile systems.

The Community's programme in advanced telecommunications technologies[27] (RACE) has substantially contributed to developments in this area and is currently supporting European industry in testing future technology options. ETSI's Special Mobile Group (SMG) which is also responsible for future development of GSM and DCS-1800, is working on standards in this area, thereby contributing to the preparation of the European position in the International Telecommunications Union (ITU), which is studying this area under the description Future Public Land Mobile Telecommunications Systems (FPLMTS).

Given Europe's leading position in the implementation of digital mobile technologies with regard to the United States[28] and Japan, Europe has the opportunity to carry forward its success in the GSM system into the future third generation market for personal communications technologies.

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26 European Committee for Telecommunications Regulatory Affairs (ECTRA), "Review of the requirements for the future harmonisation of regulatory policy regarding mobile communications services", ECTRA Mobile Project Team, October 1993.

27 Council Decision of 7th June 1991 adopting a specific research and technological development programme in the field of communications technologies (1990 to 1994), (91/352/EEC ; OJ L192/8, 16.7.91).

28 See Annex C

III.2 Barriers to be overcome

10 While Europe has developed a strong position in mobile communications and in the race towards personal communications services, substantial barriers still remain[29].

11 As the majority of Member States are moving towards a competitive environment, certain Member States continue to maintain exclusive rights in different market segments which do not allow full scale development of the market, or special rights which prevent equality of opportunity for all market participants.

12 Systems are generally licenced according to technologies.

On the one hand, this is linked to assignment methods for radiofrequencies and is justified to a certain extent by the need to ensure electromagnetic compatibility and efficient use of frequencies. It has also facilitated interoperability and the use of European standards.

On the other hand, technology-based licensing leads to market fragmentation between different technologies and standards, unless sufficient flexibility is allowed in provision and combination of such services in response to market demand.

13 Current licensing activities are nationally oriented. This results in a web of parallel national systems in the Union.

While this has the advantage of allowing systems to be fully adjusted to specific national needs, this focus also leads to substantial delays in the implementation of pan-European systems. This has been the case even for those systems where this potential is most obvious. One example is the substantial delays and gaps experienced in ensuring full-scale roaming in the Union[30] within the GSM network.

14 There is no consistent approach in the Member States with regard to service provision, especially with regard to the activities of independent Service Providers.

Common principles relating to service provision (whether as an integrated part of a mobile network or by independent service providers), with the aim of facilitating service provision throughout the Union in line with Article 59 and the Treaty Competition Rules, could overcome the current effects of both technological and

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29 For a full discussion of current barriers, see the analysis of the current European environment in Annexes B and D.

30 Roaming means the capability to access a mobile communications system anywhere in the Community, independent of country and the mobile communications operator over whose network(s) the connection is made (such as over the pan-European mobile digital system, GSM), on the basis of a single subscription to a service provider, usually in the subscriber's home territory.

national fragmentation of mobile systems. It could also make a substantial contribution to the further development of the mobile market.

15 One consequence of the current fragmentated approach to future development and service provision within the Union is the lack of a common vision on the development of personal communications services and the ultimate transition to the Universal Mobile Telecommunications System.

The lack of such vision, insufficient dynamism in the approach to service provision and failure to adjust to market requirements could jeopardize Europe's current strong position.

16 This situation is further aggravated by the lack of firm timetables for allocation of radiofrequencies for new European technologies.

While the Council Directives for the Community-wide designation of frequency bands for GSM, DECT, and ERMES have charted the pattern of development for those systems, and while ERC Decisions have been recently adopted concerning frequency allocation for TFTS and DSRR, major decisions are still outstanding.

This concerns in particular firm agreement and implementation of Europe-wide frequency bands for DCS-1800, a vital technology for Personal Communications Services ; TETRA, a major future technology for private mobile radio, and firm planning in the Union for the implementation of the frequency bands designated at WARC'92 for the UMTS/FPLMTS, which is vital for giving a firm base to the development of UMTS in Europe.

17 At the same time, the Union to date has not yet found a suitable response to the US dominated initiatives in satellite-based personal communications.

While the US is lagging behind Europe in the implementation of digital terrestrial mobile systems, it is now emphasizing satellite-based personal communications as a major strength and aims to play a dominant role in this global market.

The Council Resolution of 7 December 1993 on the introduction of satellite personal communications[31] calls for determined Community action in this field.

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31 Council Resolution of 7th December 1993 on the introduction of satellite personal communications services in the European Community (93/C 339/01; OJ C 339/1, 16.12.93).

18 The general trend in cellular systems is towards micro-cellular systems with cell sizes down from some 30 kilometres diameter to 10 kilometres and substantially less in high density urban areas. This has been prompted by technologies such as DCS-1800, as well as commercial and frequency-efficiency needs. This trend will increase the investment requirements for mobile communications operators by between 2 to 4 times in comparison to traditional cellular systems. However, mobile operators remain hampered in a number of Member States by restrictions on use of own infrastructure and/or use of third party infrastructure, as well as on the sharing of infrastructure all of which prevents them from improving their efficiency.

At the same time, mobile operators are facing the need to lower tariffs and restructure prices in order to keep pace as micro-cellular systems move towards the mass personal communications services market.

19 Access to third country markets, in particular, to the United States and Japan, remains difficult for European manufacturers and operators, while European manufacturers buy a major part of their integrated circuits and components for digital mobile equipment in the U.S. and Japan, and U.S. manufacturers and operators play a significant role in the European mobile communications market[32].

This imbalance could undermine, in the medium term, the economics of the European mobile communications sector.

III.3 The way forward

20. In analysing the way forward, full account should be taken of the scope and scale of action required to overcome current barriers impeding the development of a Union-wide market for mobile communications and the gradual transition towards a personal communications environment.

The further development of such a Union-wide market mobile services and mobile equipment can allow operators, service providers and manufacturers to achieve important economies of scale and scope, which will be reflected in improvements in innovation and services quality and decreasing prices which cannot be easily achieved on the basis of fragmented national markets. Furthermore, mobile services have by their very nature, a pan-European vocation which requires co-ordinated action,

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32 **For further detail, see Annexes C and D, Section 12**

consistent with Treaty obligations, to provide Union-wide solutions to issues of standardisation, and frequency and numbering co-ordination; and more broadly to allow a common regulatory framework to promote the emergence of pan-European services, operators and service providers.

21. This approach must draw on the basic principles enshrined in the Treaty and, in particular, Article 3 promoting the further development of the internal market, together with the fundamental principles of Community law guaranteeing the freedom of movement of goods (Article 30); the right of establishment (Article 52) and the free provision of services (Article 59); the competition rules enshrined in Articles 85, 86 and 90; as well as the mechanisms provided under Article 100(a) for harmonisation measures designed to remove barriers created, for example, by national regulatory structures or licensing regimes, within the internal market.

The approach also draws on the new political priorities and principles established by the Treaty on European Union, in particular, the establishment and development on Trans-European Networks and the fundamental principle of subsidiarity enshrined in Article 3b.

A full discussion of the extension of the Union's existing telecommunications policy to mobile and personal communications, which underpins the positions proposed in this Green Paper, on the basis of these Treaty obligations and Community legal principles is presented in Annex D.

22 The maintenance of exclusive and special rights is creating a situation which appears to be incompatible with the Treaty[33] and such rights should be abolished.

According to experience, some 95% of all calls transmitted via cellular mobile communications networks in Europe are calls to terminals connected to the fixed network or calls originating on the fixed network.

Mobile communications networks are therefore, at this stage, not likely to reduce nor substitute, but rather substantially increase traffic and revenues on the fixed network. They therefore cannot undermine the financial viability of the telecommunications organisations operating the fixed network, nor could they obstruct the performance of the particular tasks assigned to such operators[34].

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33 For a detailed discussion of the effects of such rights see Annex D, section 2

34 See Annex D, Section 2

23 As a general principle regulation should be reduced to a minimum, with market forces, subject to the Community competition rules, playing a predominant role in shaping future markets. Regulation should be confined to areas of public interest.

Licensing conditions for mobile telecommunications systems should be limited to essential requirements and conditions based on public service requirements in the form of trade regulations as defined by Commission Directive 90/388/EEC and Council Directive 90/387/EEC as well as Commission Directive 88/301/EEC and Council Directive 91/263/EEC[35], and the extension of the measures to the satellite sector[36].

Essential requirements should concern in particular effective use of the radiofrequency spectrum and electromagnetic compatibility requirements, as well as security of network operation, maintenance of network integrity, and, in justified cases, interoperability of services and data protection ; and user safety, and safety of employees.

Conditions based on public service requirements in the form of trade regulations[37] for systems intended for use by the general public which address permanence, availability and quality of the service. This may also imply conditions relating to the technical competence and financial resources of the licensee[38].

License conditions must be based on objective grounds, be transparent, be non-discriminatory and respect the principle of proportionality. When a license to provide a mobile network is granted to an operator which also runs a fixed network, the license should encompass specific safeguards to ensure fair competition[39].

This also implies that license fees must be based on objective facts, be proportionate and be justifiable.

24 The major condition for the development of the sector and the further development of the internal market and a fair competitive environment will be overcoming three

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35 Commission Directive of 28th June 1990 on competition on the markets for telecommunications services (90/388/EEC ; OJ L192/10, 24.7.90)
Council Directive of 28th June 1990 on the establishment of the Internal Market for telecommunications services through the implementation of Open Network Provision (90/387/EEC ; OJ L192/1, 24.7.90)
Commission Directive of 16th May 1988 on the competition in the markets for telecommunications terminal equipment (88/301/EEC ; OJ L131/3, 27.5.88)
Council Directive of 29th April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity (91/263/EEC ; OJ L128/1, 23.5.91).

36 Council Directive of 29 October 1993 supplementing Directive 91/263/EEC in respect of satellite earth station equipment (93/97/EEC; OJ L290/01, 24.11.93)
Draft Commission Directive amending Directives 88/301/EEC and 90/388/EEC in particular with regard to satellite communications, to be published.

37 See Annex D, Section 3.

38 Licensing award procedures should take into account the ability of potential bidders to comply with trade regulations covering permanence, availability (including, for example, speed of network development, compliance with price cap formulas) and quality of service to be contained in the licence to be awarded. The relative weighting of such criteria must be objectively based, transparent (i.e. published in detail in any call for bids) and respect the principle of proportionality.

39 It should, where necessary, provide that a distinct subsidiary should be set up to operate the mobile activity on an arms length basis.

key barriers in the Union: lack of flexibility in service provision, both across licences and within and between Member States; conditions concerning the interface between mobile network operation and the fixed network(s); and the lack of flexibility in use of own or third party infrastructure, and in sharing of infrastructure[40].

Overcoming these barriers will not only develop the mobile market, but will also allow through combined service offerings a major step to be taken towards personal communications services.

25 Achieving fair interconnection agreements with the fixed network(s) is vital for mobile operators[41]. Payments to fixed network operators for the conveyance of calls to their final destination and the provision of leased lines for the establishment of the mobile network typically account for 30-50% of total revenue of mobile network operators. These costs therefore determine to a large extent the economics of mobile network operation.

The basic framework for such interconnection is established within the Open Network Provision rules, in particular, the proposed ONP Voice Telephony Directive[42].

According to the ONP framework, National Regulatory Authorities carry the principal responsibility for ensuring interconnection. This offers sufficient flexibility to allow full account to be taken of national situations.

26 The prohibition or restriction on mobile network operators using their own transmission infrastructure or that of a third party, or on the sharing of infrastructure is a major barrier to the development of mobile communications and appears to be conflicting with the Treaty competition rules[43].

Current positions in Member States vary. Given that a number of Member States have lifted such restrictions without any visible impact on the revenues of the fixed network operator(s) or their financial viability, maintenance of such prohibitions appears difficult to justify.

27 This is particularly true in the case of infrastructure used for direct connections with other mobile operators, both within and between Member States. This has been

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40 For further consideration of these barriers, see Annexes B and D, Sections 3,6 and 10.
41 For full discussion, see Annex D, Section 6.
42 Common position on a Council Directive on the application of Open Network Provision (ONP) to Voice Telephony, 1.7.93.
43 For full discussion, See Annex D, Section 10.

aggravated by the current persistent difficulties for a number of fixed networks in providing mobile network operators with transmission facilities at reasonable cost or with the necessary technical facilities (such as control and signalling functions for roaming between mobile networks and between Member States).

Direct connection could overcome these barriers and accelerate Europe-wide roaming as well as the establishment of trans-European networks, with a schedule for such a development to be determined on the basis of the comments received during the consultation period.

Within this framework such policy should, as identified in Council Resolution 93/C213/01, "recognise the need to take into account the objectives of Community cohesion in the light of the specific circumstances of peripheral regions".

28 The regulation of service provision, as well as attitudes towards independent service provision vary substantially across Member States.

Diversification and liberalisation of service provision is essential for the future of European mobile networks, as well as for Europe-wide service provision.

In principle, network operators should meet all reasonable requests by service providers for access to their services, whether from an independent service provider or from a service provider integrated into other mobile network operations, within the limits of normal commercial practice and subject to the provisions of competition rules.

29 Service provision should not be subject to licencing in the Member States and may only be subject to a requirement for declaration by Service Providers of their activities to the National Regulatory Authority(ies) of the Member State(s) where they choose to operate[44].

A Code of Conduct for Service Providers should be established on a voluntary basis.

The Code should, in particular, identify measures to safeguard essential requirements consistent with the Community regulatory framework in this area and commitments with regard to permanence of service, availability and quality of service, as well as providing guidelines concerning technical, financial, and commercial practices fully consistent with the Treaty's competition rules.

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44 For full discussion, see Annex D. Section 3.

The Code should also take fully into account the need to attain a high level of consumer protection.

30 Definition of interfaces is required[45], in particular, for :

- the interfaces between mobile network and fixed network infrastructure ;
- the interfaces, functionalities and service elements made available by mobile network operators to independent service providers ;
- the interfaces made available to access the intelligent functionalities of fixed network(s) ;
- the interfaces for private mobile networks to interconnect with the public fixed network, where applicable ; and
- the interfaces to interconnect directly mobile networks of same or different technologies, as required.

31 The basic principles set by Council Directive 90/387/EEC[46] apply to such interfaces.

This implies in particular that, for mobile communications, interconnection conditions established at these interfaces should be based on objective criteria, be transparent, and non-discriminatory, cost-oriented, and compatible with the principle of proportionality, as well as respecting the essential requirements.

The establishment of suitable interconnection agreements respecting these principles should be primarily a matter for commercial agreement between market participants.

At this stage it does not seem necessary to establish further specific Directives concerning these interfaces and related interconnection conditions at a Community level, provided such interconnection is subject to strict supervision by National Regulatory Authorities to ensure full application of these principles and the establishment of suitable dispute resolution procedures.

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45 . The importance of defining these interfaces to remove obstacles to the development of the internal market and to promote pan European services is discussed further in Annexes B and D, Section 6.

46 Council Directive of 28th June 1990 on the establishment of the Internal Market for telecommunications services through the implementation of Open Network Provision (90/387/EEC ; OJ L192/1, 24.7.90)

32 Standards concerning these interfaces should, in general, be voluntary.

In order to facilitate interconnection, the establishment of technical standards concerning these interfaces should be promoted and published, where required, in accordance with the provisions of Directive 90/387/EEC.

Only in cases where it is strictly necessary to ensure basic interoperability and freedom of choice for users, and subject to the principle of proportionality, should references to standards be made binding under the provision of Art. 5(3) of Directive 90/387/EEC.

This corresponds to the general approach to the overall adjustment of Open Network Provision in the context of the follow-up of the 1992 Telecom Review[47], which emphasizes voluntary commitments and commercial negotiation between the parties concerned, with regulatory intervention only as the last resort.

33 As set out, personal communications services are likely to be carried initially by a combination of existing digital mobile technologies, and ultimately, by a combination of mobile communications networks and the fixed networks.[48]

As a first step to launching this evolution from current mobile services towards such a personal communications environment, the removal of restrictions on the combination of multiple mobile technologies or services through a single service provider is required. This will allow users to access different mobile communications systems and services via hand sets combining different technologies such as DCS-1800, GSM, and DECT.

Subsequently, restrictions on the free combination of services provided via the fixed and mobile networks should be removed.

34 The full freedom to combine fixed and mobile communications services and to offer, or resell, services via mobile and fixed communications networks without limitations, including the switching of connections between fixed terminal destinations, will depend on the schedule for full liberalisation of public voice services established in Council Resolution 93/C 213/01[49], namely 1st January 1998, with additional

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47 Council Resolution of 22nd July 1993 on the review of the situation in the telecommunications sector and the need for further development in that market (93/C 213/01, OJ C213/1, 6.8.1993).

48 For full discussion,see Annex D, Section 11.

49 Council Resolution of 22nd July 1993 on the review of the situation in the telecommunications sector and the need for further development in that market (93/C 213/01, OJ C213, 6.8.93)

transition periods of up to five years for Spain, Ireland, Greece, and Portugal and, where justified, two years for Luxembourg.

Such fully integrated service provision will be subject to conditions which may be agreed for licenses for provision of public voice telephony via the public fixed network, concerning, inter alia, universal service obligations and/or sharing of the financing of such obligations. It will also be subject to Community competition rules.

35 In order to introduce a more European focus into current mobile communications operations and licensing procedures, and to facilitate the establishment of trans-European networks and services, the principle of full mutual recognition of approvals, licences and authorisations should be applied whenever technically possible.

36 This applies in particular to mobile terminal equipment.

Mobile terminal equipment should be subject only to type approval according to the principles of Directive 91/263/EEC[50] and Directive 93/97/EEC, which allow application of specific conditions ensuring electromagnetic compatibility.

To the extent that mobile terminal equipment is not capable of connection to the public network and therefore currently outside the scope of application of Directive 91/263/EEC and is not covered by Directive 93/97/EEC, Directive 91/263/EEC should be extended to include such equipment within its scope[51].

Where the provisions of Directive 91/263/EEC have still not been made applicable to specific types of mobile equipment[52], and where specific licences or class licences are required in Member States to provide for efficient use and operation of equipment, the principle of full mutual recognition of licences granted in another Member State should apply to ensure free circulation of such equipment in the Union.

Further, pending adoption of CTRs[53] or other harmonised standards and subject to the framework provided by ACTE[54] establishment of interim type approval procedures in the context of the European Radiocommunications Committee (ERC)

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50 Council Directive of 29th April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity (91/263/EEC ; OJ L128/1, 23.5.91).

51 Coucil Directive of 29 October 1993 supplementing Directive 91/263/EEC in respect of satellite earth station equipment (93/97/EEC, OJ L290/01, 24.11.93) - Specific issues arise, in particular, in the case of terminal equipment not intended for connection to the public switched network. See Annex D, Section 8.

52 with the exception of satellite-based mobile equipment covered by Directive 93/97/EEC.

53 Common Technical Regulations (CTR)

54 Approvals Committee for Terminal Equipment (ACTE)

can assist in achieving the objectives of Directives 91/263/EEC and 93/97/EEC in those cases[55].

37 As regards licensing of mobile communications networks and systems[56], the principle of mutual recognition can only be fully applied, where there are no limitation of the number of licensees.

A restriction on the mutual recognition should only be introduced if justified on the basis of essential requirements such as the efficient use of frequencies, and where applicable ensuring compliance with public service requirements in the form of trade regulations[57]. Such restrictions must be consistent with the Treaty competition rules and subject to verification of their compatibility with Treaty obligations.

Any limitation of numbers should be consistent with the principle of proportionality, by imposing the least limiting solution and giving priority to competitive provision.

38 Where selection of licences is made on the basis of first-come/first-served, mutual recognition should in principle be applied subject to availability of radiofrequencies.

This concerns, in particular, satellite-based mobile communications networks and terrestrial mobile communications networks especially in border areas and in the case of mobile networks licenced for own use or use by closed user groups (private mobile radio networks).

As regards satellite-based mobile services, the situation is addressed in the proposed Directive for the mutual recognition of satellite service licences[58].

39 Where limitations are imposed on the number of licences for the reasons set out above and the award of licences is carried out, for example, on the basis of comparative bidding, full application of the principles of mutual recognition is no longer possible.

Whichever method is used to award licences - first come/first served, comparative bidding, auctioning, lottery - licence award procedures must be based on open, non-discriminatory and transparent procedures.

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55 For further discussion of the issue of type approvals, see Annex D, Section 8.

56 For full discussion of application of Community principles to licensing see Annex D, Sections 3 and 8.

57 As defined in Article 3(2) of the Services Directive. See Annex D, Section 3. Where frequency spectrum is still available, Member States could, in determining whether to accept mutual recognition of operator's licences granted in other Member States, take account of the extent to which the objectives sought by trade regulations would be satisfied by that operator.

58 Proposal for a Council Directive on a policy for the mutual recognition of licences and other national authorisations for the provision of satellite networks services and/or satellite communications services (to be published).

40 The method chosen to award licences should be implemented in a way that the final selection offers maximum guarantees for the full respect of the essential requirements and the achievement of the goals sought in any public service requirements in the form of trade regulations as regards user benefits, in particular in terms of price.

Lotteries are compatible with the Treaty, but do not seem to offer the most adequate guarantees for the future development of mobile communications market and, in particular, do not allow an assessment of the ability of participants to satisfy the criteria set out, in particular, concerning respect of the essential requirement for efficient use of frequencies as well as requirements relating to technical competence and financial resources of the operator, in order to ensure such efficient use.

As regards the award of licences through auctioning on the one hand, studies carried out for the Commission point to substantial problems flowing from auctioning of licences and related frequency resources, such as excessive transfers to the public budget or for other purposes, resulting in artificial barriers to entry to the relevant market, higher prices to the consumer and a slower coverage of the Union[59]. On the other hand, auctioning is now used in the United States and mixed forms of auctioning and comparative bidding have also been used recently in some cases in the Union and other countries. Current data is still inconclusive on the results of these experiences. Reports[60] in some Member States have addressed the issue of auctions.

At this stage, comments are sought on the different allocation methods. Currently, comparative bidding seems to be the method to be considered most satisfactory for the allocation of public mobile communications licences in the majority of Member States, while first come/first served is used in the field of private mobile radio, with the exception of licences and authorisations for Public Access Mobile Radio (PAMR), serving regional or national Private Mobile Radio systems on a shared basis.

41 Licensing in the Union is currently carried out at the national level.

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59 Additional competition concerns can arise where auctioning of licences for new systems favours the supplier of an existing technology or system, especially if that supplier is the incumbent TO. Auctions also may promote the creation of anticompetitive groupings among potential bidders.

60 See Committee of experts on basic frequency regulation matters and civil telecommunications for BMPT "Frequency regulation in the Federal Republic of Germany", June 1991

In order to further the development of the internal market and promote pan-European services and networks a number of measures should be taken to overcome the national fragmentation of the mobile market[61].

42 Roaming agreements should be promoted.

In particular, cross-border roaming agreements allow the use of mobile services and sending and receiving of calls by a user in Member States other than in territory covered by his or her original subscription with a service provider, or mobile communications operator in the case of direct service provision.

Roaming capability is fundamental to Europe-wide use of public mobile systems, in particular GSM and, in the future, DCS-1800, as well as all satellite-based mobile services.

Besides the necessary technical requirements such as exchange of call, signalling and control data between the networks over which the calls are exchanged[62], the underlying requirement is that the commercial relationship established between Service Providers and mobile communications operators in one Member State is fully recognised by other Member States and that no restrictions are applied concerning any activity resulting from such relationships.

In fact, the provision of services in the context of such roaming agreements represents the exercise of the freedom to provide services in a Member State other than the one in which the Service Provider is established[63].

Such activity should not be subject to any regulatory restriction. Nor should it be subject to any surcharge or equivalent measure unrelated to the actual cost of the provision of the roaming facility itself, whether imposed as result of regulatory or other action.

43 As regards planning and management of the central resource for mobile communications - radiofrequencies, substantial progress on coordination in Europe has been made with the establishment of the European Radiocommunications Committee (ERC) and the European Radiocommunications Office (ERO).

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61 Examples are discussed in Annexes B and D.
62 Such technical requirements also extend to adequate provisions ensuring confidentiality of communications, data protection and privacy.
63 This freedom is guaranteed by Article 59 EC. See discussion in Annex D.

The major objective must now be to establish the appropriate relationship between the ERC/ERO framework and the Union, respecting the principle of subsidiarity whilst safeguarding Union interests and obligations under the Treaty[64].

44 In the immediate future, a number of short term bottle-necks in frequency allocation must be lifted to allow mobile and personal communications market development in the Union.

This requires both decisions on frequency allocations and the timely implementation of such decisions by the Member States. This concerns in particular a firm decision on frequency bands for DCS-1800, firm allocation of harmonised bands and sufficient frequency resources for the Digital Mobile Trunking System (TETRA) and establishment of a decision concerning frequency bands for satellite-based personal communications systems (including so-called Low Earth Orbit (LEO) satellite systems), including a schedule of allocation.

45 The overall goal for securing the development of the sector should be full implementation and the early firm designation and schedule of allocation for the bands set aside at the World Administrative Radio Conference at Torremolinos (WARC'92) for the future Universal Mobile Telecommunications System (UMTS / FPMLTS) in the 1885 to 2025 and 2110 to 2200 MHz range. This goal is required in order to provide overall certainty for future sectoral development in the Community.

This is essential to maintain opportunities for Europe in the future UMTS/FPMLTS system, particularly given current US regulatory policies which give priority to the satellite-based personal communications systems, where the United States has, at this stage, a technological advantage.

46 Number allocation and the European numbering space is the second major resource to which access is vital for the development of mobile services. This will gain dramatically in importance with the advent of personal communications services.

The new coordination mechanisms in the European Committee for Telecommunications Regulatory Affairs (ECTRA) and its future associated European Telecommunications Office (ETO) which will also take care of the numbering coordination, must rapidly be put into place and a firm relationship with

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64 For further discussion of frequency coordination issues see Annex D, Section 4.

the Union established. Such a relationship should follow the approach taken in the field of radiofrequencies[65].

47 Several short-term numbering priorities will have to be addressed, in particular, harmonisation of access codes for mobile systems ; harmonisation of access codes for directory services ; harmonisation of principles of allocation of numbers or number ranges for access codes for Service Providers or for special service features.

The global objective must be the rapid creation of a European numbering space, as the only viable long-term basis for personal and portable numbers and Europe-wide personal communications.

48 Europe, based on its success in current generation digital mobile technologies, is in a leading position in the race towards the future Universal Mobile Telecommunications System (UMTS/FPLMTS), which is likely to be a future universal base of personal communications services. It can build in this field on the current work in the Community research programmes in the field of advanced telecommunications technologies[66] and in the framework of ETSI's Special Mobile Group (SMG).

However, in order to maintain and benefit from this position, a number of conditions will have to be fulfilled.

49 The major pre-condition for a market-led introduction of UMTS into the European telecommunications system is the creation of conditions which promote early development of Personal Communications Services. The proposed lifting of restrictions on service offerings which combine services provided through different existing mobile technologies and/or via the mobile and fixed networks, will play a key role in creating such conditions.

Without such steps, the necessary market pull and experience will not be successfully developed. Nor will the required market volumes be achieved early enough in Europe to allow a successful transition in a second stage for those services towards a unifying technology base such as UMTS, as the most economic ultimate solution.

50 The European Union must contribute in a co-ordinated manner to the drawing up of strong European positions in the international fora where the future standards, frequency and numbering decisions in this area will be taken.

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65 See "A new approach to the coordination of radiofrequencies in the Community, Communication from the Commission concerning proposal for a Council Decision on the implementation by the Member States of measures concerning radiofrequencies, COM(93)382, 10.9.93"

66 See in particular, Council Decision of 7th June 1991 adopting a specific research and technological development programme in the field of communiction technologies (1990 to 1994) (91/352/EEC; OJ L192/8, 16.7.91) - the RACE programme.

This concerns in particular coordination within the International Telecommunications Union.

Substantial support should be provided to ETSI's Special Mobile Group (SMG). SMG is working on standards in this area and preparing a European position for the ITU.

51 European technological development must be flexible with regard to future technology options, in order to secure an optimum position.

While work in this area should build on the strength of current European digital mobile technologies, in particular DCS-1800, GSM, and DECT, flexibility with regard to certain features should be maintained, depending on the outcome of comparative research currently being carried out in the framework of the RACE programme. This is the case in relation to future coding techniques used for the air interface (e.g. the relative merits of Time Division Multiplex Access (TDMA) and Code-Division Multiplex Access (CDMA)).

Whichever detailed features are finally chosen, care should be taken to ensure a smooth transition from the use of current technologies to UMTS technologies.

52 The Community should continue to give high priority to the development of UMTS in its research programmes.

53 The development of Europe-wide networks has been substantially assisted in the past by conclusion of Memoranda of Understanding between operators and/or manufacturers in key areas of mobile systems (MoUs have been agreed, for example, concerning the introduction of GSM and, in relation to ERMES, telepoint services, and the TFTS).

In a number of cases these MoUs have been extended to cover both EFTA countries and countries in Central and Eastern Europe and have sometimes been extended beyond Europe. This cooperation in the introduction of mobile systems should be further encouraged, in particular, in relation to the future development of UMTS[67].

54 In order to maximise the potential of European developments in the fields of UMTS, consideration should be given to awarding licences for such future third generation

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67 Priority should also be given to the promotion of use of new types of services, such as transport related information or guidance, on the pan-European mobile networks (e.g. GSM and UMTS)

services from the start in a coordinated manner and/or at a Community level. Account should be taken of the need to ensure a smooth transition from the use of current technologies for Personal Communications Services to the UMTS technologies. Account must also be taken of the specific situations in Member States and the interests of existing licensees.

55 The provisions of the Treaty concerning trans-European networks now present the opportunity to make a further step in promoting cooperation in the establishment and development of such networks. The Commission has proposed guidelines identifying projects of common interest in other telecommunications fields.

In the field of mobile and personal communications, priority could be given to the establishment of trans-European networks based on satellite-based personal communications including so-called Low Earth Orbit (LEO) Satellite Systems. Particular account should be taken of the need to link peripheral regions with central regions of the Union. Cooperation could be extended to third countries to promote projects of mutual interest in this field.

56 In order to promote the development of trans-European networks, consideration should also be given to the award of licences for future mobile communications systems directly impacting on the development of such networks, in a coordinated manner between Member States and/or at a Community level, taking due account of Member States' interests and the interests of existing licensees.

Satellite-based personal communications are a case in point.

57 Elaborating common Union positions in mobile and personal communications with regard to third countries and ensuring market access to those countries will be indispensable to drawing maximum benefit for Europe, its mobile industry and operators.

An important part of ensuring market access is the removal of non-tariff barriers. Equally, market access will be improved through agreements on the mutual recognition of conformity assessment procedures.

Coordinated positions are also necessary on issues having a direct impact on trade in this field, such as issues related to intellectual property rights, restrictions on the export of encryption techniques and other sensitive technologies.

58 As long as equivalent market access to third countries has not been achieved[68], the ability to take measures with regard to third countries should not be restricted, subject to Community commitments on a multi-lateral (such as in the context of GATT), or bilateral basis.

Where asymmetric market access currently exists, Community policy must actively pursue the on-going multilateral negotiations on basic telecommunications within the General Agreement on Trade in Services in order to open up foreign market access.

Within the limits of such international commitments and Community law, an assessment must be made as to whether the current inequalities can be redressed within the framework of Community legislation, for example, with regard to non-EU participation in mobile licences

59 The development of mobile communications into a personal communications mass market will require firm positions on areas of general public interest in the sector, in order to safeguard such interests, ensure acceptance by the public of the new systems and services, and provide a stable environment for future development.

The main issues in this respect concern security, safety, protection of privacy, and the environment.

60 Security of information systems has been addressed in a more general context in the framework of the European Community's action plan on this issue, established by Council Decision 92/242/EEC[69].

In the context of the essential requirements identified by the proposed Council Directive on the application of Open Network Provision to voice telephony, security of network operations specifically addresses the ability to maintain an appropriate level of service during defined emergency situations.

With regard to mobile and personal communications systems, major issues are also raised, inter alia, by encryption, authentication, prevention of fraud, protection of network management, data bases, and service providers.

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68 See discussion in Annex C and in Annex D, Section12

69 Council Decision of 31st March 1992 in the field of security of information systems (92/242/EEC ; OJ L123/19, 8.5.92). See forthcoming Commission Green Paper on the security of Information Systems.

Safeguarding of confidentiality of communications and establishing secure procedures for handling subscriber and call data are addressed in the context of protection of privacy and personal data.

61 Another issue is health and safety with regard to potential health hazards from exposure to electromagnetic radiation and with regard to electromagnetic interference[70].

A comprehensive action plan must be set into motion aiming at accelerating the establishment of necessary safety standards, as well as providing guidance in this field.

This should concern in particular rapid establishment of Europe-wide standards concerning thermal effects of radiation, in accordance with the mandate agreed with CEN-CENELEC in this field. It should also involve the preparation of a work programme for assessment of activities and research concerning the so-called athermal effects, and development of related European standards, as well as monitoring of potential problems of electromagnetic compatibility with other electrical equipment, such as hearing aids, heart pace makers, car automatic breaking systems (ABS) and cable systems.

Given the difficulty of establishing conclusive results on possible athermal effects in the short term, the low power emission of devices, in particular, for hand-held equipment, should become an important criterion in future standards development, systems design and systems deployment. This will assist in reducing overall electromagnetic exposure.

In the context of health and safety, a concerted approach between measures issued under Article 100A and measures under Article 118A is required in order to allow for free movement of goods whilst maintaining the right of Member States to issue measures limiting the use of such goods to safeguard the safety of workers.

62 As regards environmental concerns, sharing of sites and infrastructures will become a growing requirement to reduce environmental impact.

Sharing of infrastructure and sites should be allowed. Where overriding grounds of environmental policy or town planning so require, obligations on mobile network

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70 See Annex B, Section 8.

operators to enter into sharing agreements should be possible, subject to the principle of proportionality.

63 A central feature to reassure the public about future mobile and personal communications will be the protection of privacy and personal data.

Given that future personal communications services will combine services via mobile and fixed networks, this problem must be addressed in a global fashion.

The proposed General Data Protection Directive and the proposed specific Directive[71] will tackle many of the potential problems in this area.

Further, the issue of protection of personal data and protection of privacy should become major factors in future standards development in the sector, with regard, in particular, to following a consistent approach in relation to the evolution of personal communications[72].

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71 Amended proposal for a Council Directive on the protection of individuals with regard to the processing of personal data and on the free movement of such data, COM (92) 422, 15.12.92 ("the genreral data protection directive") and the forthcoming modified proposal for a Directive concerning the protection of personal data and privacy in the context of digital telecommunications networks, in particular the integrated services digital network (ISDN) and digital mobile networks (to be published). For further discussion of these issues, see Annex D, Section 5.

72 This should include consideration of solutions which are appropriate to the range and characteristics of evolving services, in particular with regard to technical identification/requirements for anonymity.

IV ISSUES FOR COMMENT

The analysis undertaken and the considerations and Treaty obligations set out lead to a range of proposals, which appear necessary to ensure the full development of the sector. They are set out below and submitted for comment.

IV.1 Major changes required.

The European Union's mobile communications sector can move forward from a position of strength. Europe has become a world technology leader and has succeeded in attracting substantial public and private investment to mobile communications. However, the sector is now at a critical juncture, poised on the transition from analogue to digital technologies, and from niche to mass market player. In order to fully use the potential and allow Europe's citizens, industry, investors, and the economy as a whole to reap the benefits, mobile markets must now be allowed to develop. Existing barriers[73] must be lifted : freedom to use and to provide services must be ensured, the economies of scale and scope enjoyed by Europe's competitors must be replicated and a long term perspective opened. Based on its analysis and the considerations above, the Commission considers that **five major changes are required** to remove the barriers to further development :

1 **abolishing remaining exclusive and special rights** in the sector, subject where required to the establishment of appropriate licensing conditions ;

2 **removal of all restrictions on the provision of mobile services** both for independent Service Providers and direct service provision by mobile network operators.

This should include the freedom to offer a combination of services provided under different licences, as well as the ability to provide services in different Member States, and the lifting of existing restrictions , thereby facilitating access of users to these services.

3 **full freedom for mobile network operators to operate and develop their networks** for the purpose of the activities provided for in their licence or authorisation.

This should include the right to self-provide infrastructure for use in carrying out these activities or to use third party infrastructure for that purpose, as well as the right to share infrastructure ;

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73 An overview of the current regulatory situation of the sector is given in Annex B. See in particular B.1.1.

4 **unrestricted combined offering of services via the fixed and mobile networks,** within the overall time schedule set by Council Resolution 93/C213/01 of 22 July 1993 for the full liberalisation of public voice services via the fixed network;

This would imply the right for mobile operators or independent Service Providers to bid for resale licenses on the fixed network, as well as for the lifting of all existing entry restrictions for fixed network operators in mobile markets, subject only to full application of the Treaty competition rules, in particular, Council Regulation 89/4064/EEC on the control of concentrations[74] and the provisions of the Treaty competition rules concerning abuse of dominant positions.

5 **facilitating pan-European operation and service provision.**

This should include further development of mutual recognition of type approval of mobile terminal equipment, as well as coordination of licencing and award procedures, where appropriate to facilitate development of trans-European networks.

The combination of these five changes would ensure a substantial acceleration of the development of the Union's mobile communications market, and speed progress towards true personal communications based on a combination of wired and wireless-services, with the market the ultimate arbiter of the balance between the two. This approach would prepare the Union for a smooth market-led transition to the future Universal Mobile Telecommunications Systems. Such systems will be the ultimate base for both narrow-band and broad-band personal communications, and consequently for the whole of the Union's telecommunications sector, and will combine mobility with voice, data and multimedia applications.

IV.2 Proposed positions

The working out of detailed positions based on these five major changes represents an extension of the principles of the Union's existing telecommunications policy to the mobile communications sector, based, in particular, on the principles of transparency, non-discrimination, and proportionality.

The approach must address three main areas :

→ regulation at national level of mobile systems providing services to the general public ;

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74 Council Regulation 4064/89 of 21st December 1989 on the control of concentrations between undertakings, OJ L395/1, 30.12.89.

→ operation of systems intended for own use or use by closed user groups (so called private mobile radio) ; and

→ conditions required at a European Community level.

The principle of proportionality requires that substantial public regulation should be limited to only those mobile systems providing services to the general public. Private mobile systems should not be subject to any constraints other than those currently applying to private systems or closed user groups operating via the fixed network with the possibility of additional sector specific safeguards, such as the requirement to avoid harmful interference and to ensure frequency efficiency.

In identifying detailed positions, the Green Paper has limited itself to fields where a common position is required at a European Community level. These positions concern :

→ licensing conditions for mobile operators,

→ conditions for service provision, interconnection, infrastructure, frequency and numbering issues, and

→ launching the evolution towards personal communications.

As discussed above, (see Para. 20) these detailed positions are consistent with the principle of subsidiarity as representing action necessary at a Union and national level to ensure the further development of the internal market, the provision of pan-European services and the respect of the Treaty competition rules. They are set out in Figure 1.

Chapter IV.3 sets out action in the short-term required to create at a European Community level the conditions for rapid implementation of these positions.

Chapter IV.4 proposes longer term action lines necessary to create an environment which will draw the maximum benefit from these proposals.

FIGURE 1

PROPOSED POSITIONS

The global objective of the proposed positions is to allow European-wide markets to develop and barriers to be lifted

They should ensure freedom of use and provision of services while opening the way to the development of mobile communications towards full personal communications for the European citizen.

They should provide a long-term perspective for the sector's industry as well as to the European economy as a whole, based on the extension of the principles of the European Union's telecommunications policy, in particular Council Resolution 93/C213/01 of 22nd July 1993.

I Licensing conditions for mobile network operators

1 **Abolition of exclusive and special rights in the sector concerning the operation of mobile communications systems.**

An exclusive right exists where the service is reserved by the Member State for a single public or private undertaking within a given area. A special right exists where, a Member State within a given area, designates, other than according to objective, proportional, transparent, and non-discriminatory criteria, several competing undertakings or limits the number other than according to such criteria or grants one or more of them a lasting particular advantage, other than those referred to in Article 92 of the Treaty.

2 **Licensing conditions for mobile communications systems must be based on objective grounds, be transparent, non-discriminatory, and respect the principle of proportionality.**

These principles should also extend to fees payable in respect of licences (including any fees for use of radiofrequencies).

Licencing conditions must not contain conditions other than those justified on the grounds of the essential requirements and, in the case of systems for use by the general public, public service requirements in the form of trade regulations.

3 **Essential requirements to be taken into account should be limited to those identified in Commission Directive 90/388/EEC[75] and Council Directive 90/387/EEC[76], as well as Commission Directive 88/301/EEC[77] and Council Directive 91/263/EEC[78, 79].**

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75 Commission Directive of 28th June 1990 on competition on the markets for telecommunications services (90/388/EEC ; OJ L192/10, 24.7.90)

76 Council Directive of 28th June 1990 on the establishment of the Internal Market for telecommunications services through the implementation of Open Network Provision (90/387/EEC ; OJ L192/1, 24.7.90)

77 Commission Directive of 16th May 1988 on the competition in the markets on telecommunications terminal equipment (88/301/EEC ; OJ L131/73, 27.5.88)

These concern in particular the effective use of the radiofrequency spectrum and electromagnetic compatibility requirements, as well as security of network operation, maintenance of network integrity, interoperability of services in justified cases, data protection in justified cases, and user safety and safety of employees.

4 **Conditions based on public service requirements in the form of trade regulations should be only those currently identified in Commission Directive 90/388/EEC for systems intended for use by the general public.**

These concern conditions of permanence, availability and quality of the service. The safeguarding of permanence, availability and quality of the service may imply fulfilling conditions relating to the technical competence and financial resources of the licensee.

5 **Systems not intended for use by the general public (in particular so-called private mobile radio systems, used by closed user groups) should be subject to no other conditions than those based on essential requirements, in particular, effective use of frequencies and electromagnetic compatibility.**

6 **In order to foster innovation of systems and services, and to ensure in particular efficient use of frequencies, the duration of licences should be based on the period required to pay back investment on reasonable terms.**

7 **Licences may not include conditions which restrict ownership by nationals of Member States or of the European Economic Area (EEA) or enterprises controlled by nationals of Member States or of the EEA.**

Subject to the European Community's commitments taken on a multilateral or bilateral basis, licences may include restrictions aiming at ensuring at a Union level equivalent access to third countries.

8 **Licence awards must be based on open, non-discriminatory, and transparent procedures.**

9 **Where a limitation of the number of licences to be issued is established by Member States, such limitation must be based on essential requirements such as efficient use of frequencies, and/or conditions of public service requirements in the form of trade regulation, and must be consistent with the Treaty competition rules.**

Any limitation should respect the principle of proportionality, by imposing the least limiting solution and giving priority to competitive provision.

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78 Council Directive of 29th April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity (91/263/EEC ; OJ L128/1, 23.5.91)

79 This includes the extension of these Directives to the satellite sector, which is of direct relevance to mobile satellite-based systems. See in particular , Council Directive of 29 October 1993 supplementing Directive 91/263/EEC in respect of satellite earth station equipment (93/97/EEC; OJ L290/01, 24.11.93) for services.

10 Whichever method is used to award licences - first come / first served, comparative bidding, auctioning, lottery - the method should be chosen and implemented in a way that the final selection offers maximum guarantees in respect of the full implementation of the essential requirements and ensures the achievement of the aims of any public service requirements in the form of trade regulations. A particular priority should be maximising benefits for users (in particular, in terms of price and coverage).

11 Reliance on auctions should not lead to an excessive transfer to the public budget or for other purposes to the detriment of low tariffs for the users.

Lotteries do not seem to guarantee the achievement of the criteria set out under 10, in particular, concerning efficient use of frequencies, technical competence and financial resources.

12 The principle of full mutual recognition of licences should apply whenever relevant, in particular, in the case where licences are awarded on the basis of first come / first served, subject to the availability of required frequency resources.

This should concern, inter alia, mobile services based on satellite communications, as put forward in the proposal for a Council Directive on a policy for the mutual recognition of licences and other national authorisations for the provision of satellite network services and/or satellite communications services[80].

It should also apply to systems licensed in border regions between Member States where systems could provide services on a trans-frontier basis, for example, private mobile radio systems used by taxi businesses or haulage companies.

13 Where limitations are imposed on the number of licences on the grounds set out under 9 and the award of licences on the basis of comparative bidding or auctioning makes the principle of mutual recognition no longer fully applicable, national award procedures must ensure that licence applications by nationals or companies controlled by nationals of Member States or of the EEA are possible on a non-discriminatory basis.

No limitations with regard to licence applications may be introduced, except if justified under Treaty competition rules, in particular Article 86.

14 Mobile terminal equipment should be subject only to type approval according to the principles of Directives 91/263/EEC and 93/97/EEC which allow the imposition of specific provisions ensuring electromagnetic compatibility.

Where the provisions of Directives 91/263/EEC and 93/97/EEC have still not been made applicable to specific types of mobile equipment, and specific licences or class licences are required in Member States to provide for the safe operation of equipment, the full mutual recognition of licences granted in another Member State should apply to ensure free circulation of such equipment in the Community.

15 Licensing conditions for mobile network operators must ensure the respect of competition rules and in particular, ensure transparent and non-discriminatory behaviour between fixed and mobile network operators in common ownership.

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80 To be published

II Service provision

1 Commercial freedom should be guaranteed, allowing the provision of services by independent Service Providers, as well as direct service provision by mobile network operators. All existing restrictions in licences impeding such activity should be abolished.

2 Commercial freedom should include the opportunity for Service Providers, whether independent or integrated into or forming part of mobile network operations, to offer a combination of services provided under different mobile licences, as well as the ability to provide services in different Member States, subject only to the provision of the Treaty competition rules.

3 Service Providers should not be subject to licensing procedures and may be subject only to a requirement for declaration of their activities to the National Regulatory Authority(ies) of the Member State(s) where they choose to operate.

4 A Code of Conduct for Service Providers should be established. The Code should, in particular, identify on the basis of voluntary participation by Service Providers, measures to safeguard essential requirements and commitments with regard to permanence of service, availability, and quality of service. It should also provide guidelines concerning technical, financial, and commercial practices in the sector, consistent with competition rules.

5 Mobile network operators should, in line with their obligation to provide open, transparent and non-discriminatory conditions for interconnection (see point III.2) have an obligation to accept all reasonable requests by Service Providers to deal, within the limits of normal commercial practice and Community competition law (including requests from Service Providers integrated into other mobile network operations).

It should be possible to challenge any refusal to deal before the National Regulatory Authority.

6 In order to guarantee open, transparent, and non-discriminatory conditions for independent Service Providers, mobile network operators should be required by their licence to provide for sufficient transparency, in particular concerning their accounting practices, to allow supervision of the service provision activities integrated into their operations.

7 The commercial relationship established between Service Providers and mobile communications operators should be subject to full mutual recognition by Member States.

No restrictions should be applied concerning any activity resulting from such relationships in one Member State on the activity in any other Member State.

The provision of services in the context of cross-border roaming agreements represents the provision of a service by independent Service Providers or by Service Providers integrated into a mobile network operation in the territory of a Member State other than the Member State in which the original commercial activity was established.

Such activity should not be subject either to any restriction or to any surcharge or equivalent measure unrelated to the cost of the provision of the roaming facility itself, whether imposed as a result of regulatory or other action.

III Interconnection

1 **The basic framework for interconnection of mobile communications networks intended for use by the general public with the fixed network infrastructure operated for use by the general public is set out by Council Directive 90/387/EEC[81], and Proposal for a Council Directive concerning application of Open Network Provision to Voice Telephony and Council Directive 92/44/EEC[82], as well as through the Treaty competition rules[83].**

According to this framework, the National Regulatory Authorities carry the principal responsibility for ensuring interconnection , in conformity with the Directives above.

2 **As far as other technical and commercial interfaces are concerned, in particular, between Service Providers and mobile network operators, and also access to intelligent network functions in the fixed network which are not covered by the specific Directives mentioned, the basic principles set by Council Directive 90/387/EEC apply.**

This implies in particular that interconnection conditions established at those interfaces must be set on the basis of objective criteria, be transparent and non-discriminatory, cost-oriented, and compatible with the principle of proportionality, as well as respecting the essential requirements[84].

The establishment of suitable interconnection agreements respecting these principles should be principally left to commercial agreements between market participants.

At this stage, it is not considered necessary to establish further specific Directives at Community level, concerning these interfaces and related interconnection conditions, provided these are subject to strict supervision by National Regulatory Authorities to ensure full application of those principles and the establishment of suitable dispute resolution and control procedures.

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81 Council Directive of 28th June 1990 on the establishment of the Internal Market for telecommunications services through the implementation of Open Network Provision (90/387/EEC ; OJ L192/1, 24.7.90)

82 Proposal for a Council Directive on the application of Open Network Provision (ONP) to Voice Telephony (COM(92)247, 27.8.92) (Common Position adopted 1st July 1993).
Council Directive of 5th June 1992 on the Application of Open Network Provision to Leased Lines (92/44/EEC ; OJ L165/27, 19.6.92).

83 See Annex D.6.1 and 6.2

84 Where an operator has both a fixed and a mobile network there needs to be sufficient transparency, in particular, concerning their accounting practices.

3 The requirement of transparency concerning such interconnection agreements implies in particular that full access to those agreements is given to National Regulatory Authorities and that such information is made available to the Commission on request.

4 In order to facilitate interconnection, the establishment of technical standards concerning these interfaces should be promoted and published, where required in accordance with the provisions set forth in Article 5(1) of Directive 90/387/EEC.

5 Standards regarding interfaces should only be made binding to the extent required by the Directive 92/44/EEC concerning application of Open Network Provision (ONP) to Leased Lines and the proposed Directive concerning application of Open Network Provision to Voice Telephony.

In accordance with Article 5(1) of Directive 90/387/EEC, in all other cases, the principle of voluntary application of standards should apply.

Only in cases where it is strictly necessary to ensure basic interoperability and freedom of choice for users and subject to the principle of proportionality, should references to standards be made binding under the provision of Article 5(3) of Directive 90/387/EEC.

6 As regards mobile networks licensed only for own use or use by closed-user groups (private mobile radio systems), interconnection with the public network must not be impeded, and is subject to application of Directive 90/387/EEC, Directive 92/44/EEC, and the proposed Directive on the application of Open Network Provision (ONP) to Voice Telephony, as regards the issue of access to fixed infrastructure operated for use by the general public.

The activities which may be carried on via such interconnections are subject to the provisions under which such mobile communications networks have been licensed. In principle, conditions applying to such communications networks must not be more onerous than those applying to other closed user groups operating by use of facilities of the public fixed networks.

IV Infrastructure

1 Mobile network operators should have full freedom to operate and develop their network for the purpose of the activities allowed in their licence or authorisations, including a free choice of facilities used to support such activities.

2 The provision of facilities and use of infrastructure forming part of the public fixed network is provided for and subject to the provisions of Council Directive 90/387/EEC, Council Directive 92/44/EEC, and the proposal for a Council Directive for application of Open Network Provision to Voice Telephony. Provisions relating to the interconnection of mobile and public fixed networks are set forth under III above.

3 In addition, mobile network operators should have full rights to establish their own infrastructure as well as to use infrastructure provided by third parties, subject to limiting the use of such infrastructure to those activities provided for in their license or authorisation.

4 **Mobile network operators should have the right to directly interconnect with other mobile network operators, either via facilities provided by the public fixed network, via their own infrastructure or infrastructure provided by third parties, both within Member States and between Member States.**

Use of such direct connections should be permitted for all activities allowed for in the licences and/or authorisations of the respective mobile network operators, and should include transmission of signalling and control data to facilitate roaming between mobile networks.

Where their own infrastructure requires the availability of radio resources such as links based on microwave transmission, Member States should make available suitable radiofrequencies.

5 **Mobile network operators should be allowed to share infrastructure, other facilities and sites.**

Arrangements must be transparent, non-discriminatory, and respect the essential requirements, as well as respecting the Treaty competition rules, in particular Articles 85 and 86 and Regulation 4064/89, and the general principles of Council Directive 90/387/EEC[85].

National Regulatory Authorities must be kept informed of such arrangements. This information should be made available to the Commission on request.

6 **Member States may require that mobile network operators share infrastructure and sites and conclude arrangements in line with the principles set out under 5 above, where overriding grounds of environmental policy, or public safety so require.**

Such requirements must respect the principle of proportionality, and must not substantially impede the activities allowed for in the respective licences or authorisations and they must be in line with the Treaty competition rules.

V Radiofrequencies

1 **The basic principles concerning access to radiofrequencies should be those set by Council Directive 90/387/EEC which includes in its scope according to Article 2(10) usage conditions, including "access to frequencies where required".**

2 **This implies that conditions for access to frequencies must comply with a number of basic principles.**

They must, in particular, be allocated based on objective criteria, procedures must be transparent and published in an appropriate manner and must guarantee equality of access and be non-discriminatory.

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85 See Annex D.10.2

3 **The basic approach to frequency planning, allocation, and co-ordination has been set out in Council Resolution 90/C 166/02[86].**

Resolution 90/C 166/02 requires, inter alia, that the co-ordination of radiofrequencies must respect the principle of separation of regulatory and operational duties, while timely opinions from service providers, industry, users, and standards bodies in researching the frequencies best suited for further applications should be sought.

Radiofrequency use must take place in accordance with the radioregulations of the International Telecommunications Union (ITU). Within this framework, work should proceed particularly towards the timely allocation of sufficient frequency resources to mobile and satellite applications.

The Resolution also calls for promoting the most efficient use of the frequency spectrum by taking timely account of service provider and user requirements against the background of industrial development and developments of standards.

4 **The framework for carrying out frequency coordination in Europe is defined by Council Resolution 90/C 166/02, as complemented by Council Resolution 92/C 318/01[87].**

These two Resolutions identify the CEPT's European Radiocommunications Committee (ERC) (and the European Radiocommunications Office (ERO) linked to it) as a basic framework for European coordination in this area, subject to this framework being open to the opinions of frequency experts from national authorities responsible for frequency management, telecommunications operators and other Service Providers, industry, and users.

Council Resolution 92/318/01 calls for full consideration to be given in future to the mechanism of ERC decisions as the primary method of ensuring the provision of the necessary frequencies for new Europe-wide radio services, subject to the development of working methods allowing wide consultation with the categories mentioned above as well as cooperation and interaction with the European Telecommunications Standards Institute (ETSI) and the European Commission.

5 **In response to the Council Resolution, the Commission has set out a New Approach to frequency coordination in Europe, integrating these elements[88]. It can conclude with the ERC/ERO a Memorandum of Understanding and a framework contract allowing work to be entrusted to these bodies to establish common frequency bands, once a firm legal base has been created in order to ensure that Union interests are safeguarded.**

This new approach to frequency co-ordination, whilst fully taking into account the mechanisms provided by the ERC/ERO establishes minimum conditions necessary to comply with Treaty obligations[89]

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86 Council Resolution of 28th June 1990 on the strengthening of the Europe-wide co-operation on radiofrequencies, in particular with regard to services with a pan-European dimension (90/C 166/02 ; OJ C 166/4, 7.7.90)

87 Council Resolution of 19th November 1992 on the implementation in the Community of the European Radiocommunications Committee decisions (92/C 318/01 ; OJ C318/1, 04.12.92)

88 A new approach to the coordination of radiofrequencies in the Community, Communication from the Commission concerning proposal for a Council Decision on the implementation by the Member States of measures concerning concerning radiofrequencies, COM(93)382, 10.9.93

89 See Annex D, section 4

6 Council Resolution 90/C166/02 also calls for developing common European positions in relation to the use of the frequency spectrum concerning international frequency harmonisation, in particular, with regard to the ITU and its relevant World Radio Conferences using these mechanisms.

The European Community used this approach during the World Administrative Radio-Conference, held at Torremolinos in 1992 (WARC'92), where major decisions with regard to radiofrequencies to be allocated for mobile and satellite communications were taken. The Commission intends to follow the same approach during future World Radio Conferences, whilst ensuring that Union interests are safeguarded.

7 Major immediate priorities for radiofrequency co-ordination for mobile communications in Europe result from the requirement for the full and coordinated implementation of the decisions taken at WARC'92 in the Union.

As regards radiofrequencies for systems intended for the general public, short term priorities should concern the establishment and implementation of binding decisions concerning the designation of frequencies at the European and Community level for the frequency bands designated by WARC'92 for future use by terrestrial mobile communications and satellite based communications systems.

This should include in particular designation of binding common bands for DCS-1800 services, for the future Universal Mobile Telecommunications System (UMTS), as well as frequency bands for satellite-based personal communications systems (including so called Low Earth Orbit (LEO) Systems).

Decisions should also identify firm schedules for progressive availability, as well as standards to be used, either existing or in development in order to ensure their practical implementation by the Member States.

8 As regards systems intended for own use or for the use of closed user groups (so-called private mobile radio), an immediate priority should be a decision on designation of frequency bands as well as time schedule for availability, for systems operating according to the European digital trunking standard (TETRA), which will gain major importance, inter alia, in the context of the implementation of the Schengen Agreement for communications between police forces and between public authorities.

VI Numbering

1 Beside radio frequencies, access to and allocation of numbers is an essential resource for both mobile network operators and service providers. The importance of this resource, and the potential bottle-neck it creates, will substantially increase with the evolution of mobile communications toward personal communications services.

2 Provisions for access to numbers and administration of numbering schemes have been set out in the proposed Directive on the application of Open Network Provision to Voice Telephony[90].

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90 Proposal for a Council Directive on the application of Open Network Provision (ONP) to Voice Telephony (COM(92)247, 27.8.92). (Common Position adopted 1st July 1993).

By analogy with the application of basic principles of Open Network Provision to issues of access to radiofrequencies, the same principles should apply.

This implies, in particular, that numbers are allocated based on objective criteria, procedures must be transparent and published in an appropriate manner, must guarantee equality of access and be non-discriminatory.

3 **According to the provision of the proposed Directive on the application of Open Network Provision to Voice Telephony, Member States shall ensure that the control of national telephony numbering plans is the responsibility of National Regulatory Authorities. National Regulatory Authorities should ensure that national numbering plans, and all subsequent additions and/or amendments to them are published, subject only to limitations imposed on the grounds of national security, or privacy and data protection.**

4 **The basic approach to numbering planning, allocation and coordination has been set out in Council Resolution 92/C318/02[91].**

By analogy with the basic approach in the field of radiofrequencies, Council Resolution 92/C318/02 requires, inter alia, that coordination of numbering schemes respect the principle of separation of regulatory and operational functions, while allowing account to be taken, in a timely manner, of the opinions of representatives of National Authorities concerned with network numbering schemes, network operators, service providers, industry, and users.

Council Resolution 92/C 318/02 calls for the most efficient use of numbering space and indicates that Europe-wide mobile services are to be a high priority for the development of coordinated procedures for the management and allocation of telephony numbers from a European numbering space.

5 **Council Resolution 92/C 318/02 defines the framework for coordination for numbering in Europe.**

The Resolution calls for the use of the mechanisms of coordination of the European Committee for Telecommunications Affairs (ECTRA) and requests the creation by ECTRA of a European Numbering Office (ENO), subject to allowing the opinions of all interested parties to be taken into account and involving the Commission as appropriate. In the meantime, ECTRA is creating a European Telecommunications Office (ETO), to be based in Copenhagen, which will include the numbering coordination function amongst its tasks.

In response, and mirroring the approach taken in the field of radiofrequencies, the Commission intends to conclude with the ECTRA/ETO a memorandum of understanding and a framework contract allowing work to be entrusted to these bodies to carry out the harmonisation of numbers and the creation of a common European numbering space, based on an appropriate legal basis which must ensure that Union interests are safeguarded.

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91 Council Resolution of 19th November 1992 on the promotion of Europe-wide cooperation of numbering of telecommunications services (92/C 318/02 , OJ C 318/2, 04.12.92).

6 Council Resolution 92/C 318/02 also calls for common positions at ITU numbering fora.

Common positions should in particular be developed with regard to the reform of the global numbering system, currently underway in the ITU. Preparation of common positions should take place in ECTRA/ETO, provided that safeguarding of Union interests is ensured.

7 In line with Council Resolution 92/C 318/02, global priority should be given in the European numbering coordination process to the creation of a European numbering space, with particular attention to the requirements for personal numbering.

8 An immediate priority should be harmonisation of current activities aiming at the reform of national numbering spaces, including issues of numbering for mobile communications purposes and for personal and portable numbers.

In this context, special attention should be paid to the harmonisation of access codes for mobile systems, for directory services, and for services of special public interest such as emergency and information services, as well as access codes of special relevance to the intelligent network environment This can build on the progress already achieved in the Union with the adoption of common emergency and international access codes.

VII Launching the evolution towards personal communications services

1 Personal communications services must be seen as services which ultimately will allow person-to-person calling, independent of location, the terminal used, the means of transmission (wired or wireless) and/or of the choice of technology.

Personal communications services will be based on a combination of fixed and wireless/mobile services to form a seamless end-to-end service for the user.

2 To launch this evolution, and to allow current mobile services to move towards such a personal communications environment, the basic requirements are to remove initially, restrictions on the combination of multiple mobile technologies or services through a single service provider, and subsequently, to remove restrictions on the free combination of services provided via fixed and mobile networks.

3 In order to allow such development, mobile network operators, or independent service providers, should be allowed in a first phase to combine different mobile services, provided under different licences and/or on the basis of different technologies / standards.

No restrictions should be introduced into new licences in this regard and restrictions in existing licences should be lifted.

4 In a second stage, mobile network operators or independent service providers should be able to bid for licences for the provision of public voice via the fixed network, as those licences become available.

At the latest this should be in accordance with the schedule for full liberalisation of public voice service established in Council Resolution 93/C 213/01, namely 1st January 1998, with additional transition periods of up to five years for Spain, Ireland, Greece, and Portugal, and, where justified, two years for Luxembourg, subject to the conditions which may be agreed for such licences concerning universal service obligations or sharing in the financing of such obligations, and subject to the Treaty competition rules, in particular Articles 85 and 86 and Council Regulation 4064/89.

5 In parallel and in order to give full opportunity for the development of personal communications services by existing public fixed network operators, such operators should not be prohibited ab initio from bidding directly or indirectly for licences for any mobile communications services.

Existing prohibitions on such bids should be abolished at the latest by the deadlines set for full liberalisation in Council Resolution 93/C 213/01, namely, 1st January 1998, with additional transition periods for the Member States referred to in 4 above, subject to the Treaty competition rules, in particular Articles 85 and 86 and Council Regulation 4064/89.

6 In order to prepare the mobile communications sector to play its role in the rapid transition towards a personal communications environment, Member States should allocate licences, in particular, for those technologies most suited for providing the wireless part of such services.

In particular, Member States should allocate at least one licence for operating mobile systems according to the DCS-1800 standard, and allow for the development of micro-cellular extensions of current mobile systems licensed according to the GSM standard in the 900 MHz bands.

Member States should also allocate licences for so-called public access / telepoint applications, in particular, for systems operating according to the DECT standard.

7 In order to promote the development of trans-European networks, in accordance with Article 129b of the Treaty, licences for future mobile communications systems directly impacting the development of such networks should be awarded, where required and most efficient, in a coordinated manner between Member States and/or at a Community level, taking due account of Member States interests and interest of existing licensees.

In particular, and in accordance with the Council Resolution on the promotion of systems for satellite-based personal communications, including so-called Low Earth Orbit Satellites (LEOs) systems, licences for such future systems should be awarded at a Community level. In order to maximise the potential of European developments in the field of the Universal Mobile Telecommunications Systems (UMTS), which can ultimately provide a unified and cost-efficient basis for personal communications services, licences for such future third generation services should from the start be awarded in the Community in a coordinated manner and/or at Community level.

Account should be taken of the need to ensure a smooth transition from the use of current technologies for the provision of personal communications services to the use of the UMTS technologies to provide such services in a more economic and universal manner, as well as of the need to take account of the specific situations in Member State and the interests of existing licensees.

IV. 3 Measures required for implementation

Building on the positions proposed and the analysis of the current situation and the measures to be taken, the range of action within the European Union to facilitate the achievement and smooth implementation of these goals is summarised below. In extending the existing telecommunications policy of the Union to the mobile communications sector the following measures can be anticipated :

- MONITORING OF THE PROGRESS ACHIEVED IN THE INTRODUCTION OF COMPETITION IN THE SECTOR,

  in order to implement the principles set out, and amendment of Directive 90/388/EEC[92] on competition in the markets for telecommunications services, where required in order to include those principles.

  This would involve in particular :

  → abolition of exclusive and special rights with regard to mobile and personal communications and replacement by licensing frameworks in line with conditions that are consistent with European Community law ;

  → definition of criteria to guarantee that licence award procedures are carried out in an open, transparent, and non-discriminatory manner, in particular, in cases where there are justifiable technical limitations on the number of licences granted ;

  → measures to ensure the necessary transparency between market participants, in particular, in cases where fixed network operators also operate mobile networks, and between the service provision function of mobile network operators and their other operations.

- ADJUSTMENT OF THE OPEN NETWORK PROVISION FRAMEWORK

  and amendment of Directive 90/387/EEC[93], where required to include the principles set out in the positions.

  This concerns, in particular, adjustment of the scope of Directive 90/387/EEC, in order to ensure the general application of the principles of equality of access, transparency, non-discrimination and proportionality.

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92 Commission Directive of 28th June 1990 on competition on the markets for telecommunications services (90/388/EEC ; OJ L192/10, 24.7.90)

93 Council Directive of 28th June 1990 on the establishment of the Internal Market for telecommunications services through the implementation of Open Network Provision (90/387/EEC ; OJ L192/1, 24.7.90)

Such adjustment should be seen in the context of the general process of adaptation, called for by Council Resolution 93/C 213/01[94]

- ACCELERATED APPLICATION OF MUTUAL RECOGNITION OF TYPE APPROVAL OF TERMINAL EQUIPMENT

and extension of Directive 91/263/EEC[95] to include mobile terminal equipment not capable of connection to the public network, which is currently outside its scope[96].

Accelerated application must include more rapid adoption of Common Technical Regulations (CTRs), in particular, for terminal equipment using new digital mobile technologies. CTR5 and CTR9, adopted in October 1993, will support the mutual recognition of type approval of terminal equipment using GSM technology, replacing the interim type approval based on NET10.

Accelerated application of Directives 91/263/EEC and 93/97/EEC should also include mutual recognition of terminal equipment on the basis of fulfilment of the essential requirements for those types of equipment for which CTRs have still not been adopted, in accordance with the procedures foreseen in the Directive and the principles of the Council Resolution on a New Approach to technical harmonisation and standards and the Communication on a Global Approach to Certification and Testing[97].

Further, establishment of interim-type approval procedures in the context of the European Radiocommunications Committee (ERC) should be encouraged in order to facilitate application of the Directive in the case set out above, where, in the absence of adopted CTRs, recognition is made on the basis of fulfilling the essential requirements.

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94 Council Resolution of 22nd July 1993 on the review of the situation in the telecommunications sector and the need for further development in that market (93/C 213/01, OJ C213, 6.8.93)

95 Council Directive of 29th April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity (91/263/EEC ; OJ L128/1, 23.5.91)

96 as far as not covered by Directive 93/97/EEC

97 Council Resolution 85/C 136/01 of 7th May 1985, OJ C136/1, 4.6.85 and Communication of the Commission on a Global Approach to Certification and Testing of 15th June 1989, COM(89)209, OJ C267/3, 19.10.89.

- DEVELOPMENT OF THE MUTUAL RECOGNITION OF LICENCES FOR THE OPERATION OF MOBILE COMMUNICATIONS NETWORKS, WHERE APPLICABLE

and adoption of a Directive for this purpose, including mechanisms for coordination of award and licensing procedures where appropriate in order to promote trans-European networks.

This should concern, in particular, those cases where award on a first come/first served basis is appropriate, and therefore full mutual recognition, subject to availability of radiofrequencies, is possible, namely :

→ satellite-based mobile communications networks.

This situation will be covered by the proposed Directive for the mutual recognition of satellite service licences[98] ;

→ terrestrial mobile communications networks in particular in border areas and in the case of mobile networks licenced for own use and for use by closed user groups (private mobile radio networks) ;

→ mutual recognition of licences or class licences in those special cases, where the use of mobile terminal equipment may be subject to licensing, in conformity with Community law.

Coordination of award and licensing procedures between National Regulatory Authorities and/or at Community level should include licensing of experimental systems for services and technologies with Europe-wide needs, in particular, in relation to the creation of trans-European networks.

- ESTABLISHMENT OF A EUROPE-WIDE CODE OF CONDUCT FOR SERVICE PROVIDERS

to identify on the basis of voluntary undertakings, appropriate principles to safeguard compliance with essential requirements as well as standards with regard to permanence, availability, and quality of service, and establishing guidelines concerning technical,

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98 Proposal for a Council Directive on a policy for the mutual recognition of licences and other national authorisations for the provision of satellite networks services and/or satellite communications services (to be published)

financial and commercial practices in the sector[99], consistent with competition rules and respecting the need for a high level of consumer protection.

- COMPLETION OF THE FRAMEWORK CONCERNING THE NEW APPROACH TO THE COORDINATION OF RADIOFREQUENCIES IN THE COMMUNITY[100]

in line with Council Resolution 90/C 166/02 as complemented by Council Resolution 92/C 318/01[101], aiming at promoting close cooperation with the European Radiocommunications Committee (ERC) / European Radiocommunications Office (ERO) and recognising the role of ERC Decisions as the primary method of ensuring the provision of the necessary frequencies, while safeguarding the Union's interests.

Major elements of such a framework should be the conclusion of a Memorandum of Understanding and a Framework Contract allowing work to be entrusted to these bodies to elaborate common frequency bands, once an appropriate legal basis for such cooperation has been put in place.

- CREATION OF A FRAMEWORK CONCERNING COORDINATION IN THE FIELD OF NUMBERING,

reflecting the approach taken in relation to the coordination of radiofrequencies set out above.

In line with Council Resolution 92/318/02[102], such a framework should foresee close cooperation with the European Committee for Telecommunications Regulatory Affairs (ECTRA) / European Telecommunications Office (ETO), which is currently in the process of establishment.

Major elements should be the conclusion of a Memorandum of Understanding and a Framework Contract allowing work to be entrusted to these bodies, with the primary objective of creating a European numbering space and undertaking necessary coordination of national numbering reforms, in particular, with regard to personal numbering.

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99 Such guidelines could include measures designed to alleviate fraud.

100 A new approach to the coordination of radiofrequencies in the Community, Communication from the Commission concerning proposal for a Council Decision on the implementation by the Member States of measures concerning radiofrequencies, COM(93)382, 10.9.93

101 Council Resolution of June 1990 on the strengthening of the Europe-wide co-operation on radio frequencies, in particular with regard to services with a pan-European dimension (90/C 166/02 ; OJ C166/4, 7.7.90) and
Council Resolution of 19th November 1992 on the implementation in the Community of the European Radiocommunications Committee decisions (92/C 318/01 ; OJ C318/1, 04.12.92).
See also Council Conclusions of 7th December 1993.

102 Council Resolution of 19th November 1992 on the promotion of Europe-wide cooperation of numbering of telecommunications services (92/C 318/02 ; OJ C318/2, 04.12.92).

- ENSURING PROTECTION OF PERSONAL DATA AND PRIVACY IN THE CONTEXT OF DIGITAL MOBILE COMMUNICATIONS NETWORKS.

and adopting in this context the proposed General Data Protection Directive and the proposed specific Directive on protection of privacy in the digital network environment[103]. This would strengthen the protection of personal data and privacy in the context of both fixed and mobile digital network services.

A central feature of the new environment must be maintaining privacy, in particular with regard to the handling of subscriber and call data, and the use of intelligent network services provided via fixed and mobile networks.

Major issues are the safeguarding of confidentiality of communications during transmission via radio links, automatic registration of the subscribers location in the data bases required for locating the position of subscribers in the cells of mobile cellular systems, as well as for the operation of intelligent network services.

This will be indispensable to safeguard public confidence in the future personal communications environment.

IV.4 Action lines for the development of a favourable environment

A number of action lines should be followed to draw maximum benefit from the proposals.

These action lines aim at :

→ safeguarding the public interest within the sector.

This addresses the concerns over user safety. It also involves meeting the environmental issues which are fundamental to public acceptance of the future developments in the sector.

Finally, it concerns interconnection and interoperability which are essential preconditions to promoting market developments in a competitive environment ;

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103 Amended proposal for a Council Directive on the protection of individuals with regard to the processing of personal data and on the free movement of such data, COM (92) 422, 15.12.92 ("the general data protection directive") and the forthcoming modified Proposal for a Council Directive concerning the protection of personal data and privacy in the context of public digital telecommunications networks, in particular the Integrated Services Digital Network (ISDN) and public digital mobile networks (to be published).

→ ensuring optimum use of the basic resources needed by the sector, by agreeing on clear priorities both for coordination of radiofrequencies and for numbering, as well as supporting work towards these objectives ;

→ promoting market and service development in the sector, in particular, through the development of trans-European networks and the promotion of mobile technologies in the less favoured regions, as well as in Central and Eastern Europe ;

→ strengthening the position of European industry, operators and service providers by ensuring access to third country markets and re-inforcing Europe's position in advanced digital mobile technologies, in the transition towards the future Universal Mobile Telecommunications System.

These action lines should be carried out by the Union in cooperation with relevant organisations, in particular, the European Committee of Telecommunications Regulatory Affairs (ECTRA) and its future European Telecommunications Office (ETO) ; the European Radiocommunications Committee (ERC) and the European Radiocommunications Office (ERO) ; the European Telecommunications Standards Institute (ETSI) and the European Committee for Standardisation and Electrotechnical standardisation (CENELEC). Such cooperation should be on the basis of agreed procedures. Where appropriate, it could extend to the Memoranda of Understanding established by operators and/or equipment companies.

1 ENSURING SAFETY AND SAFEGUARDING ENVIRONMENTAL CONCERNS IN THE FUTURE MOBILE AND PERSONAL COMMUNICATIONS ENVIRONMENT

Central issues which must be addressed are electromagnetic compatibility and the potential for health hazards through exposure to electromagnetic radiation. The Commission proposes setting in motion a comprehensive action programme to accelerate necessary safety standards, as well as providing general guidance in this field.

This must involve in particular :

→ rapid establishment of Europe-wide safety standards concerning thermal effects of radiation, in accordance with the mandate agreed with CEN-CENELEC for

establishing European standards in this field, based on Directives 91/263/EEC and 93/97/EEC[104], 73/23/EEC[105], and 89/336/EEC[106] ;

→ preparation of a work programme for the development of European standards and assessment of related activities and research on so-called athermal effects, based on existing CEN-CENELEC mandates ;

→ integration of other research activity, in particular, the on-going work in the COST-framework ;

→ monitoring of potential problems of electromagnetic compatibility encountered with other electrical equipment, such as hearing aids, heart pace makers, car-ABS-systems, and cable systems ; issuing of mandates to CEN-CENELEC to establish appropriate European standards for enhancing protection, where required and to the extent not covered by existing mandates.

→ rapid integration of European standards in this field into TBRs (Common Technical Basis for Regulation), and CTRs (Common Technical Regulations) used in approval of mobile or related equipment.

In order to reduce overall electromagnetic exposure, low power emission characteristics, in particular for hand-held equipment, should become an important criterion in future standards development, systems design and systems deployment.

In order to safeguard the environment and to take account of town planning issues, standards should be designed to allow sharing of sites and radio infrastructure

The Commission proposes to give special attention to these aspects in future standardisation mandates to the European Telecommunications Standards Institute (ETSI) and to CEN-CENELEC, as well as in the preparation of positions in the international standardisation fora.

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104 Council Directive of 29th April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity (91/263/EEC ; OJ L128/1, 23.5.91)
Council Directive of 29 October 1993 supplementing Directive 91/263/EEC in respect of satellite earth station equipment (93/97/EEC; OJ L290/01, 24.11.93)

105 Council Directive of 19th February 1973 on the harmonisation of the laws of the Member States relating to electrical equipment designed for use within certain voltage limits (73/23/EEC ; OJ L77/29, 26.3.73)

106 Council Directive of 3rd May 1989 on the approximation of the laws of the Member States relating to electro-magnetic compatibility (89/336/EEC , OJ L139/19, 23.5.89), and Council Directive of 28th April 1992 amending Directive 89/336/EEC on the approximation of the laws of the Member States relating to electro-magnetic compatibility (92/31/EEC ; OJ L126/111, 12.05.92).

PROMOTING STANDARDISATION TO ENSURE INTERCONNECTION AND INTEROPERABILITY,

both through the timely definition of interfaces and through facilitating mutual recognition of type approvals for mobile terminal equipment.

As regards interconnection and interoperability, an environment for future open interconnection of systems requires substantial progress in the definition of European standards. The standards should specify the most essential interfaces, while leaving flexibility for innovative approaches.

According to the studies undertaken, this should particularly concern :

- → the interface between mobile networks and fixed network infrastructure, as far as not covered by the current standards work ;
- → the interfaces, functionalities, and service elements made available by mobile network operators to independent Service Providers ;
- → the interfaces made available to access the intelligent functionalities of the public fixed network(s) ;
- → the interfaces to be offered to mobile networks operated for own use or for use by a closed user group (private mobile networks) to allow interconnection with the public fixed network(s) ;
- → interfaces allowing direct interconnection of mobile networks based on either the same or different technologies.

The Commission intends to initiate a programme of standardisation mandates to ETSI to accelerate the definition of standards in this area. This will be based on, and will complement, current work within ETSI and within the various Memoranda of Understanding formed by mobile networks operators and/or manufacturers for systems implementation.

As regards facilitating mutual recognition of type approvals, work should concentrate on :

→ accelerating establishment and completion of standards in ETSI concerning the new digital technologies, in particular :

- enhanced features of the GSM system , for both voice and data, and for DCS-1800 ;
- DECT, Digital Cordless Telecommunications ;
- TFTS, Terrestrial Flight Telecommunications System ;
- ERMES, the pan European digital paging system ;
- Mobile data ;
- TETRA, the European digital trunking system ;
- DSRR, Digital ShortRange Radio ;
- Wireless LANs and wireless PABX ;
- Satellite-based mobile and personal communications systems.

→ rapid transposition of relevant parts of the respective standards into TBRs and CTRs ;

→ stepping up support to conformance testing, validation, and setting up of accredited test laboratories in this area. This will take place in the context of existing Community programmes[107].

Accelerating the definition of interfaces and supporting the necessary steps for rapid mutual recognition of type approval in the key future mobile technologies is a pre-condition for realisation of the market's full potential. It is also the basis of the implementation of an open environment according to the principles of Directive

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107 In particular the Community's programme for supporting conformance testing (CTS programme)

90/387/EEC[108] and implementation of Community-wide type approval according to Directives 91/263/EEC and 93/97/EEC[109].

The Commission intends to accord high priority to these objectives in its standardisation mandates to the European Telecommunications Standards Institute and to maintain close contacts in these matters, in particular, with ETSI TC SMG (Technical Committee, Special Mobile Group), TC RES (Technical Committee, Radio Equipment Standardisation), and TC SES (Technical Committee, Satellite Earth Stations, which also deals with mobile satellite-based terminals).

3 SETTING PRIORITIES FOR FREQUENCY COORDINATION RELATED TO MOBILE AND PERSONAL COMMUNICATIONS

As set out in the positions, the major priorities of the Union for radiofrequency coordination for mobile communications reflect the requirement for the full and coordinated implementation of the decisions taken at the World Administrative Radio Conference at Torremolinos, 1992 (WARC'92).

At the same time, a number of short term bottle-necks in frequency allocation must be lifted to allow market development within the Union.

The Commission proposes therefore the following main priorities :

→ specific action :

- agreement on frequency bands for DCS-1800 in the Union and replacement of the current ERC Recommendation by a ERC Decision, including firm allocation schedules ;
- establishment of an ERC Decision for the allocation of harmonised bands and sufficient frequency resources for the digital mobile trunking system (TETRA), including firm allocation schedule ;

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108 Council Directive of 28th June 1990 on the establishment of the Internal Market for telecommunications services through the implementation of Open Network Provision (90/387/EEC ; OJ L 192/1, 24.7.90)

109 Council Directive of 28th April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity (91/263/EEC ; OJ L 128/1, 23.5.91), and Council Directive of 29th October 1993 supplementing Directive 91/263/EEC in respect of satellite earth station equipment (93/97/EEC ; OJ L 290/1, 24.11.93).

- within the implementation of the WARC'92 decisions, establishment of an ERC Decision concerning frequency bands for satellite-based personal communications systems (including so-called Low Earth Orbit (LEO) satellite systems).

→ global objective :

- early designation and schedule of allocation for the bands set aside at WARC'92 for the future Universal Mobile Telecommunications System (UMTS) / Future Public Land Mobile Telecommunications System (FPLMTS) in the 1885 - 2025 and 2110 - 2200 MHz range.

  This should provide overall certainty for future sectoral developments in the Union.

The Commission intends to follow closely full implementation by the Member States of decisions in these priority areas as well as of Council Directives 87/372/EEC, 91/287/EEC, and 90/544/EEC concerning frequency allocation for the Global System for Mobile Communications (GSM), Digital European Cordless Telecommunications (DECT), and the pan-European digital paging system (ERMES), as well as existing ERC Decisions such as the ERC Decision for the Terrestrial Flight Telephone System (TFTS), which should provide the basis for rapid introduction of public aeronautical correspondence services in the Union, and the ERC Decision on Digital Short Range Radio (DSRR).

4 INITIATING COORDINATION OF NUMBERING AND WORKING TOWARDS A EUROPEAN NUMBERING SPACE FOR PERSONAL COMMUNICATIONS

As set out in the positions, the creation of a European numbering space is the key to the viable implementation of a personal communications environment in the Union.

At the same time, a number of immediate steps can be taken to facilitate the development of mobile communications.

The Commission therefore proposes the following main priorities in the co-ordination of numbering for mobile and personal communications :

→ specific action :

- harmonisation in the framework of ECTRA/ETO, and in close contact with ETSI and the respective MoUs set up for system implementation, of access codes for mobile systems ;
- harmonisation of access codes for directory services ;
- harmonisation of principles for allocation of numbers and number ranges of access codes for Service Providers or for special service features ;
- harmonisation of access codes to emergency services, as far as not covered by Council Decision 91/396/EEC[110], and other services of special public interest ;
- harmonisation of access codes of special relevance to the intelligent network environment.

→ global objective :

- rapid creation of a European numbering space, as the only viable long-term base for personal and portable numbers and Europe-wide personal communications, in line with Council Resolution 92/C 318/02[111]. This should be based on preparation by ECTRA and should use the opportunity for profound reform offered by the global reform of the world numbering system currently underway in the International Telecommunications Union.

  The Commission intends to follow closely full implementation by the Member States of decisions in these priority areas.

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110 Council Decision of 29th July on the introduction of a single European emergency call number (91/396/EEC ; OJ L 217/31, 6.8.91).

111 Council Resolution of 19th November 1992 on the promotion of Europe-wide cooperation on numbering of telecommunications services (92/C 318/02, OJ C318/2, 4.12.92).

as well as their use to support the development of telecommunications in the less favoured regions, and in the countries of Central and Eastern Europe.

The development of Europe-wide mobile operations has been substantially assisted in the past by conclusion of Memoranda of Understanding between operators and/or manufacturers in key mobile system development areas. Examples include the MoU concerning introduction of GSM, and in relation to ERMES, telepoint services and more recently TFTS. In a number of cases, these MoUs have been extended to cover both EFTA countries and countries in Central and Eastern Europe and have sometimes extended beyond Europe.

This cooperation in the introduction of such mobile systems should be further encouraged.

The provisions of the Treaty concerning trans-European networks now present the opportunity to make a further step in promoting such cooperation through the establishment and development of such networks. According to the Treaty, particular account will be taken of the need to link peripheral regions with central regions of the Union. Furthermore cooperation may be extended to third countries to promote projects of mutual interest and to ensure the interoperability of networks.

The Commission has proposed guidelines identifying projects of common interest in other telecommunications fields. It is proposed that in the field of mobile and personal communications priority should be given initially to the establishment of trans-European networks based on satellite-based personal communications including so-called Low Earth Orbit (LEO) satellite systems.

This should include, together with the Member States and the sector, the establishment of guidelines identifying projects of common interests, and identifying projects of mutual interest with third countries.

Further, special attention should be given to provision of telematics applications via mobile networks/services, in fields such as transport, health care, education and training where the use of mobile communications offer flexibility for new applications.

6 ELABORATING COMMON COMMUNITY POSITIONS WITH REGARD TO THIRD COUNTRIES AND ENSURING MARKET ACCESS TO THOSE COUNTRIES,

in order to ensure the Union's full contribution to the global development of mobile and personal communications and equivalent market access for European equipment industry, network operators and service providers.

Main objectives should be :

→ Common Community positions in the international fora where the major future standards, frequency, and numbering decisions will be taken.

This concerns coordination in the International Telecommunications Union and its World Radio Conferences, and with committees and working groups in the respective standards and numbering fields ;

→ development of common procedures with regard to trade and circulation of services and equipment to/from third countries in line with any agreements by the European Union with those countries and based on the principles of the GATT ;

→ Common Community positions on issues having a direct impact on trade and Community exports in this field, such as issues related to intellectual property rights, on restrictions on exports of encryption techniques and other sensitive technologies ;

→ Common Community positions with regard to obtaining equivalent market access to third country markets, taking account of the Union's commitments on a multi-lateral or bilateral basis.

7 CONTINUING SUPPORT FOR THE EVOLUTION TOWARDS THE UNIVERSAL MOBILE TELECOMMUNICATIONS SYSTEM,

as a common future basis for personal communications.

The Universal Mobile Telecommunications System (UMTS), currently under development in Europe, aims at ultimately providing a unified cost-efficient basis for personal communications services.

It is proposed that :

→ the Community continues its support for UMTS developments through its research programmes in the field of communications technologies, in the context of its R&D Framework Programme and by promoting telematics applications on UMTS. ;

→ substantial support is provided to ETSI's Special Mobile Group (SMG). SMG is working on standards in this area and preparing a European position for the standardisation sector of the International Telecommunications Union which is dealing with this area under the title Future Public Land Mobile Telecommunications System (FPLMTS) ;

→ work in this area builds on European strength in current digital mobile technologies, in particular DCS-1800, GSM, and DECT. At the same time flexibility with regard to certain features must be maintained such as future coding techniques used for the air interface, depending on the outcome of comparative research currently being carried out in the framework of the Community's research and technological development programme ;

→ the satellite component of UMTS should be carefully investigated, in view of the current proposals for satellite-based personal communications;

→ whichever detailed options are finally chosen, care should be taken to ensure a smooth transition from the use of current technologies to UMTS technologies.

V CONCLUSION

The evolution of mobile and personal communications represents one of the three major trends which dominate the current developments in communications - alongside the general globalisation and internationalisation of the communications sector, and the emergence of multi-media services, combining the digital provision of voice, image, and data and of interactivity.

At the same time, mobile and personal communications networks will form a major component of the future trans-European communications network environment.

The European Union enjoys a position of technological leadership in this sector. Maintaining this position and drawing maximum benefit from it for the European citizen, European industry, and European society now depends on creating the right conditions for future development.

The major pre-conditions will be increasing market flexibility, while developing a common vision and safeguarding the fundamental public interest in the sector. Contributing to finding the right balance in the context of the Union through a broad public discussion is the aim of this Green Paper.

After an appropriate period of consultation, the Commission will present its conclusions on the future development of mobile and personal communications in the European Union and on the required measures.

Towards the Personal Communications Environment:

Green Paper on a common approach in the field of

mobile and personal communications in the European Union

ANNEX A

REVIEW OF TECHNOLOGY AND MARKET DEVELOPMENTS

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REVIEW OF TECHNOLOGY AND MARKET DEVELOPMENTS

1. GENERAL OVERVIEW

Mobile communications is currently the fastest growing sector within the telecommunications industry. The majority of this growth has occurred since the mid-1980s following introduction of public cellular telephony services in Europe, although private mobile radio communications have in fact been in use in Europe since the 1940s.

Europe today has a total mobile user base of around 16 million subscribers (a figure which excludes cordless telephony), made up mainly of users of the three most established services - private mobile radio, paging and analogue cellular radio. This total user base grew by over 20% in 1991, led by an increase in cellular users of over 40%. As well as now accounting for greater than 50% of the total user base, cellular also accounts for over 90% of the value of the total European market for mobile services and 75% of that for mobile equipment[1].

Because of the diverse requirements driving mobile developments, many technology and market characteristics are exhibited at the level of individual systems and services. A number of important trends, however, are significant in terms of the general continuing development of the sector[2].

Exhibit A1 gives an overview of the current mobile market situation in the European Union.

While digital systems at present account for some 10% of the cellular subscriber base, further rapid transition from analogue to digital systems is expected over the decade. This review of technology and market developments therefore concentrates on digital mobile communications.

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1 One of the most dramatic effects in European telecommunications over the recent period has been the substantial price decreases in digital mobile terminal equipment prices, together with the widespread reductions in service prices and innovative pricing packages, (for example, the introduction of schemes targetted at customers with low usage). Current annual cellular revenue per subscriber is 1,100 ECU, compared with around 400 ECU per fixed network subscriber. However, with the evolution of mobile and personal communications services towards mass market deployment, the difference in revenue levels will diminish.

2 Further detail can be found in supporting studies, in particular "Scenario Mobile Communications up to 2010 - study on forecast developments and future trends in technical development and commercial provision up to the year 2010", EUTELIS Consult, October 1993, undertaken for the Commission in preparation for the Green Paper. Additionally, there are a large number of studies and market analyses regularly published by consultancies and market research companies.

For details on current status of systems, see in particular "Review of the Requirements for the future harmonization of regulatory policy regarding mobile communications services", report by ECTRA Mobile Project Team, European Committee for Telecommunications Regulatory Affairs, October 1993.

Exhibit A1: European Mobile Telecommunications at end-1993 : key data

1.	**USERS**	
	Total number of users of mobile communications in Europe[1]	**15,800,000**
	on public networks[2]	**70%**
	and on private networks[3]	**30%**
	operating on analogue systems[4]	**91%**
	and on digital systems[5]	**9%**
2.	**SERVICE REVENUES**	
	Total public mobile service revenues in Europe[6]	**8.5 Billion ECU**
	Mobile services as a percentage of all telecommunications services	**10%**
3.	**EQUIPMENT REVENUES**	
	Customer equipment sales	**4.6 Billion ECU**
	Terminals for use on public cellular systems	**75%**
	and other networks[7]	**25%**
4.	**PROJECTED CUMULATIVE INVESTMENT TO 2000[8]**	
	Projected investment in mobile infrastructure (lower bound[9])	**27 Billion ECU**
	Projected investment in mobile infrastructure (upper bound[10])	**45 Billion ECU**
	As a percentage of all telecommunications investment[11]	**7 - 13%**

Source: Published market research

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1 Comprising 8,100,000 cellular telephony users, 4,500,000 private mobile radio (PMR) and public access mobile radio (PAMR) users, and 3,100,000 wide-area paging users.
The installed base of other services, such as telepoint and mobile data, remains small at present with an estimated 100,000 subscribers in total. Cordless telephone use in residential and/or business environments is excluded from this total.
Includes European Economic Area and Switzerland, equivalent figures for central and eastern Europe are not available.

2 Public networks include: analogue cellular telephony (NMT 900, NMT 450, TACS, C-NET, Radiocom 2000 and others), GSM, DCS 1800, paging and telepoint.

3 Private networks include: PMR, PAMR and dedicated mobile data networks.

4 Analogue systems include: analogue cellular telephony, analogue paging and PMR and analogue PAMR.

5 Digital systems are: GSM cellular telephony, DCS 1800 cellular telephony, digital PAMR and telepoint. GSM cellular telephony, currently undergoing very rapid expansion, represents the majority of digital users.

6 1993 service revenues for analogue and digital cellular telephony, and wide-area paging.

7 Includes paging terminal, private mobile radio terminals and private mobile radio base stations.

8 During this period, mobile telephony subscribers as a percentage of all telephony subscribers will increase from approximately 4% to 11.14%. Revenues will also grow although declining costs and the effects of competition (notably the range of tariff packages offered) will mean that revenues per subscriber will fall from the present level of over 1100 ECU per annum to less than 500 ECU.

9 Based on public investment plans and on licences already allocated or planned.

10 Assuming widespread adoption of Personal Communications based on DCS 1800 technology.

11 Cumulative telecommunications investment in the European Union from 1991 to 2000 will be 345 to 401 Billion ECU according to Analysys' study "Performance of the Telecommunications Sector up to 2010 under different Regulatory and Market Options".

1.1 The transition to digital systems

Recent technical development in Europe has been concentrated on second-generation digital mobile systems offering improved cost and performance compared to initial analogue systems, as well as greater capacities and new functionality.

ETSI-specified mobile systems and technologies include:

- GSM - 'Global System for Mobile communications' digital cellular
- DCS1800 - digital cellular system based on GSM, operating at 1800 MHz;
- DECT - digital European cordless telecommunications;
- ERMES - digital paging and messaging system;
- TFTS - system for terrestrial in-flight passenger telecommunications;
- TETRA - digital trunked mobile radio system;
- DSRR (digital short-range radio system for private mobile radio)

each of which comprise a technological advance on first-generation analogue products, and offer, for the first time, through their Europe-wide specification, true possibilities for pan-European mobility and manufacturing economies of scale.

1.2 Second and third generation systems

It is likely that a subset of second generation systems will, through successive development, play a key role in the delivery of future personal communications services[3] up to and into the next century.

For the longer term, industry and policy makers both in Europe and at the global level are actively promoting research and development towards a unified technological approach to meeting needs for world-wide personal communications. The development of a universal mobile system which can support the full range of market-specific applications via a single terminal is seen to require a further, third generation evolution of mobile communications technology.

Research and development on this third-generation mobile technology in Europe is concentrated, under the European Community RACE programme, on developing the architectural aspects of a Universal Mobile Telecommunications System (UMTS). Responsibility for coordinating European technical specifications suitable for implementation of UMTS has been allocated to the ETSI Technical Committee SMG (Special Mobile Group).

At the global level, the ITU has resolved to produce international a priori standards for a third-generation global mobile communications system under the concept of Future Public Land Mobile Telecommunications Systems (FPLMTS). FPLMTS has gained support at the WARC '92 through the earmarking of global frequency bands for its introduction.

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3 See Sections 4.6 and 4.7

1.3 Convergence of mobile communications with intelligent systems

The provision of large degrees of mobility, including the capability to roam[4] between networks, has created new technical challenges for call handling and related functions in networks such as GSM. These arise from the basic needs to hold, update and interrogate information to enable real-time handling of the location of mobile terminals/numbers, authentication of roaming subscribers and terminals, and routing of calls. A degree of 'network intelligence' is therefore intrinsic to the provision of mobility functions.

The solutions adopted for GSM involve the use of computerised databases distributed across different GSM networks and the implementation of advanced parts of the CCITT No.7 signalling system to enable information transactions between networks and databases. These are core components of network intelligence.

The ability to handle a high volume of information transactions will become increasingly important as mobile subscriber numbers increase in future. RACE estimates project a volume of signalling transactions which may be an order of magnitude greater than the levels for which current systems are designed.

In addition to the need to enhance transaction handling capabilities to provide basic mobility functions, progress towards mass-market personal communications will in future create additional requirements for network intelligence, including number translation capabilities associated with personal numbering, the setting up and modification of individual subscriber service profiles, and provision of a range of advanced services.

Such capabilities will not only apply to mobile networks, but will span the range of fixed, mobile and satellite platforms over which personal communications services are likely to be offered.

1.4 Sharing of resources

Of increasing concern in a competitive environment is the efficiency with which technologies allow for sharing of resources between systems. While this touches radio frequencies, in particular, it also extends to sharing sites and infrastructure.

For public mobile communications, personal communications will generate a wealth of technologies, operators and users. Development of increasingly spectrally-efficient and agile technologies is therefore a continuing priority for the mobile industry.

For private mobile technologies, the introduction of trunked mobile radio systems, such as TETRA, as an alternative to self-provided private mobile radio (PMR) systems offers, through pioneering the large-scale sharing of private-use radio channels, a significant example of the trend towards sharing of resources.

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4 For technical terms see Glossary

Increasing use of trunked mobile radio also signifies a trend in the private mobile communications area away from separate towards shared radio communications infrastructures. This is likely also to become an increasingly important aspect in the public mobile communications area in view of the likely future requirements for infrastructures.

1.5 Satellite-based systems

Mobile and personal communications are not limited to the usage of terrestrial networks. Satellite based systems provide voice and non-voice services to an ever increasing number of users at sea, and also on land and in the air.

The international maritime satellite organization Inmarsat has been offering voice and telex services to mobile users for more than ten years. Originally the service was only intended for maritime mobile communications, but in the eighties the Inmarsat system came to be used for land-mobile communications as well. The Inmarsat system had about 20,000 terminals in use late 1992 (Inmarsat A[5]), of which about three quarters are on vessels, and the remaining quarter on land. About 25% of all these terminals are registered in European countries.

Recently, there has been increased attention to the use of satellite systems for mobile voice and data services via satellite. In Europe Euteltracs (Eutelsat), Inmarsat-C, and Traksat's service are examples of satellite-based data services[6].

In an already changing environment, it appears that the usage of satellite systems for mobile services may enter yet another period of revolutionary change, now brought about by new concepts for personal communication services via satellite. Already in the Inmarsat system, terminal sizes and related prices are decreasing. The new systems that are proposed offer a wide variety of technical solutions in terms of power of the systems, architecture, facilities or use of orbits (ranging from systems using the Geostationary Orbit (GEO) to systems using a Low-Earth Orbit (LEO), Highly Eliptical Orbit (HEO) or even other orbits). A common aim of these systems is the delivery of voice and/or non-voice services to customers via mobile, hand-held terminals[7].

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5 Inmarsat Standard-A terminal is the original terminal used by Inmarsat for its services. In January 1991 Inmarsat added the Standard-C terminal to its range. This latter category of terminal is used for text and data services only. At the end of 1992 there were approximately 3.500 of Inmarsat C terminals in use.

At the beginning of 1993 Inmarsat launched its Inmarsat-M (portable satellite phone) service. Inmarsat also offers an aeronautical satellite communications service (since 1990). Future plans include the introduction of Inmarsat-B, the digital successor to Inmarsat-A.

6 Published market research suggests that the current base of around 6,000 terminals for land mobile satellite data services, such as Inmarsat C and Euteltracs in Europe should rise to 100,000 terminals in use by 2000.

7 See Communication from the Commission on satellite personal communications, COM(93)171 final, 27 April 1993. Most proposals are currently US-based, such as the widely-known proposal for the Iridium project led by Motorola.

2. PUBLIC MOBILE COMMUNICATIONS

2.1 The Global System for Mobile Communications - GSM

While analogue cellular systems still dominate the European installed base, GSM - the new pan-European digital system is catching up rapidly (see **Exhibit A2**).

Work on GSM standardisation started in 1982 under the CEPT (the European Conference of Post and Telecommunications Administrations) and was transferred to ETSI following its formation in 1987. GSM introduction was from the start strongly supported by the European Community, in particular by a Council Recommendation and Council Directive adopted in 1987, and a Council Resolution adopted in 1990[8].

GSM is now the major European digital mobile system and has become a world-wide success[9]. Its implementation was supported by the GSM Memorandum of Understanding (MOU) in which all European Community operators are members.

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8 Council Directive of 25 June 1987 on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the European Community (87/372/EEC; OJ L196/85, 17.07.87) (GSM);

Council Recommendation of 25 June 1987 on the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community (87/371/EEC; OJ L196/81, 17.07.87);

Council Resolution of 14 December 1990 on the final stage of the coordinated introduction of pan-European land-based public digital mobile cellular communications in the Community (GSM) (90/C329/09; OJ C329/25, 31.12.90).

9 For details of the Community strategy in this field, see Communication from the Commission on the coordinated introduction of the pan-European digital cellular mobile communications system (GSM), COM(90)565 final, 23.11.90

Exhibit A2 : Main Trends in cellular telephony during 1993

Analogue still dominates the European installed base....

	Operator		Network type	Subscriber base October 1993	Annual Growth Rate
EU	Belgacom	B	NMT 450	66.000	14%
	TeleDanmark		NMT 450	47.000	-6%
			NMT 900	185.000	23%
	Deutsche Telekom	D	C-Netz	807.000	9%
	Telefonica	E	NMT 450	59.000	-11%
			TACS 900	180.000	82%
	FT Radiocom 2000		RC 2000	331.000	1%
	SFR		NMT 450	125.000	23%
	Eircell	IRL	TACS 900	50.000	25%
	SIP	I	RMTS	35.000	-33%
			TACS 900	950.000	39%
	P&T	L	NMT 450	950	0%
	PTT Telecom	NL	NMT 450	27.000	4%
			NMT 900	170.000	33%
	TMN	P	C-Net	30.000	30%
	Cellnet	UK	TACS 900	711.000	23%
	Vodafone		TACS 900	895.000	19%
EFTA	PTV	A	C-Netz	56.000	-7%
			D-Netz	145.000	49%
	Telecom Finland	SF	NMT 450	168.000	6%
			NMT 900	235.000	33%
	Telemobil	N	NMT 450	159.000	5%
			NMT 900	162.000	38%
	Comvik	S	NMT 450	21.000	0%
	Telia Mobitel		NMT 450	257.000	3%
			NMT 900	452.000	21%
	PTT	CH	Natel C	241.000	17%
	Europe		-	6.564.950	20%

Source: Operators published market research

... but GSM growth is strong in a number of Member States.

	Operator		Network type	Subscriber base October 1993	GSM Start date
EU	TeleDanmark	DK	GSM	6.000	Mar-92
	Dansk Mobiltelefon (DMT)		GSM	*15.000	Jul-92
	DeTeMobil D1	D	GSM	190.000	Jul-92
	Mannesmann D2		GSM	260.000	Jun-92
	FT Itineris	F	GSM	15.000	Jul-92
	SFR		GSM	7.000	Jul-92
	SIP	I	GSM	1.000	Oct-92
	TMN	P	GSM	16.500	Oct-92
	Telecel		GSM	21.000	Oct-92
	Vodafone	UK	GSM	1.000	Dec-91
	STET Hellas Telec.	GR	GSM	**3.000	Jul-93
	Panafon SA		GSM	**3.000	Jul-93
	Eircell	IRL	GSM	**400	Jul-93
	P&T	L	GSM	*3.400	Jul-93
EFTA	PTV	A	GSM	0	Oct-93
	Telecom Finland	SF	GSM	5.000	Jun-92
	Radiolinja		GSM	6.000	Dec-91
	Telemobil	N	GSM	1.000	May-93
	NetCom		GSM	*2.000	Sep-93
	Comvik	S	GSM	5.500	Sep-92
	Europolitan		GSM	2.000	Sep-92
	Telia Mobitel		GSM	3.500	Nov-92
	PTT	SZ	GSM	2.000	Mar-93
	Europe		-	569.300	-

Source: Operators GSM MoU/CEC Studies

Subscriber numbers estimated at start of October 1993 except for :

* Subscriber numbers estimated at September 1993 and ** Subscriber numbers estimated at August 1993

Startdates refer to public service availability.

These figures change quickly due to rapid growth; e.g. in Germany by January 1994 each GSM operator had more than 500,000 subscribers. In Greece the two GSM operators have more than 20,000 subscribers, whilst the Belgian GSM operator, Proximus, is operational.

GSM offers a number of advantages over analogue cellular, including:

- High speed data transmission
- Portability of the user identity through the use of the SIM-card[10]
- Pan-European roaming
- Enhanced range of value-added services
- Increased traffic density due to greater spectrum efficiency
- Increased security via the A5 algorithm and variants[11]
- Increased quality of service

GSM can be deployed as a micro-cellular network to allow for increased traffic levels in high-density areas. A further important potential development of the GSM specification will allow the introduction of half rate encoding of speech, thereby supporting a two-fold gain in voice traffic handling capacity.

GSM is at present commercially available in 9 Member States, with current planning supporting availability in all Member States by 1994. Progress in establishing roaming agreements in Europe has been initially slow. While the situation is now improving, substantial gaps in pan-European coverage for roaming still remain.

A number of problems have had an impact on the introduction of GSM. These include:

- intellectual property right (IPR) issues
- exportation of the security algorithm, where only compromise solutions have so far been found
- problems of interference with non-radio devices
- the emerging concerns of radiation hazards and environmental impacts
- delays in terminal type approval, requiring an Interim Type Approval (ITA) scheme as a necessary short-term solution.

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10 The SIM (Subscriber Identification Module) card is an 'intelligent' card which holds details of a GSM user. It can be inserted by the user into any authorised GSM terminal to register on the network, and thus provides an option for roaming without the need to carry a GSM handset between locations where service is required. The SIM-card is also being used as a means of enabling cross-border competition between GSM service providers.

11 A5 denotes the information encryption method designed to provide end-to-end security in the GSM system.

Initial GSM implementations support only voice telephony and emergency calls. Enhancements in due course will support full data transparency, facsimile service and short call facilities. The latter capability will allow a GSM terminal to effectively act as a paging terminal, receiving and storing short messages, for example when the user chooses not to answer incoming calls.

Forecasts predict a very high market potential for GSM in Europe, as well as world wide. Within the Union, before the year 2000, GSM is expected to provide a coverage that is equivalent or better than corresponding analogue services with significantly better quality of service and the capability to support international roaming. This, with appropriate marketing, is expected to provide a significant stimulus for subscribers to migrate from analogue services. Market forecasts indicate that GSM may attract around 15-20M subscribers by the year 2000 across the European Union and EFTA countries.

GSM specifications have now been extended to support operation at higher frequency bands, based on a micro-cellular structure. The resulting specifications are known as DCS-1800 (see sections 4.1 and 4.2)

2.2 Digital Cordless Telecommunications - DECT

DECT is set to become the generalized digital cordless telephone in Europe, however with significantly broader applications. It is aimed at offering mobility around the office (via the cordless PABX), home, and public areas (via 'telepoint' services), and may be deployed in wireless local loop configurations.

The development and introduction of DECT was supported by a Council Recommendation and Council Directive adopted in 1991[12].

The first DECT products are now available on the European market in the form of cordless extension upgrades for PABX installations.

DECT is designed to be capable of supporting very high traffic densities (upwards of 6,000-12,000 Erlang/Km^2 depending on application), making it suitable for very concentrated usage environments such as in city centre offices and transport hubs. For smaller PABX installations, residential and telepoint applications, DECT will have the CT2 technology as a competitor.

For these applications, the cost of DECT equipment will be critical in realising full market potential, estimated to be around 30 million users in Europe.

DECT could potentially be used to provide cordless access to a range of networks. ETSI has already developed DECT profiles for integration with GSM and ISDN.

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12 Council Directive of 3.June 1991 on the frequency bands designated for the coordinated introduction of digital European cordless telecommunications (DECT) into the Community (91/287/EEC; OJ L144/45, 08.06.91);

Council Recommendation of 3 June 1991 on the coordinated introduction of digital European cordless telecommunications (DECT) into the Community (91/288/EEC; OJ L144/47, 08.06.91).

DECT has, as with other systems, faced a number of issues during development:

- competition from investment in the development of GSM, resulting in a shortage of manpower for the development of the standard, both in the ETSI and in manufacturers
- competition for the adoption of alternative European cordless standards (CT2 and DCT 900)
- as with GSM, there have been delays in getting CTRs[13] approved in good time
- some countries consider there are risks that DECT effective capacities may be reduced due to possible interference with systems in neighbouring bands. In the UK, a particular problem of frequency sharing between DECT and DCS 1800 has been seen.

The validation and demonstration of DECT applications, supported by the Commission under the CTS (Conformance Testing Service) program (planned for the first quarter of 1994) will be a definitive push for a wider use of DECT. The main initial DECT appplications (cordless PABX, telepoint and local loop) are the essential part of the planned programme.

The market potential for DECT is forecast to be very high once the technology is fully available. It could become, alongside GSM (wide range, high mobility), the major component of European wireless mass-market communications (short range, low mobility).

2.3 Public Access/Telepoint Applications

In its basic conception, telepoint[14] approximates to a cordless public call-box, providing access to the public network for making calls only. Enhanced implementations aimed at increasing contactability involve combining the basic one-way service with paging (including the offering of combined cordless/paging terminals) and voice messaging, and the implementation of network functionality which can hold and route calls to a telepoint subscriber when he comes in range of a base-station.

The two main non-proprietary solutions for the present and near future are CT2 and DECT. All current implementations are based on CT2, however a DECT-based trial is now planned in France. DECT is seen as a medium term possibility in the European context.

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13 CTRs: Common Technical Regulations; the basis for harmonized type approval specifications in the context of Council Directive 91/263/EEC.

14 Telepoint is a limited mobility service involving the use of a cordless telephone, carried by the user, to access the public network from any point within range of shared radio base-stations. These have so far been deployed mainly in town centres, railway stations, etc. Telepoint extends the standard home and office use of cordless telephones.

Telepoint in Europe has seen mixed success. Although some success has been seen in the Netherlands and major success recently in France, to date this has not been mirrored elsewhere. In the UK, all licensed operators have now abandoned efforts in this area. Plans for telepoint launches in Germany have been postponed.

However, success in other markets (notably in Asia, e.g.Hong Kong and Singapore, see Annex C section 3) must be seen as a signal of the potential for such services.

2.4 The Pan-European Digital Paging System - ERMES

Development and introduction of ERMES was given political support through the adoption of a Council Recommendation and Council Decision in 1990[15]. Implementation of ERMES is supported by an MOU between 28 European signatories.

Currently, there are no commercial ERMES systems in operation in the Member States, also firm plans now exist for the licensing of operators in a number of Member States. France allocated three licences in Autumn 1993.

Several issues have delayed the implementation of ERMES:

- the priority given by both operators and suppliers to the implementation of other systems (GSM in particular)
- in some cases, paging networks have been very recently installed, and existing available capacity is leading to a "wait and see" attitude to ERMES.
- ERMES may compete against the capability of the short message service (SMS) of GSM, possibly using SMS-only GSM terminals.
- Some operators have identified that in order for ERMES to be commercially successful as a supplement to the existing paging networks, it will depend heavily on roaming traffic. A lack of commitment to date to the undertakings given at the MoU meetings in this area is causing a loss of confidence with regard to the implementation of national ERMES networks.
- Questions have been raised about interference with non-radio systems, in particular, broadcast and cable TV services in Germany. Consequently required experimental ERMES trials have held up licence allocation.

However, once these problems are overcome, ERMES has the potential to become the future backbone for European wide-area paging.

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15 Council Directive of 9 October 1990 on the frequency bands designated for the coordinated introduction of pan-European land-based public radio paging in the Community (90/544/EEC; OJ L310/28, 09.11.90) (ERMES);

Council Recommendation of 9 October 1990 on the coordinated introduction of pan-European land-based public radio paging in the Community (90/543/EEC; OJ L310/23, 09.11.90) (ERMES)

2.5 The Terrestrial Flight Telecommunications System-TFTS

The Terrestrial Flight Telecommunications System (TFTS) is the first digital system designed to provide passenger telephone correspondence services using direct radio links between aircraft and ground stations with one-way access to the fixed ground network[16].

TFTS could become a vital element in trans-European communications structures, and although by nature limited in volume, a flagship of European digital mobile systems.

ETSI has defined the technical specification for TFTS radio characteristics and the interfaces with European public networks. The European Airlines Electronic Committee (ECAC) has specified the TFTS airborne equipment and its interface with the cabin equipment.

TFTS ground infrastructure is currently being rolled out. Competing Operators indicate that they have signed up a number of European airlines for TFTS service.

A commercial TFTS-based service is due to be available during 1994. An initial service became available in December 1993 at London Heathrow airport.

2.6 The evolution towards the Universal Mobile Telecommunications System - UMTS

As set out, the UMTS third-generation mobile telecommunications system is designed to be a universal multi-function multi-service digital system evolving from current second-generation systems.

The general service objectives for UMTS include:

- UMTS should provide services in a wide range of operating environments allowing communication from home, office, cities or rural areas, fixed locations or moving vehicles;
- UMTS should provide a wide range of services;
- UMTS should support a wide range of mobile terminal types, from integrated lightweight handheld voice terminals to multimedia terminals and mobile terminals which can provide a communications interface to other terminals;

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16 The Commission in 1992 proposed a Council Directive to secure frequency designations for TFTS (COM(92)314 final - SYN 440, 22.07.92). This was later replaced by an ERC decision, under the guidelines set out by the Council Resolution of 19 November 1992 on the implementation in the Community of European Radiocommunications Committee Decisions (92/C318/01; OJ C318/1, 4.12.92). See also new approach to frequency coordination, Annex D. ERC is about to adopt a recommendation on Interim Type Approval which will be implemented in CEPT countries prior to the adoption of a CTR for TFTS.

- UMTS should support Universal Personal Telecommunications (UPT) concepts.

Responsibility for standardisation of UMTS has been given to the ETSI Technical Committee SMG (Special Mobile Group). Its tasks in this area include:

- production of technical baseline material for UMTS;
- production of parts of the European standards;
- cooperation with European research programmes (e.g. RACE);
- coordination with the ITU Standardisation sector for world wide standards on UMTS/FPLMTS.

The European Community RACE II programme of research and development into advanced communications technologies contributes to the work on UMTS via projects in the areas of radio access technologies such as TDMA and CDMA, cell and frequency planning and networking aspects[17].

The objectives for UMTS are dealt within the ITU under the title Future Public Land Mobile Telecommunications Systems (FPLMTS). Within the ITU, work has been progressing on FPLMTS since 1986. Frequency arrangements for FPLMTS were initially set out WARC' 92 (see Annex B).

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17 Within RACE a number of distinct projects participate in the work towards the definition of UMTS. These include ATDMA, CODIT, MONET, PLATON, MAVT, SAINT and TSUNAMI. The overall objective of the project CODIT, is to explore the potential of CDMA for UMTS, while that for ATDMA is to develop advanced techniques for realising a TDMA-based UMTS. The relative merits of these multiple techniques will be evaluated at the end of the projects. The main objective of project PLATON, is to develop new software tools that will allow efficient frequency planning for UMTS, while the project MONET aims at development of a framework for network standards for UMTS. The project MAVT, aims at identifying new video audio coding algorithms for the transmission of high quality audio, moving and still video in a mobile environment. Recently two new projects were launched namely SAINT which will evaluate and identify the requirements for the integration of satellites in UMTS and TSUNAMI which focus its work on the development of adaptive antenna systems for UMTS.

A number of other R&D projects in the framework of RACE also contribute towards the definition of future mobile communication systems namely MOBILISE which addresses a number of aspects related to the introduction of UPT; MODAL, contributing to the planning and evolution of the fixed infrastructure for future Mobile Broadband Systems; and MOEBIUS, a project focused on satellite-based mobile broadband communications.

Another very important project in the context of future developments in mobile communications is the project MBS which will explore the possibility of very high data rate mobile communications in the 60 GHz frequency range.

3. PRIVATE MOBILE COMMUNICATIONS

3.1 Private mobile radio (PMR)

Private Mobile Radio (PMR) developed out of the need to be able to establish closed user group communications with fleets of vehicles. Operation is typically from a despatch centre to mobiles operating over a limited number of dedicated radio channels. Communication may be via both voice and data; voice communication is typically half-duplex (ie "Push to talk"). Its low functionality means that PMR is assigned to niche, but nevertheless large, market sectors.

PMR is currently experiencing relatively moderate growth, reflecting the maturity of the market, the availability of alternatives such as cellular, and significant congestion and frequency allocation problems, in particular as the efficiency of spectrum use can be very low.

Analogue trunked PMR (so-called PAMR - Public Access Mobile Radio) systems were introduced in the European Union in 1986. These systems support shared use of radio channels between users, the main aims being more efficient use of spectrum and improvement on basic PMR service levels. The UK MPT1327 specification is most widely-used in Europe, and is slowly establishing itself as a de facto standard. Other proprietary systems also exist.

A principal difference of trunked PMR compared to basic PMR from the users' point of view is they have the option to subscribe to a service instead of building and running their own infrastructure.

The digital TETRA (Trans-European Trunked Radio) standard being developed by ETSI represents the second generation of trunked mobile radio systems.

3.2 The trend towards digital trunked systems - TETRA

ETSI is currently completing the specification of TETRA (Trans-European Trunked Radio). TETRA provides for efficient use of spectrum, interoperability between networks and common definition of equipment, aiming at offering users, operators and suppliers a more efficient and lower cost solution than with current analogue PAMR systems. It will, where required, support a high level of service functionality including roaming capabilities.

Public safety and operations-based organisations (police, fire-brigades, border authorities, forestry services, etc.) are likely to be the major users of TETRA. Benelux public safety organisations, acting within the Schengen group, have stated an urgent requirement for product availability during 1994, however the full requirements of these organisations have yet to be covered ETSI specifications.

An important requirement where use of such systems spans intra-EC borders is the contiguous availability of suitable frequencies.

TETRA could in fact become a major factor of renewed growth in the European PMR market.

3.3 Mobile Data

Data can be carried over most mobile systems, and a variety of applications have been implemented carrying data at low speeds.

Dedicated mobile data systems are a more recent development, and in most cases use a packet-based technique to achieve spectrum efficiency. Applications include despatch-type services and remote data entry. Most use is currently within closed user groups, however growth in portable personal computers may produce a wider range of services. The Mobitex system has emerged as the most widely adopted platform for dedicated mobile data networks in Europe, although other proprietary systems also exist.

The ETSI-specified TE[illegible]ystem will provide a European standard for mobile data services as well as for voice. ETSI is also working on the specification of a mobile packet-data radio system.

3.4 Digital Short Range Radio-DSRR

DSRR is intended to provide a low-cost digital PMR system, offering direct communication between mobile users, or operation via a repeater, without the need for a specific mobile infrastructure, such as that required by TETRA.

The Commission has proposed a Directive concerning the frequency bands to be designated for DSRR. In the meantime, according to the new approach to frequency coordination (see Annex D), the European Radiocommunications Committee (ERC) has adopted an ERC-decision on the frequencies to be made available for DSRR.

The availability of DSRR products has been delayed. Claims regarding possible interference with other systems, in particular GSM, and a "wait and see" attitude from the manufacturing industry are contributing to this.

As a result a major European digital product is currently being held back from market deployment, in particular due to the continuing unresolved frequency issues. Urgent resolution of these issues is required[18].

3.5 Wireless LANs and Wireless PABXs

In the area of wireless local area networking, the ETSI-specified "HiperLan" system refers to a radio-communications sub-system intended to provide high speed, short distance links between computer systems and is typically intended for local, in-house and on premises working. It provides a standard, allowing for transmissions up to 20 Mbit/s, is expected to be delivered by ETSI during 1994.

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18 Related, but technically less-sophisticated systems also allowing radio-based communications without the need for fixed infrastructure have existed for many years in the form of Citizen's Band and amateur radio. Such systems have primarily been used for leisure activities.

In the area of wireless PABXs, proprietary solutions dominate. CT2 and DECT (see section 2.2) are well placed to allow for lower-cost, more flexible and intercompatible equipment. Out of the two, DECT has more potential, mainly for non-voice communications as it allows for higher bit rates than CT2. Nevertheless, for true high bit rates, new standards are needed.

4. THE CONVERGENCE OF FIXED AND MOBILE COMMUNICATIONS : THE EVOLUTION TOWARDS A PERSONAL COMMUNICATIONS ENVIRONMENT

Personal communications means moving from a terminal-to-terminal calling concept to a person-to-person calling concept.

Personal communications involves the offering of a range of telecommunications services that are able to be flexibly tailored and packaged to meet the needs of individuals, allowing them to communicate independently of their location or access method.

Taking this idea to any great extent anticipates ultimately an environment in which services could potentially be delivered over mobile, fixed, and/or satellite networks, accessed using either wireline and wireless terminals, and covering public and private domains, both business and residential.

According to the studies carried out[19], the European market for wireless personal communications could reach around 80 million users by the year 2010. Ultimately, personal communications penetration could be expected to reach near 80 % of the entire population, i.e. up to one connection per adult.

4.1 The development of Micro Cellular Networks

A major step towards an infrastructure supporting the wireless part of personal communications services is the use of small-radius cells (micro-cells), which allows a high rate of spectrum reutilisation (aimed primarily at increasing the number of radio channels available in zones or enclosed areas with high peak traffic levels, thus supporting higher subscriber densities).

To be more efficient and less costly, micro-cellular architectures require more decentralized intelligence than the normal cellular solutions. Decision and control needs to be done as far as possible at a local level in order to keep transmission costs and the volume of signalling traffic to workable levels.

The roll-out of micro-cellular networks is now underway in Europe with the implementation of so-called Personal Communications Networks (PCNs) making use of the DCS 1800 standard in the UK and Germany, and the deployment of micro-cellular versions of GSM at 900 MHz in urban areas.

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19 See in particular EUTELIS "Scenario Mobile Communications 2010 - Study on forecast development and future trends in technical development and commercial provision up to the year 2010, October 1993".

4.2 Personal Communications Network-PCN/DCS 1800

PCN licences were originally granted in the UK, resulting from consultation on the basis of the DTI's "Phones on the move" document. The aim was to extend the benefits of mobile communications to a wide market and stimulate competition in cellular communications, based on the use of cellular systems operating in the 1800MHz band (denoted as PCN systems). The current licence-holders both chose to implement the European DCS1800 standard. A PCN-type licence has since been granted in Germany, and announcements have been made in France and the Netherlands.

The DCS 1800 standard is essentially a modification of the GSM specification to support operation in the 1800MHz band. The low power level used, both in the terminal and in the base station and the use of frequencies in the higher band implies shorter distance coverage but supports higher traffic densities in urban areas, near main roads and crowded areas in general.

Further incremental developments are being considered by ETSI for GSM at 1900MHz and 2100MHz, in order to position the European standard for additional markets[20].

The main differences of PCNs compared to GSM from the users' point of view are likely to be the cost, size and weight of the hand-helds which are generally expected to be lower. According to DCS1800 operators and some analysts, scale economies for handset terminals will be greater than for GSM.

4.3 Wireless in the local loop

Currently, the most widespread applications of wireless in the local loop in the Community are based on the use of conventional analogue cellular techniques in conjunction with 'fixed' mobile terminals. Such techniques are being used in Spain and Eastern Germany to provide coverage for fixed telephony service, where the wireless local loop is seen as a cost-effective and faster alternative to roll out of wired fixed networks.

Cordless standards such as DECT provide the possibility of "neighbourhood telepoint" under which cordless terminals may access shared base-stations over relatively short distances. Access could potentially be to both current fixed and mobile networks.

In the UK, one company[21] is developing a proprietary wireless technology which will involve the deployment of roof-based antennae at subscriber premises.

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20 Work within ETSI is also focusing on the combination of GSM and DCS 1800 and of GSM and DECT.

21 The company Ionica has been granted a licence to offer wireless local loop access to the public network in competition to BT and cable TV companies.

Furthermore, mobile operators will, from 1994, be allowed to offer fixed services over their networks[22].

ETSI is shortly to produce a technical report and recommendations for standardisation concerning wireless local loop technologies.

4.4 Complementary growth of traffic on mobile networks and the fixed network

Current demand for cellular telephony, which accounts for 90% of mobile service revenues, translates into substantial additional telephony traffic over and above that between fixed network subscribers.

This is mainly attributed to the fact that the mobile subscriber is more of the time in a position to initiate and receive calls. Mobile communications overcomes the main disadvantage of fixed telephony - an ability to reach the called party only 30% of the time. Calls to a mobile subscriber are more often completed, which has the effect of producing increased calling.

Currently, in developed markets, according to estimates, 95% of calls involving a mobile subscriber are made to or from a fixed subscriber. A large majority of the demand for cellular communications correspondingly translates into additional revenue for the fixed network.

In the medium to long term, the proportion of mobile-to-mobile calls may increase as users, both business and ordinary consumers, start to subscribe in volume to wireless personal communications services.

Projections for wireless personal communications in more advanced markets suggest that 30-40% of consumers and 30-50% of business users may subscribe to mobile personal communications by the year 2010.

As a result, there could be a diversion of revenue from the fixed network operators, if they do not adopt a strategy allowing them to evolve into personal communications services providers - and are allowed to do so.

The challenge for the traditional fixed network operators during this time frame will be to ensure their active participation in the overall growth of the personal communications market and in related markets, as they develop.

4.5 Development of mobility in the fixed network: personal numbering in the intelligent network environment

A range of services and equipment have been developed which assist mobility on the fixed network:

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22 Mercury Communications has also announced its intention to provide local access to its fixed network using radio technology.

- 'supplementary' services such as call forwarding and diversion have long been available in private networks. These are now becoming available on the PSTN/ISDN, however, the number of subscribers who have access to or use them is currently limited[23];

- cordless technology offers freedom of communication without physical connection to the network, within range of home;

- services such as card-based rebilling and telepoint add convenience to making calls from different locations;

- voice messaging services and terminal equipment such as answering and facsimile machines allow messages to be received whilst away from the normal location;

- a limited number of services employing the concept of a personal number also exist, but have to-date attracted few users. Such services are currently based on proprietary pre-intelligent network functionality deployed on a service-specific basis.

The future provision of services under a full-scale universal personal telecommunications (UPT) concept[24] is generally seen to require full intelligent network (IN) functionality. IN will provide a cost-efficient platform for developing a range of advanced services. Its introduction will depend on rapid progress in the deployment of digitalization into the fixed network.

Key aspects of UPT are:

- The personal number, for receiving calls at different fixed-network locations and for billing of calls made. Potentially, the personal number could be held by an individual for life;

- The bringing together under a single umbrella of various other services linked to the 'personalisation' of telecommunications, e.g. flexible routing and billing services;

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23 The proposed directive on the application of ONP to voice-telephony foresees provision of a number of these functions. See Common Position of 1 July 1993.

24 Universal Personal Telecommunication (UPT) implies that a user can be identified regardless of location of equipment used, on the basis of a unique "Personal Number", allowing a subscriber to make and receive calls at any terminal.

It therefore allows a user to access telecommunications services on any terminal connected to the fixed or other network(s) on the basis of a personal telecommunications identifier. The extent to which the network is able to provide those services is delineated in the user's service profile. In this sense, personal mobility is provided for in the network's capability to locate the terminal associated with the user for the purposes of addressing, routing, and charging of the user's calls, independent of the user's location.

- User control. It is intended that UPT subscribers should be able to select services and options to suit individual requirements, for example, controlling the routing of calls by time of day and selectively accepting calls.

UPT may turn out to be essential for the fixed network to attract users in response to the growing challenge from mobile communications. In basic form - combining a personal number with basic fixed telephone service - UPT could offer a low-mobility, low-cost alternative to mobile telephony. Higher-value options could involve increasing the range of features offered.

At present, however, it is too early to say how the market will react to UPT. Currently, activity in this area is driven by suppliers, and the perceived need from users has still not developed.

It is clear that the need to ensure user-friendliness will be critical. Future approaches for UPT are likely to be modelled on the use of SIM-cards as for GSM, whereby the user simply inserts the card with pre-configured service and identification details into a terminal and enters a PIN code. Much of the development for GSM could potentially be reused in the fixed network.

4.6 The convergence of mobility in the fixed and mobile networks: personal communications as a global service offering, and the role of service providers

The rapid introduction of digital mobile systems and the development of the mobility concept in the fixed network will lead to the convergence of mobile and intelligent networks leading to personal communications services as a global service offering[25].

With regard to the voice telephony service, which will continue to be the main requirement of personal communications users of all types, suppliers in Europe are aiming at a range of solutions increasing consumer mobility across the different user environments:

- Development of personal numbering services on the fixed network. This will, as its major benefit, facilitate increased contactability at potentially any location where the user is likely to be stationed for any length of time.

- Roll-out of micro-cellular networks coupled with marketing initiatives to target consumers. The cellular approach aims to produce a single solution to personal communications, allowing users to make or receive calls at most locations (e.g. via roaming), using a single personal communicator.

- Introduction of cordless PABXs, driven by manufacturers, which will facilitate mobility around business premises and is likely to generate requirements for roaming between sites.

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25 See also "Review of the Requirements for the future harmonization of regulatory policy regarding mobile communications services", report by ECTRA Mobile Project Team, European Committee for Telecommunications Regulatory Affairs, October 1993.

This may stimulate the potentially large but currently unsatisfied European consumer market for low-cost cordless telephones. Home and office cordless use may stoke demand for telepoint-type services in key locations such as town centres and transport hubs.

- Introduction of mobile systems (both terrestrial and satellite-based) to extend access to communications to aeroplanes, high speed trains, ships etc.

- Promotion of small wireless personal communications devices for business and work applications, such as personal digital assistants and handheld personal terminals, permitting in particular wireless data transmission and remote database access.

  The emerging personal communicators will create radios new requirements, initially for electronic mail and facsimile but likely to develop with the broadband multimedia market.

It is likely that some combination or convergence of services offered via these approaches may occur in order to exploit all the market opportunities which exist for personal communications:

- At the level of service provision, an opportunity would exist to offer service and tariff packages based on the combined use of network- and facilities-based services from different suppliers, together with the necessary terminals, numbers, cards etc, providing sufficient flexibility is offered to service providers.

  In an increasingly complex networking environment, integrated service providers could have a valuable role advising on and tailoring packages to suit different requirements.

- At the user level, possibilities to converge and simplify the use of personal communications across different platforms could include:

  - The ability to employ the same personal number across different types of network and service (which is part of the full vision of UPT);

  - A single smartcard, which could be inserted into different terminals, whether they be fixed, cordless or mobile, to access services offered over different systems in a uniform and simple way;

  - Dual- or multi-mode 'personal communicators' which would support access to different networks.

    Examples of dual-mode terminals already exist, for example cordless/paging for telepoint applications and analogue/digital cellular terminals. Further possibilities are DECT/GSM, DECT/DCS1800, GSM/DCS1800, GSM/satellite(LEO), DCS1800/North American PCS. Such terminals are technically feasible, but would, at least initially, be likely to cost 10-40% more than single-mode terminals for

either system, and be of greater size and weight. The user would have to perceive clear overall benefits to offset these disadvantages.

Requirements to support very high traffic densities in areas such as office centres or airport terminals, which DECT is best placed to accommodate, may give rise to technological motives for dual-mode terminals.

- Convergence will also occur at the network level. The boundaries between fixed and wireless networks are already being blurred by the provision of 'fixed' access via radio, and the use of cordless for office, home and telepoint applications.

  There are no technological reasons why current fixed and mobile networks could not in future support common types of access, capabilities and services, obviating technical or user distinction between them - once providers are allowed to combine the provision of services via the fixed and mobile networks.

  The ability to use a personal number and a single smartcard across different networks in fact implies that different networks should employ common intelligent capabilities. DECT in particular may offer possibilities as a standard means of access to a range of networks and systems (including those on aircraft, high speed trains, ships etc).

  UMTS portends comprehensive integration at the network level in order to provide support to the delivery of personal communications in most economic way.

4.7 The future personal communications environment, the role of the Universal Mobile Telecommunications System, satellite based systems and the intelligent network

Movement towards the personal communications environment is being driven by a combination of technological, market and regulatory factors:

- The new opportunities made evident by technological advances, particularly in the mobile area and the resulting rapid price decreases for digital mobile equipment[26];

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26 According to the studies carried out, it appears that the development towards mass-market use of mobile communications and the evolution towards mass-distributed personal communication services will accelerate substantially once terminal handset prices fall below 250 ECUs.

While recommended digital handset retail prices are still, in general, a factor of 2 to 3 times higher, rapid price decreases are already apparent and these will accelerate the development towards personal communications.

In some instances, service providers even now offer price packages which seem to reach the above-mentioned critical price level.

- A number of basic socio-economic trends in the European economy and society require improved mobility.

  This concerns in particular, the globalization of companies and business activity ; growth towards full-service economies ; higher levels of education, job enrichment and growing complexity of the work environment requiring enhanced information exchange between people ; growing number of single person households and a decrease in the size of families leading to more social contact outside, and growing numbers of elderly people requiring easier access to communications[27].

  These trends lead to predictions for a three to four-fold increase in the number of wireless terminals in use by the year 2000 compared to today.

- The need for major players to reassess competitive strategies in the light of continuing liberalisation and greater competition both within and across the fixed and mobile areas, particularly in the light of the liberalization of public voice telephony by 1st January 1998 according to Council Resolution 93/C213/01[28].

The number and range of players who appear likely to make the delivery of some form of personal communications services a central part of their future planning indicates that personal communications will be one of the main investment drivers in telecommunications over the next 15 years. Projected cumulative investment in mobile communications infrastructure alone ranges from 27 to 45 billion ECU up to the year 2000, representing between 7 and 13 % of total telecommunications investment.

Much of this investment will need to be directed to the building of a strong intelligent networking base necessary to provide mobility functions, personal numbering, billing, individual service tailoring and other enhanced services.

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27 See in particular EUTELIS "Scenario Mobile Communications 2010 - Study on forecast developments and future trends in technical developments and commercial provisions up to the year 2010, October 1993".

28 With additional transition periods of up to five years for Spain, Ireland , Greece and Portugal and, where justifiied, two years for Luxembourg.

It is likely that the development of personal communications in Europe up to 2000 or beyond will be characterised at the network level by a broad diversity of networks and systems supporting a range of service capabilities, including:

- GSM, DCS 1800 (PCN) networks
- Cordless, Telepoint (DECT, other CT)
- Satellite personal communications systems (including LEOs)
- Intelligent fixed networks
- Fixed/wireless loop access
- Paging (ERMES),
- TFTS,
- private mobile radio, such as TETRA

Competition between operators of public networks and systems will be a key feature of the future environment. Today, this largely exists between operators of similar systems; functionally different systems tend to be aimed at different market segments, offering services which are distinct in application and cost. There will in future, however, be much closer competition across the above areas as system functionalities are expanded and costs reduce.

An important question concerning longer-term network development for personal communications relates to the linkage between strategies based on incremental development of current 2nd-generation technologies to support personal communications services (which is likely to produce partial integration of services and systems) and strategies for introduction of the 3rd-generation UMTS to support personal communications, fully integrated at the network and system level.

The balance of these strategies will be determined in the main by commercial evaluation and regulatory influences. Technical factors which could influence decisions are the ability of evolving 2nd generation systems to achieve the necessary radio capacities and transaction processing throughput to meet continuing demand.

However, personal communications are likely to be, at least initially, more of a marketing concept, linked more to the services that will be offered, than to a technical definition of networks and technologies. Significant effort must however be put into allowing service provision and combination of services to evolve freely to ensure success.

As there is unlikely to be a single user profile against which suppliers can build personal communications products and services, it will be essential to adopt structures which provide the freedom of operation to identify and respond effectively to the service needs of the different customer groupings - made up of both individuals and organisations - who will define the various personal communications market segments.

Free entry into the provision/retailing of mobile communications services, allowing service providers commercial autonomy to trade throughout the Union, would be an essential step in this direction. The earlier provision of benefits resulting from more rapid take-up of mobile services would be transferred across Europe, significantly

assisting with pan-European service goals and wider economic and social development in Europe. Such service providers, independent or integrated into network operations, with the necessary safeguards, would, for example, be able to assist with roaming facilities for business and leisure travel abroad.

A major consequence of an open environment for service provision both via mobile and fixed networks could be the emergence of new telecommunications players to exploit the opportunities of personal communications and synergies with activities in other sectors such as the media, travel and automotive industries. As a result, diverse methods of retailing and distribution of personal communications services and products could be expected to be introduced.

The appearance of integrated service providers who could provide tailored service packages based on voice telephony offerings from both fixed and mobile network operators, would serve to a significant extent to bring about a convergence of personal communications services over the range of different networking platforms. Integrated service provision could be fully enabled from 1998 onwards, according to the schedule for liberalisation of public voice telephony service set out by the Council in July 1993.

The full benefits of convergence are, however, only likely to be felt by users once they can conveniently access personal communications services offered over fixed and mobile networks, via both wireline and wireless access in both public and private domains. The ability to employ a single personal number and maintain a service profile across environments will be core aspects of this. In this respect, smartcards and multi-mode 'personal communicators' may well turn out to be key elements of future development.

The availability of such capabilities will depend heavily on access to intelligent functionality and sharing of information across different networking environments. The development of shared intelligence therefore stands out as the major networking requirement of the integrated personal communications environment.

5. CONCLUSIONS

A wide range of services and systems have been developed in response to different market requirements

European industry has developed a wide range of leading digital mobile systems, such as in cellular, paging, PMR and dedicated mobile data systems aimed at different market segments, offering advanced services and significant market potential.

In each of these areas, second-generation digital technology is now or will shortly be available representing a major advance on first-generation analogue systems, in terms of improved cost and performance as well as greater capacity and new functionality.

Mobile growth rates are the highest across the telecommunications sector

The new digital mobile systems - and particularly Europe's flagship, GSM, - offer still higher growth potential. Mobile communications is the fastest growing area of telecommunications. The total user base for the three most established mobile services, which are still based on analogue systems grew by over 20% in 1991. Cellular growth consistently exceeds expectations, and it now accounts for greater than 50% of the total mobile user base, with recent months producing record levels of new subscriptions.

Currently, the European marketplace is still dominated by the installed base of analogue subscribers; however, following the widespread deployment of digital systems, new growth will be based on digital systems.

With 95% of cellular mobile traffic currently to and from PSTN subscribers, the growth in mobile communications also generates substantial revenue and growth for fixed network operators.

Mobile has set the pace for innovation

A strong record of technological innovation is evidenced by European leadership in the development of 2nd-generation European digital systems, in particular, the Global System for Mobile communications (GSM) and the development of micro-cellular systems such as DCS-1800, as well as cordless and public access technologies such as DECT - all of them likely to be major components of the wireless part of future personal communications. The development of mobile hand-held terminals continues to lead to substantial price decreases and is breaking new ground in light-weight design.

Innovation has also been a strong feature of the marketing of mobile services:

- traditional market structures have been adapted through the distinction of wholesale network supply and service/retail businesses and new methods of sales and distribution. This is opening the way for the development of a substantially more dynamic distribution structure.

- a high degree of market orientation is becoming a feature of strategies for targeting both business and consumer markets, leading to a range of differentiated tariff and service packages, with price decreases rapidly approaching general consumer levels;

- mobile is leading the way towards combined offering of services, for example telepoint plus paging and use of enhanced services such as voicemail and calling line identity;

- mobile technologies are generating new possibilities for Europe-wide services, such as SIM-card based service provision.

Mobile communications is playing a key role in enabling economic and social development

Efficient communications are crucial to the well being of Europe's citizens. Wireless communications is playing an increasingly important role in supporting basic socio-economic trends in both the economy and society, which require improved mobility.

This concerns in particular globalization of companies and business activity ; growth towards full-service economies ; higher levels of education, job enrichment and growing complexity of the work environment requiring enhanced information exchange between people ; growing number of single person households and a decrease in the size of families leading to more social contact outside, and growing numbers of elderly people requiring easier access to communications.

It is also playing an increasingly important role as a means of stimulating investment into public telecommunications services and in contributing to universal access in outlying and less developed areas.

Introduction of pan-European mobile systems and services is progressing but major problems have been encountered.

Development and introduction of pan-European mobile systems and services is progressing strongly, in particular with GSM as the leading technology. However there have been delays in availability due to a number of problems.

Major problems have affected the implementation of pan-European type approval, implementation of pan-European roaming, and the implementation of pan-European service features.

The timely availability of stable technical specifications and CTRs for type-approval, and efficient and timely administrative mechanisms for coordinating frequencies and type approval are essential.

The strategy with regard to introduction of DCS 1800 remains fragmented.

DCS 1800 will become a major base technology for micro-cellular systems and therefore for the wireless part of personal communications services.

So far, decisions to implement DCS 1800 networks have been taken in only four Member States. At present, availability of frequencies for such services is not being effectively coordinated. The situation with regard to DCS 1800 is thus extremely fragmented and represents a major risk with regard to European market expansion in the base technology for personal communications.

The major challenge now is to open development for combined service offerings across the range of different technologies and across the Community.

Within the mobile area, a variety of networks and services are growing in an uncoordinated way. The structures introduced for development of mobile communications in Member States have promoted a separation of the supply of different mobile services, and this has tended to impede the exploitation of synergies between different services for those users who would benefit from their combined use - a major pre-condition for personal communications services.

There is therefore a need to remove structural impediments within the mobile area in order to allow the full market opportunities for combined offering of services to be realised.

Furthermore, services are beginning to be offered in similar ways on both fixed and mobile networks. The activities of mobile service providers shows similarities with calling card service providers in the fixed area; both are recruiting, managing and billing subscribers and are entering into wholesale/retail-type arrangements with network operators.

Full freedom for convergence to occur at the service provision and user levels will provide for greater innovation, and will allow the full range of market opportunities for personal communications to be exploited.

Flexibility of entry for both fixed and mobile operators required.

Once the provision of public voice service via the fixed network is fully liberalized in line with the time schedule agreed by Council, it is essential that future-oriented policies do not maintain artificial barriers which might otherwise be broken down by market and technology developments.

Flexibility of entry across the range of fixed and mobile operations is now required to fully realise the potential of personal communications.

High mobility, low mobility and fixed services are likely to play complementary roles.

Different market needs can be served with different services at different costs. Market segmentation will be the key to fully exploiting the potential of personal communications, and therefore it is essential that freedom exists to adjust to the requirements of different customer groups who define the various market segments.

The overall challenge is the development towards the personal communications environment.

Telecommunication users will increasingly require mobility and person-to-person calling instead of terminal-to-terminal calling, i.e. full scale personal communications including personal numbering. Users will not be concerned with the supporting technology but with the services offered and parameters such as price, availability, reliability, quality and ease of use. In order to allow these requirements to be met, the right regulatory conditions must be established. These must be based on increasing flexibility, the freedom to optimize system and service operations, and must allow for market operations.

Towards the Personal Communications Environment:

Green Paper on a common approach in the field of mobile and personal communications in the European Union

ANNEX B

ANALYSIS OF THE ENVIRONMENT IN EUROPE FOR FUTURE DEVELOPMENT

TABLE OF CONTENTS

ANALYSIS OF THE ENVIRONMENT IN EUROPE FOR FUTURE DEVELOPMENT

1. CURRENT REGULATORY STRUCTURE

1.1 Basic regulatory structure

In most Member States, Telecommunication Organisations were during the 1980s given an automatic and mostly exclusive right to provide mobile services (paging and analogue cellular telephony). The introduction of new technologies, together with in some cases the limited success of the monopoly provision of services, has since led Member States to reassess their basic approach and to move towards substantial competitive provision[1]. This reflects the general trend, pushed by a combination of technological advances, market demand and regulatory changes[2], towards more liberalised telecommunications services on both a global and European level[3].

Exhibit B1 summarises the situation regarding licences currently allocated or planned in the European Union for the main areas of mobile communications.

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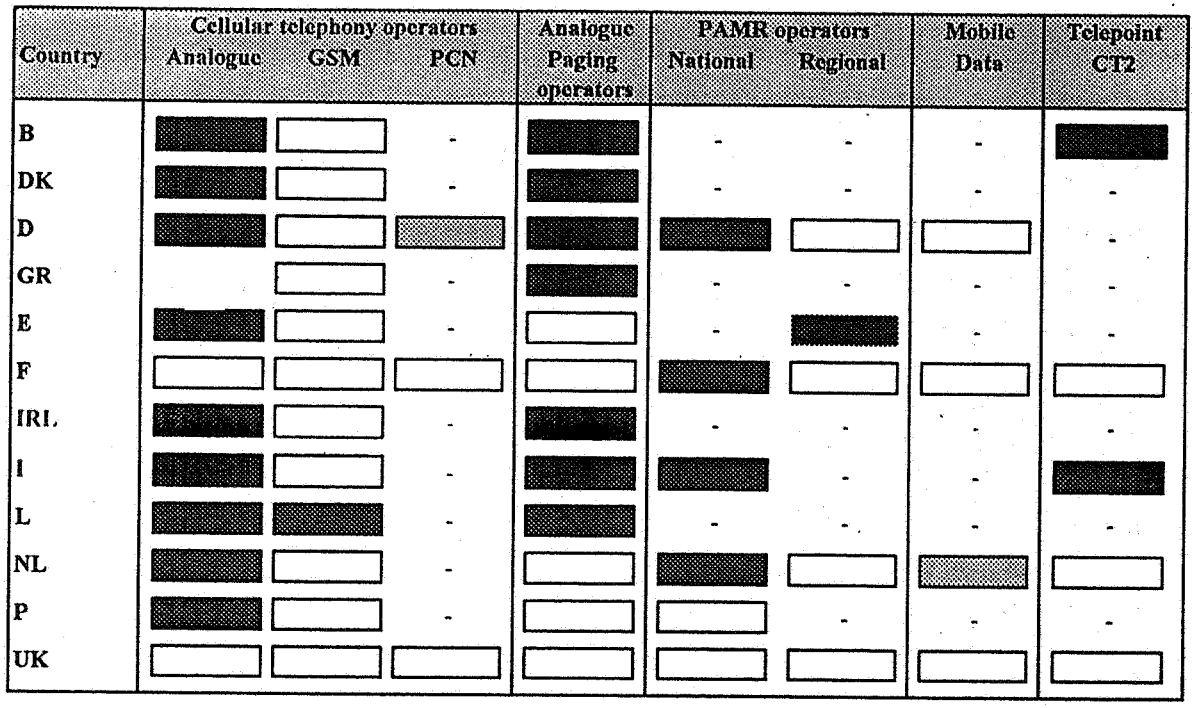
1 Analogue mobile telephony services are competitively provided only in France and the United Kingdom, whilst GSM, is generally emerging on the basis of a duopoly.

2 The mobile field was specifically set aside by the Commission's 1987 Green Paper on Telecommunications, COM(87)290 final, 30.06.87 for special consideration. Member States have, however, interpreted the liberalisation trends set in the 1987 Green Paper in developing national policy for mobile communications

3 For details on the regulatory situation in the Community, see in particular "Licensing and declaration procedures for mobile communications in Member States of the European Community", Report to the Commission of the European Communities prepared by Stanbrook & Hooper and KPMG Peat Marwick, August 1993

Exhibit B1 : Licences allocated or planned for European mobile communications



Key:

- Single licence allocated to incumbent Telecommunications Organization (TO).
- Single licence allocated, or planned, to organization other than the national TO.
- More than one licence allocated, or planned.
- No licences allocated or information not available.

Note: The table does not include licences awarded or planned for the digital paging system ERMES by a number of Member States.

Source: CEC Studies

A number of current general characteristics of the Union's mobile markets can be identified:

- Member States have traditionally taken a technology, rather than a service-based approach, with each new technology being seen as a separate market and being subject to separate licensing procedures (paging, cellular etc.). Separate licensing often prevents operators from offering different mobile services, despite the economies of scale or scope that could be achieved.

- In granting licences, preference has often been given to the existing TO, though in certain cases with a requirement for it to provide its services through a structurally separate subsidiary.

- Only the provision of mobile terminal equipment, following the 1988 Terminal Equipment Directive[4], is fully open to competitive provision in all Member States.

- In many cases restrictions on mobile network operators still oblige them to lease fixed link infrastructure from TOs rather than allow them to self-provide infrastructure where this would be economically attractive.

- Mobile services in the Community are provided on a regional or national basis. There are no pan-European mobile operators and hardly any pan-European service providers.

- Where new technologies (e.g. GSM) permit pan-European roaming this occurs mostly on the basis of one stop shopping and billing service arrangements between existing national operators. Services are provided over national rather than pan-European infrastructure, with much of the call being routed over the fixed networks of the TOs.

1.2 Relationships between market participants

The reference model depicted in **Exhibit B2** highlights the main commercial relationships between the organisations involved in providing mobile services. This model is generically applicable to all types of mobile market irrespective of variations in competitive structure between countries, or of differences between mobile services.

Each link shows a commercial relationship between two players which might require physical interconnection of networks, the linking of other facilities (e.g. for transferring call records), or the supply of infrastructure or other services.

Two or more of these roles may be integrated within a single organisation which, in some instances, also possesses fixed voice telephony and infrastructure rights. Fixed and mobile networks may be run by different business units in the same organisation, but this is not always the case. Similarly, the roles of mobile network operator and service provider (which recruits and manages the subscriber base) are often performed by the same organisation, which might be a business unit within a TO, or an independent mobile operator.

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4 88/301/EEC, OJ L131, 27.05.88, p 73

Where one part of an integrated organisation operates under special or exclusive rights whilst providing network access or other services to another part of the same company which is facing competition from newly-licensed operators or service providers, these independent players may require the same range of access arrangements or services in order to be competitive.

Requirements for open, efficient and fair access are therefore potentially applicable to any of the commercial relationships shown in Exhibit B2 in which competing organisations rely for all or part of their service on facilities provided by another market participant with special or exclusive rights or with a strong market position.

1.3 Public mobile communications

Analogue cellular

There are competing analogue cellular telephony operators only in the United Kingdom and France. In the rest of the Community analogue cellular mobile services are provided by the existing TO, generally on the basis of their statutory monopolies with relatively few specific conditions imposed upon them. Formal licensing was not carried out.

In the UK and France, competition with the TO has been limited to a single private sector operator responding to a tendering procedure. In the UK BT was required to enter the mobile market only by means of an arms length subsidiary, Cellnet, which was established with a major private sector shareholder.

In the United Kingdom, a wholesale/retail arrangement was introduced by expressly prohibiting analogue cellular network operators from selling services or equipment directly to users. Instead, mobile service providers were introduced who would purchase airtime from the cellular network operators at wholesale rates for resale to individual subscribers. Restrictions on direct sales have subsequently been removed through licence modifications with effect from January 1994.

GSM (Global System for Mobile communications)

In contrast to analogue cellular, current planning for commercial development of cellular communications in 11 Member States supports two GSM operators (see Exhibit B1).

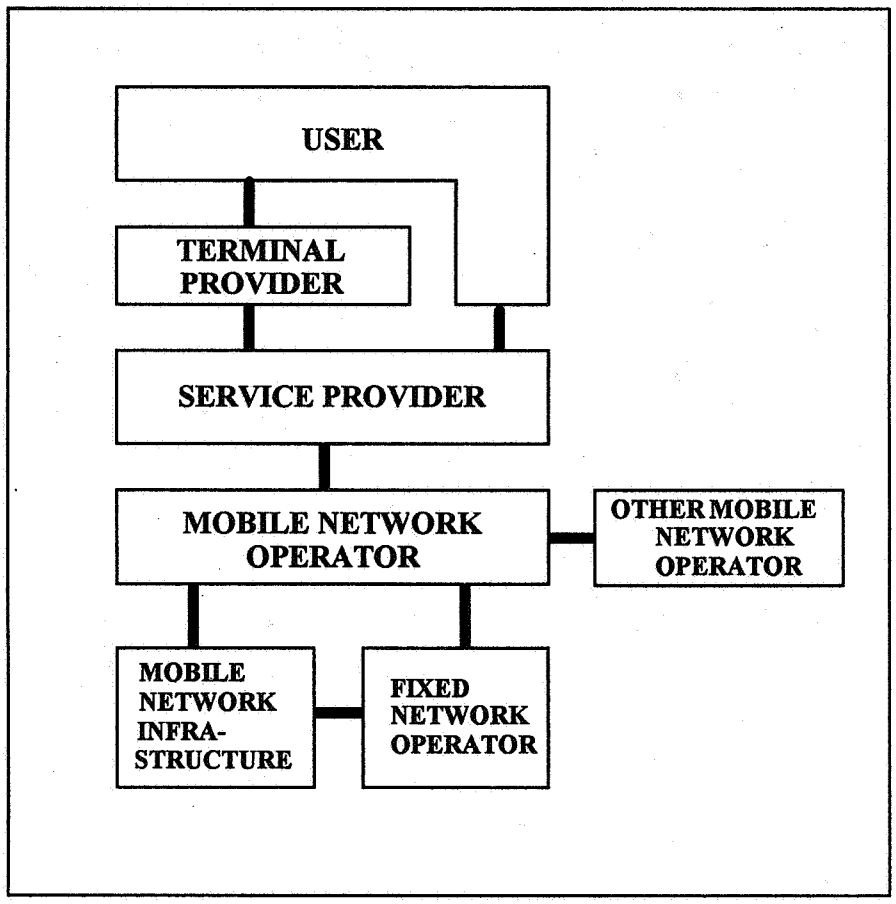
A public/private duopoly (with the private operator selected by tender) has been established or is foreseen in the majority of these Member States[5], with a private-private duopoly the chosen structure in Greece.

DCS-1800 (PCN - Personal Communications Networks).

DCS-1800/PCN services, at 1800 MHz, have been licensed in the UK and Germany in competition to the existing GSM operators. Foreseeing that DCS-1800/PCN micro-cellular architectures would lead to increased infrastructure costs, with the need for greater expenditure on leased line connections, the UK

5 In the United Kingdom and France, the private sector GSM licence has been granted to the existing analogue mobile operators, who were originally chosen by tender.

EXHIBIT B2 - Regulatory reference model of relationships between mobile functions



Two or more of these functions may be combined in one single organisation e.g. mobile radio infrastructure and, in a number of cases, transmitting infrastructure for linking radio base stations and switching centres. Mobile operators also include in many cases, service provision (direct service provision). Service providers have a close relationship in many cases with terminal providers (retailers).

has permitted the PCN licensees to provide their own fixed links between base stations and local switches. An equivalent freedom was given to all cellular operators from January 1994.

In the UK three licences were originally granted by public tender, however, two licence holders - Mercury PCN and Unitel have since merged their activities. Mercury's 'One to One' service was launched commercially in September 1993.

Germany has licensed the E1 network and services are expected to be launched in Berlin and Leipzig early in 1994. France has announced definite plans to licence DCS-1800 operation. Spain and the Netherlands are currently considering this.

Telepoint services

Pilot or commercial telepoint public access services, based on CT2 technologies, have been authorised on a limited basis in a certain number of countries. Success has been limited, and commercial service is currently available only in France ('Bi-bop') and the Netherlands ('GreenPoint').

France and the Netherlands have both recently decided to support expansion of telepoint. France has granted a licence to Compagnie Générale des Eaux for a trial DECT-based telepoint service. The Netherlands has decided on complete deregulation.

Wide area paging

Paging services remain the most important non-voice mobile service market. Analogue paging is competitively provided in five Member States - France, Portugal, Spain, the UK and the Netherlands.

In Germany a number of TO-run systems are in operation, whilst in Belgium, Denmark, Greece, Italy and Luxembourg, there is a single TO run paging system. In Ireland, Telecom Eireann and Motorola provide services through a joint venture, Eirpage.

Analogue services are generally provided on a national basis, though a number of operators have established standards allowing national paging to be extended to other Member States.

The prospect of comprehensive pan-European paging is being realised by the development of digital paging systems based on the ERMES service standard. A number of Member States[6] have either allocated or indicated an intention to allocate ERMES licences.

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6 For example, France has announced the allocation of three operating licenses based on the ERMES standard to Omnicom, France Telecom and Cofira.

The lower profile of paging compared to mobile telephony is reflected in licensing being generally less politically sensitive, detailed or restrictive than for cellular telephony[7].

Public Access Mobile Radio

PAMR is a relatively new service in the European Union. The tendency so far is to grant licences to a single national operator[8] and several regional operators. It is provided competitively at a regional level only in France, Germany, the Netherlands and the United Kingdom. Germany is expected to grant a further national licence in the near future.

The two main barriers to the development of such services appear to be the general prohibition on interconnection to the fixed network and customer resistance to sharing a network. Closed user groups and corporate users prefer to retain control of their own PMR service.

In 1992 the UK lifted restrictions previously placed on PAMR licensees preventing them from selling services directly to the public.

1.4 Private mobile communications

PMR is a developed and uncontroversial market in all Member States. Licences tend to be granted on a routine basis, with limitations on numbers imposed on the basis of spectrum availability. Services are generally of a local character. Licence restrictions generally relate to prohibition on the provision of services to third parties and prohibition on interconnection with the fixed public network.

2. LICENCES AND TYPE APPROVAL

2.1 Overview of licensing in the European Union

According to the studies carried out[9], there is considerable variation within the Community and between services in the procedures used for awarding licences, including:

- automatic grant of a licence to the TO with no competitive provider, through national legislation reserving to it provision of mobile services.
- the automatic grant of a licence to the TO, with complex tendering procedures for the second operator (e.g. GSM in Germany and Denmark)

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7 However, some problems have emerged with regard to licensing of ERMES-based systems in Germany and the UK, due to problems of freeing the foreseen frequencies or questions about frequency interference (see Annex A).

8 In the United Kingdom two national licences were originally granted, but the licence-holders have subsequently merged their activities.

9 See in particular study by Stanbrook & Hooper and KPMG Peat Marwick, cited previously.

- less formal application procedures, leaving the initiative to the applicant in structuring its bid (e.g. DCS-1800/PCN in the UK)

- pre-qualification i.e. exclusion of bids from existing operator (e.g. BT and cellular operators excluded from bidding for a DCS-1800/PCN licence in UK; BT could only bid for a cellular licence in a consortium; German GSM operators excluded from PCN tender).

- the use of an auction for GSM in Greece

- award on 'first come, first served' basis with few formal requirements (regional PAMR licences in Germany;)

- routine declaration procedures for PMR in most Member States.

A particular feature of the award process has been the tendency even when creating a competitive market structure to favour the TO over any new entrant. This manifests itself, for example, in the automatic grant of a licence to a TO without a tendering procedure or the ability to operate a mobile service without a formal licence, and so potentially without strict regulatory control.

Whilst the variety of procedures may according to the studies, be seen by some bidders as a deterrent to market entry, concern has focused on those elements of award procedures which reflect their discretionary nature:

- a lack of openness in the bidding process

- uncertain and unpublished assessment criteria

- few rights of appeal

The main areas of distortion flowing from the variety of licensing conditions can be summarised as follows:

- more favourable terms for the TO

- use of fixed infrastructure and interconnection terms

- scope of licensed services

- licence duration

- terms for retail service provision

2.2 The major criteria applied in existing licences

Whilst licensing regimes vary from Member State to Member State and from service to service, it is possible to find a range of elements which are commonly addressed in the licensing of mobile services, and of cellular mobile telephony, in particular.

Geographical scope/quality conditions

Most licences impose a variety of quality requirements, often linked to agreed industry or European standards, such as the recommendations on GSM. Other specific conditions may relate to service quality, such as call drop-out rates, or geographical coverage linked to a specified timetable. Such linkage will often form the basis of decisions to release further frequency allocations and form possible grounds for revocation of the licence in question.

In practice, whilst roll out requirements might appear to place very significant burdens on mobile operators, such targets have often been reached ahead of schedule. This is particularly so, within competitive markets, where the extent of geographic coverage is often a key feature for the selection of one operator over another.

Fixed infrastructure use and interconnection with the PSTN

The right to self-provide infrastructure and the terms of interconnection with the TO constitute two of the key determinants in the success of a mobile operation. Interconnection and leased line charges are estimated to account for between 30-50% of mobile network operator revenues in competitive markets.

Generally, Member States require mobile services to use TO leased line capacity in order to meet the majority of their infrastructure requirements, with microwave links or provision of own fixed infrastructure being possible only in a number of Member States and in limited cases, such as between base stations and mobile system controllers for GSM. (A similar possibility has been incorporated into the DCS-1800/PCN licences).

Interconnection with the PSTN is usually prohibited or very limited in the case of paging, public access mobile radio and private mobile radio systems. In the case of cellular telephony, whilst interconnection is permitted, the mobile operator often has little choice as to where such interconnection is effected.

Limitations are also normally applied to prevent interconnection of mobile operators to other mobile operators, or to prevent cross-border connections into the fixed network in another Member State.

Interconnection is usually a matter for commercial agreement between the parties, subject to regulatory intervention in the event of the parties failing to reach agreement.

Licence fees and frequency fees

Fees vary considerably, reflecting in certain cases simply the administrative costs involved in processing an application, and in others the perceived market value of the service concerned. In general fees for paging systems and for PAMR and private mobile radio are substantially less than licences for national cellular telephony services.

The impact of licence fees may vary between the public and private sector, with private sector operators subject to short term pressures for return on investment, which mean that high entry fees can represent a significant barrier to market entry.

However, to the extent that each Member State is selling off valuable frequency spectrum which is a finite national resource, it is arguable that placing a commercial value of the frequency available will lead to the use of frequencies for those purposes for which there is greatest user demand. It would also be consistent with environmental policy, particularly the concept of "the polluter pays'", not merely in placing a price on the environmental impact of new radio-based services, but also in establishing awareness that the frequency spectrum is a limited resource and promote its more efficient use.

Scope of licences

Member State approaches to the scope of mobile licences vary. An initial concern are potential variations between private and public sector mobile operators[10], as to the services which each may offer. Additionally, restrictions have been placed in certain Member States on the scope of mobile operators' activities, motivated in part by a wish to ensure the emergence of strong competition at a service level, which however, have the effect of limiting the efficiency with which the mobile operator can provide its services.[11]

Licence duration

Licence duration varies both from country to country and from service to service, as Member States have attempted to balance the need for a stable regulatory environment encouraging long-term investment, with the needs to meet user demand and promote effective service delivery and efficient use of the frequency spectrum.

Many of the analogue mobile telephony systems were not subject to formal licensing procedures. GSM licences vary in duration from 5 years (renewable) in Denmark to 25 years in the United Kingdom.

Analogue paging licences vary from a minimum of 10 years to a maximum of 30 years (both found in Spain),

PAMR licences vary depending on whether it is for a national or regional service. In the UK the national licence is valid for 25 years, whilst regional licences are generally for an initial 6 month period. In Spain licences vary between 10 and 30 years, whilst in many other countries, PMR licences are granted on a yearly renewable basis.

An additional factor is that licences do not necessarily start at the same time, which allows the TO considerable lead time in which to establish itself in the market.

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10 In Germany, D2 is obliged to use the GSM standard, preventing it from adapting its service, for example, to incorporate the DECT interfaces, whilst D1 does not face any similar restriction., making its GSM investment more profitable.

11 In the UK, analogue and GSM operators were initially prevented from providing service except through an arm's length subsidiary. The UK refrained from imposing a similar condition when licensing DCS-1800/PCN services, though conditions to ensure no discrimination vis-à-vis third party service providers were included in the licence conditions. The restriction on GSM operators was lifted from 1 January 1994, reflecting the relatively mature development of the cellular market in the United Kingdom. In Germany D2 may not provide the full range of GSM services, as agreed in the Memorandum of Understanding establishing the GSM standard, (for example, D2 cannot provide short messaging services).

Changes in ownership

Some licences contain restrictions on changes of ownership without the approval of the licensing authority (or at least make such changes grounds for the revocation of such licences). The limits are often linked to the acquisition of share holdings of 25% or more, as that gives specific voting rights under the company law of most Member States.

Such restrictions may limit the ability of mobile operators to attract outside capital and expertise, but also act as a brake on the creation of a market for mobile operating licenses.

2.3 Type approval, interim type approval and mutual recognition of type approval

Prior to the full application of Council Directive 91/236/EEC[12] due to delays in establishing the required Common Technical Regulations (CTRs), an interim type approval (ITA) scheme was instigated in 1991 to avoid impacting GSM introduction. According to the terms of adoption of the CTRs, the conformance of terminals approved according to the ITA scheme must be ensured before 1995.

On 28 September 1993, the first two CTRs were adopted under the Directive, CTR 05 and CTR 09, relating to type approval of terminals for the pan-European digital cellular system GSM.

2.4 Terminal and subscriber identification, and related databases and arrangements

When a subscriber logs on to a GSM network (by switching on a GSM terminal or inserting a SIM-card), both terminal and user are verified by means of database lookup transactions. This allows verification of whether the terminal is 'black-listed', for example, if stolen, and whether the subscriber is entitled to receive service (particularly to check whether the roaming facility is enabled).

An essential requirement for the effective working of such arrangements is the assignment of unique identifications throughout the area where a terminal or SIM-card can be used.

The information required for checking the terminal Equipment Identification Number (EIN) number and the subscriber profile are held in databases located within the user's 'home' network. Commercial agreements between operators support access to and use of such data by different operators.

The conditions for access to and control of such databases are becoming more and more critical for the future development of the sector.

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12 Council Directive of 29 April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity (91/263/EEC; OJ L128/1, 23.05.91)

3. INTERCONNECTION AND INTEROPERABILITY

3.1 The basic role of interconnection

Interconnection arrangements, which provide new market entrants with access to the subscriber base of established network operators, are one of the most crucial factors governing the growth of competitive services.

Regulation of interconnection arrangements is a key tool for managing the introduction of competition in telecommunications markets. The extent of regulatory involvement varies significantly from country to country, reflecting the underlying attitude towards competition. Some countries have set interconnections terms *a priori*, others have preferred to act as 'referees', only becoming involved if the parties could not agree among themselves.

3.2 Analysis of interface requirements between different operators

Requirements of public mobile telephony operators - Fixed/mobile interconnection

Mobile telephone network operators rely very heavily on the public fixed network infrastructure. In commercial terms, the fees paid by mobile operators for interconnection to the fixed network typically account for 30-50% of their total revenues.

This arises from two main components: Typically 95% of calls on mobile networks originate or terminate on the fixed network in European countries with developed telecommunications infrastructures. The mobile operator has to pay an interconnection fee for the handling of this traffic and conveyance of calls to/from final destinations/origins of the calls via the fixed network.

The second main component is the transmission infrastructure needed by the mobile network operator to connect base stations to mobile switching centres (MSCs) and for the interconnection of MSCs. In most Member States this takes the form of circuits leased from the fixed network operator.

The key issues for a mobile network operator seeking interconnection to the public switched network are in the following areas:

- Number and location of interface points.

  Where a mobile network operator has full territorial coverage, it is in the interests of the mobile network operator to have flexibility in the number and location of points of interconnection to other networks. This allows the mobile operator to choose the optimum (i.e. most profitable) routing for outgoing traffic from his network.

  Normally a mobile network operator would choose to carry traffic on its own network as far as possible, handing it over to the fixed network at a point close to the destination customer. In this way, the mobile operator has the maximum control of its own costs.

- Technical interface characteristics.

  It is important for the efficient operation of the mobile system that the mobile network is connected at a 'trunk' level to the public switched network. Normally this means a non-standard interface specially engineered for the mobile operator. Relevant technical aspects of the interface include:

  - interface specification for physical interconnection
  - transmission and signalling standards to be supported
  - circuit capacity between the networks
  - advanced facilities to be supported (call forwarding, freephone, calling line identification etc.)

  The GSM standard raises some specific technical issues with regard, in particular, to signalling standards.

- Management and administrative links. The mobile network operator needs access to the management and administrative systems of the fixed network operator for billing, maintenance, directory services etc.

- Supply and usage conditions. Mutually agreed supply and usage conditions need to cover such matters as provisioning times for interconnect circuits; quality-of-service targets; contingency procedures; procedures for interworking; routing principles; duration of agreements; compensation claims;

- Prices, normally include:

  - a one off interconnect payment to cover engineering work
  - recurrent interconnect charges based on the number of interconnect ports used
  - traffic related charges (conveyance of calls), including volume discounts
  - charges for advanced facilities (e.g. freephone or premium rate calls) and for shared facilities (e.g. operator, emergency and directory services)

  Clearly, the absolute level of these charges is of paramount importance for the mobile network operator. There is also a point of principle. Where these charges include a contribution towards the cost of universal service obligations placed on the fixed network operator, such contributions should be transparent, based on objective criteria and be fairly shared by all participants in the market[13].

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13 This is an issue of general concern in the context of interconnection arrangements and access charges. It is to be reviewed by the Commission according to the Council Resolution of 7 February 1994 on the maintenance and development of universal service in a competitive environment in preparation for the general adjustment of

- Numbering. The mobile network operator needs a suitable allocation of number ranges, access codes and service prefixes.

Requirements of Private mobile operators

Private mobile systems are either not connected to the public telecommunications system or else, where they are connected, use standard public network interfaces.

In some cases, minor enhancement of a standard network interface may be desirable, in particular, to allow for the transfer of network management information.

The issue of interconnection with the public fixed network will be become more and more a critical issue for the future development of Private Mobile Radio, in particular future PAMR systems.

Requirements of mobile telephony operators - transmission infrastructure

Mobile network operators need transmission links within the mobile network quite distinct from any interconnection to the public switched network. These are point-to-point links between base stations and mobile switching centres and between MSCs.

In the UK, Germany, the Netherlands and Greece[14], mobile operators have the right to provide their own infrastructure links nationally. In other Member States, mobile operators must use lines leased from the fixed network operator.

Requirements for mobile/mobile network interconnection

Mobile/mobile interconnection covers several different situations:

- Inter-operator roaming between nationally based systems.

  Interconnection between national mobile networks allows users to roam at a national level between operators. The possible benefits for users are improved service, availability and coverage. For new entrants, this may provide a rapid means of becoming established in the market by taking advantage of an existing network. There is the further possibility of gains in spectrum efficiency through sharing of frequency channels

- Direct connection of mobile networks

  Direct interconnection between mobile networks allows the operators to pass mobile-mobile traffic without the cost of interconnect fees for use of the fixed

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regulatory conditions for the full liberalisation of public voice service by 1 January 1998 (with additional transition periods of 5 years for Greece, Spain, Portugal and Ireland and where justified 2 years for Luxembourg). Proposals concerning this adjustment are to be submitted by the Commission by 1 January 1996 (see Council Resolution of 7 February 1994 on universal service, to be published).

14 France has allowed use of own infrastructure by its second public cellular operator from 1 January 1994 onwards.

network. At present it is estimated that mobile to mobile calls do not exceed about 5% of the total traffic, but this is bound to grow.

- Interconnection of dissimilar mobile networks

  The main motivation of this type of service is to improve service availability and to offer new facilities to users. Call diversion from a cellular terminal to a paging service is one example.

  Another reason would be to facilitate the migration of analogue subscribers to GSM. An operator of both analogue and GSM systems will want their two sets of subscribers to be able to communicate.

Increasing user demand for service integration, and the technological convergence between fixed and mobile services, point to a growing need for mobile to mobile interconnection.

The current barriers are:

- *Regulatory.* Some regulatory barriers preventing direct interconnection were put in place to allow new entrants to establish themselves in the market. Once new entrants are established, these barriers should disappear. Others are there to protect the special and exclusive rights of the established fixed network operators.

- *Technical.* Incompatibilities between, for example, the technologies of first generation analogue cellular systems make interconnection technically difficult. Technical difficulties are rarely insurmountable and can be overcome if regulation allows it.

Requirements of mobile service providers

A service provider in this context is the organisation responsible for some or all of the functions of managing the subscriber (including recruitment, registration, billing and accounting, customer support), airtime reselling, providing enhanced services, (both network embedded, for example, CLI - Calling Line Identification and peripheral, for example, voice mailbox), and terminal provision.

The service provider function relies on support from the mobile operator, which could include:

- provision of billing and call accounting information
- provision of details of new services (launch dates, tariffs etc.)
- allocation of number blocks
- access to network management facilities to check network status in response to customer queries/complaints
- provision of directory services
- access to administrative systems for registration of new customers

- provision of details of defective terminals

The relationship between a service provider and a mobile operator is one of the most important issues for mobile communications, along with the relationship between the mobile network operator and the fixed network operator.

Many of the issues are similar to those at the interface between the fixed and mobile network, and arise from the need to ensure fair competition when a mobile operator is also a service provider in competition with other service providers i.e. non discrimination, equality of access, supply and usage conditions.

It should be noted however that this interface is in most cases an administrative/management interface; it may involve the computer systems of the service provider accessing the computer systems of the mobile operator over a physical link, but it does not generally involve the physical interconnection of networks.

Requirements for other operators

The key interfaces concerning telepoint are the air interface between the terminal and the Telepoint system, and the interface between the Telepoint system and the fixed public network.

The main priority for paging services is a range of fixed network interfaces to allow users to input paging messages in the most convenient and cost effective way (PSTN, leased line, PSDS, mobile etc.). As paging is a unidirectional service, these are basic transmission and signalling interfaces and there is less requirement for links which support billing or network management functions. There is some demand for inter-system roaming, but the need for roaming interfaces is presently still not a priority for paging systems.

3.3 Interoperability, inter-working and roaming

The twin forces of market demand and technological innovation are both pointing towards the same long-term goal - full mobility for the telecommunications user, who will make use of mobile and/or fixed networks as appropriate, and in most cases will be unaware of the underlying network technology. Achieving such interoperability at a European level will be a powerful cohesive influence within the Union.

The European citizen will be able to travel throughout the EU, and by inserting his or her smart card in a fixed or portable telephone will be able to make and receive calls anywhere in the Union.

Two essentials for the rapid deployment of Union-wide services are:

- services providers offering services on a Union-wide basis, building their services upon the mobile networks provided in each Member State

- removal of restrictions on mobile operators to interconnect their networks with each other or with the fixed networks in their own or other Member States

Most mobile services, like their predecessors the fixed network services, grew up as nationally based services. Union-wide operation was either not considered or came

only as an afterthought. In the cellular area, for example, Europe has a variety of first generation analogue cellular systems introduced in the 1980s which are based on incompatible technical standards which prevent interoperability.

Technical compatibility is a necessary but not sufficient condition to allow users to "roam" between networks[15]. Commercial agreements between operators are also required to ensure that users can log on to the service in a country they are visiting, and inter-operator billing system are needed to ensure that visitors are billed to their home account. To allow for transportability of terminal equipment, reciprocal type approval agreements are also necessary.

The current situation regarding European inter-operator roaming agreements for GSM is shown in **Exhibit B3**. This shows that full coverage for pan-European roaming remains to be achieved.

GSM roaming employs a complex numbering and registration scheme which links location management, authentication and billing processes across two or more GSM networks. The roaming procedure includes registration and identification of visiting users; normal calling to and from visiting users, and billing and settlement procedures.

Roaming uses the signalling infrastructure provided by CCITT signalling system no 7 (SS7) - specifically the mobile application part (MAP). MAP in turn requires the Transaction Capabilities Application Part (TCAP) which sits below the multi-layer protocol structure of SS7. If these elements are not provided, mobile signalling information cannot be sent, received or routed and roaming is not possible. Most installed digital switches still do not support TCAP. It is envisaged that TCAP will gradually be deployed across the main trunk and international exchanges of the PSTN/ISDN in Europe, but there are two constraining factors:

- reluctance of TOs to encourage use of their signalling systems by others
- possible charges for signalling traffic.

It is important therefore that to support roaming, GSM operators are able in the short term to provide direct SS7 TCAP signalling links between their networks, since the PSTN/ISDN will not support these transactions. This overlay SS7 network will be needed for some time, and depending on the charges, if any, made by TOs for the use of signalling channels, may remain a permanent feature of GSM interconnection.

GSM was conceived from the start as a pan-European system built to harmonised standards. GSM remains a priority area for Community action in order to stimulate the market for truly trans-European mobile systems.

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15 Roaming agreements between mobile communications networks, besides the provision of technical interconnection facilities and agreements on the exchange, for example, of control and billing data, imply basically a commercial arrangement of service provision via each other's network, or allowing independent service providers to provide for such commercial arrangements.

Exhibit B3 : European inter-operator roaming agreements for GSM services remain patchy (August 1993)

			B	DK		D		GR		E	F		IRL	I	L	NL	P		UK		A	SF		IS	N		S			CH
			Belgacom	Sonofon	TeleDanmark	DeTeMobil D1	Mannesmann D2	Panafon	Stet	Telefonica	Itineris	SFR	Eircell	SIP	P&T	PTT Telecom	TMN	Telecel	Cellnet	Vodafone	PTV	Telecom Finland	Radiolinja	P&T	Telemobil	Netcom	Comvik	Europolitan	Telia Mobitel	PTT
EU	Belgacom	B				X	X								X															
	Sonofon	DK				X	X				X	X	X	X			X	X		X		X	X		X		X	X	X	X
	TeleDanmark					X	X					X		X				X		X		X	X		X		X	X	X	X
	DeTeMobil D1	D	X	X	X									X	X					X		X			X		X		X	X
	Mannesmann D2		X	X	X						X	X		X	X			X		X		X	X		X		X	X	X	X
	Panafon	GR																												
	Stet																													
	Telefonica	E																												
	Itineris	F		X			X							X								X					X	X	X	X
	SFR			X	X		X																X				X	X		X
	Eircell	IRL		X																							X		X	
	SIP	I		X	X	X	X				X									X		X	X		X		X	X	X	X
	P&T	L	X			X	X																							X
	PTT Telecom	NL																												
	TMN	P		X																		X					X	X	X	X
	Telecel			X	X		X															X			X		X	X	X	X
	Cellnet	UK																												
	Vodafone			X	X	X	X							X								X	X		X		X	X	X	X
EFTA	PTV	A																												
	Telecom Finland	SF		X	X	X	X				X			X			X	X		X					X		X	X	X	X
	Radiolinja			X	X		X					X		X						X					X		X	X	X	X
	P&T	IS																												
	Telemobil	N		X	X	X	X							X				X		X		X	X				X	X	X	X
	Netcom																										X			
	Comvik	S		X	X	X	X				X	X	X	X			X	X		X		X	X		X	X				X
	Europolitan			X	X		X				X	X		X			X	X		X		X	X		X					X
	Telia Mobitel			X	X	X	X				X		X	X			X	X		X		X	X		X					X
	PTT	CH		X	X	X	X				X	X		X	X		X	X		X		X	X		X		X	X	X	

Notes: X - Roaming agreement signed at August 1993 and subject to change.
Roaming agreements involving European and non-European operators are not shown.
Central and eastern European GSM licences - e.g in Hungary and Russia - are not yet operational.
This situation is subject to rapid change. Information should be obtained directly from mobile telecommunications operators or service providers.

Spain has indicated its intention to licence two GSM operators.

Source: GSM MoU Permanent Secretariat.

3.4 Pan-European clearing mechanisms

Traditionally, telecommunications accounting has been handled bilaterally between operators, on the basis of accounting conventions drawn up by the ITU.

The increasing number of players in European telecommunications, and the need for accurate billing of 'roaming' customers, will stretch bilateral arrangements to their limits.

For example, a subscriber registered on a mobile service in country A may visit country B and from there may call a premium rate service in country C.

Accounting information must be passed between the networks in counties A, B, and C to ensure that:

- the premium rate service provider in country C receives appropriate payment for the use of its service
- the network operators in countries B and C receive payment for conveyance of the call over their networks
- each of these components is included in the total sum billed to the customer by the network operator in country A, and that adequate details of the call are itemised in the customer's bill.

For complex transactions of this type in a field with many participants, clearing house systems have been found to offer the best solution. Such mechanisms have already demonstrated their effectiveness in other sectors, such as banking.

3.5 The vital interfaces: fixed network/mobile operator and mobile operator/service provider

From the discussion above, two interfaces emerge as vital for the future development of mobile systems:

- the interface between the fixed network and the mobile network
- the interface between the mobile operator and the service provider.

Regulatory principles for these interfaces are necessary for two reasons:

- both are bottle-necks, as service providers will have limited choice of mobile operators from whom to take services, and mobile operators face a limited choice of infrastructure providers/fixed network operators.
- vertical integration, allowing the same organisation to be a fixed network operator, a mobile network operator and a mobile service provider could distort competition unless regulatory safeguards are put in place.

4. STANDARDS

4.1 The role of the European Telecommunications Standards Institute (ETSI)

All the most significant European standards in the mobile arena have been produced by the European Telecommunications Standards Institute, ETSI[16].

The main ETSI committees concerned by radiocommunications services and equipment are TC-SMG (Technical Committee, Special Mobile Group), with special responsibility for GSM, DCS-1800 and the development of the future Universal Mobile Telecommunications System (UMTS); TC-RES (Technical Committee, Radiocommunications Equipment and Systems), with broad responsibilities in the field of equipment and systems; and TC-SCS (Technical Committee, Satellite Communications Systems), covering inter alia also mobile satellite communications.

4.2 The Universal Mobile Telecommunications System (UMTS) - standards for third-generation systems

The responsibility for the standardisation of UMTS within ETSI has been given to the Technical Committee SMG (Special Mobile Group).

Within this technical committee SMG5 has been set up to study and define UMTS in liaison with the ITU Standardisation Sector studies on FPLMTS (Future Public Land Mobile Telecommunications Systems).

The Community research and development effort in advanced telecommunications (the RACE program) is playing a central role in the development of UMTS and the necessary preparatory work for the elaboration of standards (see Annex A).

The work in RACE is co-ordinated closely with the standardisation work in ETSI.

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16 ETSI, the European Telecommunications Standards Institute was established in 1988 following the Commission 1987 Green Paper on telecommunications.

The ETSI Technical Assembly (TA) has final responsibility for the standardisation work. It decides on the standardisation work programmes, and the establishment of Technical Committees (TCs) and Project Teams which progress the standards work.

The Commission has concluded a framework contract with ETSI and entrusts standardisation mandates to ETSI in the framework of Community Telecommunications legislation, in particular Directive 91/263/EEC concerning mutual recognition of type approval of terminal equipment and establishment of required European Telecommunications Standards (ETSs) and the related Common Technical Regulations (CTRs), and Directive 90/387/EEC concerning implementation of Open Network Provision .

A similar arrangement has been concluded with CEN/CENELEC. This arrangement allows the Commission to entrust standardisation mandates for the establishment of European standards generally in the electrotechnical field, such as in the field of electromagnetic compatibility.

5. FREQUENCIES

5.1 The Fundamental role of Frequencies

All radio devices communicate through the transmission and reception of energy. This energy is transmitted within the radio-frequency part of the electromagnetic spectrum.

The amount of spectrum available for mobile radio is limited and requires careful management. The range suitable for most mobile applications lies between about 100 MHz and 3 GHz. The limits of use are set by radio propagation factors and other technical criteria. Manufacturing difficulties limit the extent to which the higher frequencies can currently be used.

Exhibit B4 gives an indicative overview of spectrum use for mobile communications in Europe.

According to the studies carried out, in the range below 1000 MHz (1GHz) currently some 14% of radiofrequency spectrum are allocated to public mobile communications services. In accordance with the decisions taken at WARC 92 (see below), substantial additional frequency resources will be allocated in the range 1GHz to 3GHz for both terrestrial and satellite-based mobile communications services. This concerns primarily terrestrial digital mobile systems which will become available in the immediate future and which are central to future development of key technologies (DCS-1800; DECT; TFTS; see annex A for further detail), as well as radiofrequencies for UMTS. In the field of satellite mobile communications, this concerns the future satellite-based personal communications services, including the Low Earth Orbiting Satellite systems (LEOs).

In Europe, Council Directives relating to frequency designations for key pan-European systems: GSM, DECT and ERMES have been adopted[17].

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17 Council Directive of 25th June 1987 on the frequency bands to be reserved for the co-ordinated introduction of public pan-European cellular digital land-based mobile communications in the European Community (87/372/EEC ; OJ L196/85, 17.7.87) - the frequency designation for the GSM system;
Council Directive of 9th October 1990 on the frequency bands designated for the co-ordinated introduction of pan-European land-based public radio paging in the European Community (90/544/EEC; OJ L310/28, 9.11.90) - the frequency designation for the ERMES system;
Council Directive of 3rd June 1991 on the frequency bands to be designated for the co-ordinated introduction of digital European cordless telecommunications (DECT) into the Community (91/287/EEC; OJ L144/45, 8.6.1991).

Exhibit B4: General Overview of Spectrum Use by Different Civil Land Mobile Services in Europe

Mobile equipment in Europe can be generally (but not uniquely) found in the following frequency ranges. Note that these systems use only some slices (sub-bands) within the indicated limits and that these sub-bands may differ between countries, except those harmonised bands to be found listed below. For precise information, reference should be made to national frequency plans.

Frequency Range	Systems
47 - 88 MHz	CT1, Paging, PMR, MOBITEX
138 - 174 MHz	first PLMN's[1], RC2000, PMR, PAMR (MPT 1327), ERMES, Paging[2], MOBITEX
380 - 400 MHz	TETRA[3]
420 - 470 MHz	RC2000, NMT450, System C, RTMS, PMR, Paging
862 - 960 MHz	TACS, ETACS, NMT 900, GSM, DSRR, CT2, PMR
1670 - 1900 MHz	TFTS[4], DCS 1800[1], DECT
1885 - 2200 MHz	FPLMTS/UMTS(note 1.4)
5795 - 5815 MHz	RTT
63 - 64 GHz	RTT
76 - 77 GHz	RTT

Harmonised bands:

- for GSM 890-91. MHz (905-914 MHz and 950-959 MHz shall be the initial sub-bands) according to Council Directive 87/372/EEC;
- for DECT 1880-1900 MHz according to Council Directive 91/287/EEC;
- for ERMES 169,4-169.8 MHz according to Council Directive 90/544/EEC;
- for TFTS 1670-1675 MHz and 1800-1805 MHz according to ERC Decision;
- for DSRR 888-890 MHz and 933-935 MHz according to ERC Decision;
- for RTT 5.795-5.805 GHz, 5.805-5.815 GHz, 63-64 GHz and 76-77 GHz according to ERC Decision
- Recommendations of the CEPT-ERC (providing guidance without commitment), inter alia:
- For TETRA, a total of between 2 x 3 MHz to 2 x 5 MHz within the range 380 - 400 MHz should be made available according to ERC Recommendation T/R 02-02.
- DCS1800 should be made available according to ERC Recommendation approved October 1993 (Reference number not available at date of printing).

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1 most of them already de-activated or to be de-activated on short term
2 mainly POCSAG
3 not yet approved and/or planned
4 allocation by ITU/WARC92

5.2 The role of the ERC and ERO.

The new role of the CEPT/European Radiocommunications Committee (ERC) and the creation of the European Radiocommunications Office (ERO) represent the major reform of coordination of radiofrequencies in Europe.

According to its new role, the European Radiocommunications Committee develops radiocommunications policies, prepares for ITU conferences, and plays a general co-ordinating role in frequency, regulatory and technical matters in the context of the European Conference of Postal and Telecommunications Administrations (CEPT). It establishes conditions for access to frequencies in consultation with operators, users, manufacturers, standards bodies and other interested parties, in close co-operation with the Commission.

Linked to the ERC the European Radiocommunications Office (ERO) is a centre of expertise and acts as a focal point for consultations on spectrum planning and management.

The ERO has started to carry out Detailed Spectrum Investigations (DSIs) of radio spectrum usage in Europe. The overall objective is to support the development of a common European Table of Frequency Allocations to be completed by 2008.

The First Phase (range 3400 MHz to 105 GHz) was completed in March 1993. The Second Phase, covering the range 29.7 MHz to 960 MHz was launched in March 1993 and is to be completed by January 1995.

In carrying out this work, the ERO has co-opted assistance from the European Telecommunications and Professional Electronic Industry (ECTEL). There is now also close co-operation between the ERC/ERO and ETSI, in particular with regard to the needs to avoid frequency interference problems for radiocommunications equipment.

A Memorandum of Understanding between the ERC and the Commission and a framework contract are in preparation, similar to the approach chosen for the co-operation of the Community with ETSI. ERC also intends to enter into Memoranda of Understanding with the European Free Trade Association (EFTA), as well as with ETSI.

In 1992, the ERC created a new instrument for coordination of radiofrequencies and the provision of harmonised frequency bands, the so called ERC Decisions. Council Resolution 92/C318/01 has called for using ERC Decisions as the primary method for future coordination of radiofrequencies in Europe[18]. In its Communication of 10 September 1993, the Commission has set forth the necessary conditions to ensure that the Union's interests are safeguarded in this context[19] (see Annex D).

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18 Council Resolution of 19th November 1992 on the implementation in the Community of the European Radiocommunications Committee decisions (92/C 318/01; OJ C318/1, 04.12.92)

19 See "A new approach to the coordination of radiofrequencies in the Community", Communication from the Commission concerning proposal for a Council Decision on the implementation by the Member States of

Since 1992, the ERC has adopted ERC Decisions concerning the designation of radiofrequencies for the Terrestrial Flight Telecommunications System (TFTS), Road Transport Telematics[20] and Digital Short Range Radio (DSRR).

5.3 Future frequency allocations for terrestrial mobile and personal communications, and satellite-based mobile and personal communications.

A principal task of the ITU World Administrative Radio Conference held in 1992 at Torremolinos (WARC 92) was to extend allocated bands for mobile services, including the satellite mobile services. **Exhibit B5** shows the frequency allocations made at WARC 92 relevant to the mobile communications area.

Based on a range of design assumptions and estimates of penetration and traffic for dense use in large cities, CCIR calculated prior to WARC '92 that UMTS/FPLMTS would need some 227 MHz of spectrum. At WARC '92 a total of 230 MHz between 1885 and 2200 MHz was designated for world-wide use, eventually in FPLMTS implementations.

Within this, 2 x 30 MHz were identified for the satellite mobile services. However, this allocation is to take effect in Region 1 (including Europe) only by the year 2005. In the United States of America, this will operate already from 1996 onwards.

The regulations established at WARC '92 permit other systems and services to share the FPLMTS bands and contain no directions concerning priorities for satellite or terrestrial elements in the extension bands.

A number of smaller allocations were also made to the MSS (Mobile Satellite Services) at around 2,500 MHz and 1626 MHz, at around 400 MHz and around 140 MHz, amounting to a total satellite bandwidth of about 2 x 66 MHz. However, the conference failed to make any specific provision for feeder link applications to these satellite bands, generally because of the assumption that they will be carried by the Fixed Satellite Service. Problems, are likely to arise unless some effort is made to identify bands, expansion bands and appropriate measures to permit sharing of the feeder links.

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measures concerning radiofrequencies, COM(93)382, 10.9.93. See also Council Conclusions of 7th December 1993.

20 These two ERC Decision have replaced the original proposals by the Commission for Council Directives designating frequencies for this system.

Exhibit B5: Additional frequency allocations relevant to mobile communications following WARC 1992

The 1992 World Administative Radio Conference (WARC 92) allocated frequencies on a worldwide and regional[1] basis for a range of current and emerging radio services. An outline summary of allocations is reproduced below.

Terrestrial mobile (inc. FLMTS).	Worldwide	1885-2025 MHz; 2110-2200 MHz.
Satellite mobile[2]	Worldwide	1626.5-1660.5 MHz (u); 1525-1559 MHz (d);
	Region 2[3]	1930-1970 MHz (u); 2120-2160 MHz (d);
	Worldwide	1980-2010 MHz (u); 2170-2200 MHz (d);
	Worldwide	2670-2690 MHz (u); 2500-2520 MHz (d).
	Region 2[4]	1675-1710 MHz (u); 1492-1525 MHz (d);
Low Earth Orbit Satellites	Worldwide	1610-1626.5 MHz (u); 2483.5-2500 MHz (d);
	Worldwide[3]	1614-1627 MHz (bidirectional)
	Worldwide[3]	148-150 MHz (u); 137-138 MHz (d);
	Worldwide	400-401 MHz (d)
Aeronautical Communications	Worldwide	1670-1675 MHz (u); 1800-1805 MHz (d);
	Canada/USA & Mexico	1670-1675 MHz (u); 1800-1805 MHz (d) 849-851 MHz (u); 894-896 (d);

Note that these summary allocations may be subject to limitations and should be read in conjunction with the full text of WARC 92 resolutions and recommendations

Source: CEC

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1 For radio regulatory purposes, the ITU divides the world into three regions. Region 1 consists of Europe, Africa, the former USSR and Mongolia. Region 2 the Americas, and Region 3 the remainder of Asia and Oceania.

2 Allocations are paired, with an uplink (u) allocated for transmission from the Earth to satellite and a downlink (d) in the reverse direction.

3 All or part of these frequency bands are allocated on a secondary basis.

4 Additional allocation.

5.4 Future co-ordination issues in Europe

Given the outcomes of WARC '92 there are major priorities for radiofrequency co-ordination for mobile communications in Europe. To ensure that European radio communications administrations, service providers, operators, industry, broadcasters, and other users derive maximum benefit from the spectrum, decisions taken at WARC '92 must be fully implemented in a co-ordinated way throughout the European Union.

For systems intended for the general public, immediate priorities should be the establishment of binding ERC decisions concerning co-ordination of frequencies at the European level for the frequency bands designated at WARC '92 for future use by terrestrial mobile communications and satellite based communications systems. This should, in particular, include the designation of common bands for DCS-1800 services, for the future UMTS as well as frequency bands for satellite-based personal communications systems.

For systems intended for private use or for the use of closed user groups an immediate priority should be a decision on the designation of frequency bands, and the agreement of a time scale for their availability for systems operating according to TETRA, the European digital trunking standard.

Refarming of spectrum and uses is a matter which will continue to require careful and concerted actions. It will be important that co-ordinated positions are taken at future World Radiocommunications Conferences (WRCs)[21] with regard to future frequency allocations.

6. NUMBERING

6.1 The new requirements for numbering

Numbering capacity is a finite and potentially scarce resource. Therefore, in developing a future policy for mobile and personal communications in Europe, it is necessary to ensure that the development of the appropriate networks and services are not constrained by numbering capacity. This challenge can be addressed by careful management of the overall numbering schemes, both at the international and the national levels.

In particular the overall management and allocation arrangements must address three general issues to ensure:

- that there is sufficient capacity and flexibility within the overall numbering scheme for all operators and users
- that where appropriate coherent numbering and dialling plans are introduced by all operators

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21 The next World Radiocommunications Conferences (WRCs) will take place in 1995 and 1997.

- that numbering is placed on a level playing field for all operators, and in particular, that there are equitable allocation arrangements. In the specific case of mobile and personal network and service operators and service providers their needs with respect to numbering are

  - sufficient capacity within national numbering schemes with the appropriate access branding (identification) and appropriate tariffing

  - the ability to extend allocations

- the freedom to develop services uninhibited by constraints caused by numbering

For mobile and personal communications services, users may also require numbers which are transferable between operators (i.e. portable numbers) thereby allowing users to change operators without requiring a change of number.

6.2 The personal telephone number and universal personal telecommunications (UPT)

At present, users of mobile services are allocated numbers which are country, network and operator specific. However in the future, with increased globalisation, and increasing competition between operators and service types, users may wish to have numbers which are independent of network provider, service type, location and terminal equipment. In other words, users should have *personal* numbers which are allocated to each individual.

Such personal numbers would not be limited in scope to mobile or wireless services but would be generally applicable across all mobile and wireless services and the fixed network (i.e. the PSTN/ISDN). This would allow for full personal mobility with the potential for standardised access arrangements.

6.3 The requirements for numbering coordination and the future role of ECTRA

At present, numbering arrangements are developed nationally within a framework set up by the International Telecommunications Union (ITU).

Numbering policy within the EC to date has mainly concentrated on harmonisation of certain numbering codes, through the creation of :

- a common European emergency number (112)[22]; and

- a common international access code (00)[23]

In future, it is clear that with increasing service innovation and greater levels of competition, numbering will become a key issue.

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22 Council Decision of 29th July 1991 on the introduction of a single European emergency call number (91/396/EEC; OJ L217/31, 6.8.91)

23 Council Decision of 11th May 1992 on the introduction of a standard international telephone access code in the Community (92/264/EEC; OJ L137/21, 20.5.92).

Future arrangements for numbering management must take into account dynamic market changes in order to allow in particular for growth, the introduction of new technology and new services, progressive regulatory changes and the gradual convergence of fixed and mobile services.

This results in the need for a clear European wide policy for the development of numbering schemes in Europe, and greater independence of the management function than exists at present in many countries, are thus evident.

Numbers for mobile and personal services are currently allocated from within national numbering plans. The only example outside this arrangement is the numbering allocation for Inmarsat where numbering is done by ocean region using Inmarsat specific numbers. In the future with an expected increase in regional and global mobile services, numbering for such services must be co-ordinated on a broader basis than purely national schemes. Numbers could for example be allocated from within the proposed European numbering space.

The initial framework for co-operation in this field is set out in Council Resolution 92/C318/02 of 19 November 1992 on numbering[24] (see Annex D). In response, the European Committee for Telecommunications Regulatory Affairs (ECTRA) has set up a project team, and is planning to integrate coordination of numbering and the creation of a European numbering space, as well as preparation of European positions for the discussions in the ITU in this field, into the main activities of its European Telecommunications Office (ETO), currently in the process of being set up.

7. PROTECTION OF PRIVACY AND DATA PROTECTION

7.1 The new requirements for protection of privacy

The evolution in the industrialised countries towards the creation of information societies is closely connected to the increasing use, processing and exchange of personal data in all spheres of social and economic life. In the European Union these trends are reinforced by the establishment of the internal market, stimulating a rapid growth in trans-border flows of personal data. The increasing importance of data processing and data exchange demand new measures to ensure the effective protection of personal data and privacy.

In the telecommunications sector, the digitalisation of the networks has led to specific new requirements.

On the one hand, fully-computer-based processing can offer a substantially higher degree of data security through, for example, the use of highly sophisticated encryption techniques.

On the other hand, digital processing of both operational and call data within computerised exchanges, may make it easier to record and monitor systematically specific call-related data, such as origin of specific calls or the location of the calling or called party. Such monitoring was only feasible in "non-intelligent"

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24 OJ C318/2, 4.12.92

analogue networks after substantial and costly adaptation of the network equipment and therefore was only implemented in very exceptional circumstances.

At the same time, new intelligent telecommunications functions, such as calling-line identification and itemised billing, offer substantial additional service features to the subscriber which enhance both service quality and which can contribute to the level of consumer protection.

The new possibilities and service features presented by digital technology requires specific new regulatory measures if the protection of privacy is to be guaranteed in the new environment, and the erection of barriers within the internal market based on national data processing rules is to be avoided.

7.2 Current measures in the Member States

Currently, ten Member States have already adopted legislation in the field of data protection. In the two other Member States draft data protection legislation is currently under consideration.

As there has been no uniform approach at a Union level, the solutions adopted vary from Member State to Member State. In most Member States the sector is covered by general data protection legislation, with significant variations in the extent to which this provides legislative or other mechanisms adapted to the specificities of digital networks and services. Germany has adopted specific legislation covering the provision of telecommunications services.

The growing interest in the issue has also already led at international level to the consideration of the specific telecommunications-related data protection problems. The Council of Europe is currently considering a Recommendation on data protection in the context of telecommunications services. The International Conference of Data Protection Commissioners has adopted several resolutions concerning telecommunications and the issue is also being addressed within the OECD framework.

The European Parliament as early as 1986 adopted a Resolution calling on the Commission to submit proposals in order to ensure a consistent level of data protection in the context of the evolving integrated services digital network (ISDN).[25]

As part of the package, and alongside a proposal for a Directive on data protection in general[26], the Commission submitted a "Proposal for a Council Directive concerning the protection of personal data and privacy in the context of public digital telecommunications networks, in particular the Integrated Services Digital Network (ISDN) and public digital mobile networks"[27]. This proposal, which is complementary to the general directive, aims at implementing further measures for the protection of personal data and privacy with regard to the specific requirements

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25 Resolution on Council Recommendation 86/659/EEC, OJ No C 7, 12 January 1987, p. 334

26 COM (90) 314 final, 13.9.90

27 OJ No C 277, 5.11.90, p. 12

of digital telecommunications networks in order to prevent divergent developments in the Union which could endanger the internal market for both telecommunications services and terminal equipment (see Annex D for further detail).

8. SAFETY AND ENVIRONMENTAL CONSIDERATIONS

8.1 The issue of electromagnetic compatibility and electromagnetic exposure

All radiocommunications devices involve the transmission and reception of energy. Transmission power levels can vary between a few thousandths of a Watt for wireless microphones, up to very high power in the case of radar equipment. High power levels may produce health risks, and most industrialised countries have some rules concerning public and/or occupational limits on exposure. Physical means, such as fences keep people away from danger areas in most cases.

Two main types of effect are attributed to exposure to electromagnetic radiation - thermal and athermal effects.

As regards thermal effects, a number of organisations have endeavoured to assess the health risks of exposure to non ionising radiation. At an international level a review by the International Non Ionising Radiation Committee of the International Radiation Protection Association (IRPA/INIRC) led to the publication in 1988 of guidelines on the limits of exposure to radio frequencies.

At a national level various national standards have been established (such as National Radiological Protection Board standards in the UK, VDE 0848 in Germany and the ANSI standards in the USA). There is however a relatively large range of standard values documented in these standards and significant differences in the measurement and implementation parameters. In addition much of the evidence on which these standards have been based is statistically inconclusive, and some of the longer term effects are not well researched.

In the case of athermal effects, so far as the possible harmful effects of use of mobile terminals is concerned, the experimental evidence amassed so far does not show that the level of radiation could be harmful to health, but on the other hand it does not prove conclusively that it is not. It is nevertheless at present generally accepted that the health risks associated with the normal use of mobile terminal equipment seem to be low. Given substantial public concern, it is, however, urgent that the Community continues to monitor the situation and support research to allow for additional evidence to be produced.

A further factor is that the burgeoning growth in mobile communications has led to an increase in the occurrence of electromagnetic interference. This problem is already addressed in Directive 89/336 on electromagnetic compatibility[28]. However, the proliferation of electronic devices in road vehicles (such as anti-lock breaking (ABS) systems); the use of mobile systems and handsets in close proximity to vehicle electronics; cable television; itself a growth industry in the

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28 Council Directive 0f 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (89/336/EEC; OJ L363/30, 13.12.89 as amended by Council Directive 92/31/EEC of 28 April 1993; OJ L126/11, 12.5.93

Member States or to hearing-aids and heart pace-makers, demands a careful exercise to monitor the effectiveness and applicability of existing European Community measures. Mechanisms to mandate CEN-CENELEC to establish appropriate European standards for enhancing current protection continue to be justified.

8.2 The issue of access to suitable sites and environmental aspects

All wide-area mobile radio systems require externally mounted antennae at central base sites. These antennae are used for transmitting and receiving signals to and from the user terminals.

In order to satisfy radio propagation requirements, antennae are generally mounted above and clear of local ground obstacles, buildings, people, trees, etc. In addition, since most mobile radio systems require near line-of sight between the central base sites and the user terminals, antennae have to be mounted on relatively tall towers and often on hill top sites. Such requirements can have a visually obtrusive impact.

The distance between antenna sites will again vary depending upon the service, but in the worst case, for high density areas with small cell sites, antenna sites may be required to be no more than 2 km to 3 km apart. Where there are two or three operators in a region this can result antenna masts being only one kilometre apart.

The overall result is that with a variety of mobile services, and with each service being provided potentially by multiple, competing operators, there is the potential for the emergence of a very large number of relatively closely spaced, visually obtrusive antenna sites.

In some instances it has been possible to reduce the visual impact of individual antennas either by concealing them behind other installations (such as advertising hoardings) or by disguising them as other more visually acceptable installations). However it is currently considered impractical and uneconomic to do this on a widespread basis.

8.3 Sharing of infrastructure

In order to reduce environmental impact, two measures are possible. The first is to encourage operators to share sites wherever possible. While this may increase the number of antennas mounted on individual towers, it will reduce the overall number of towers.

The second measure is to permit competing network operators to share common radio infrastructure. This will have a marginal effect on the extent of competition between operators and reduce the overall number of individual base station antennae required within a given region.

Consequently, site sharing between operators of telecommunications services, or between telecommunications and operators of non-telecommunications facilities, such as terrestrial broadcasting sites, should be allowed. Infrastructure sharing should be considered under defined circumstances, allowing two or more operators to share some range of common radio infrastructure. This may include antenna sites; masts, antennas, transceivers and other network equipment.

9. THE FUTURE PERSONAL COMMUNICATIONS ENVIRONMENT: MOBILITY IN THE FIXED AND WIRELESS NETWORKS

9.1 Current fragmentation through separate licences

The current reality of a highly fragmented European network and service environment tends at present to undermine the vision of convenient, seamless personal communications services covering all user situations.

Fragmentation occurs primarily as a consequence of nationally-based regulatory approaches and the influence of these on market structure:

- National licensing has tended to produce varied licensing approaches and conditions on operators, meaning that many services are still available only on a national basis and terminal equipment cannot be used freely from one network to another;

- Regulation has drawn distinct boundaries between the fixed, mobile and satellite areas, with separate licensing/authorisation in each area;

- Within the mobile area, further regulatory market boundaries have been introduced through separation of licensing along the lines of different mobile radio systems, for reasons of frequency management and the ability individually to control the numbers of entrants using each type of system.

Aside from supply side inefficiencies that such approaches can bring, such as the loss of economies of scale and scope and distortions to competition, a highly important effect for many users in order to obtain a full range of telecommunications products and services, users must deal with a variety of different suppliers, and work within the limitations of individual chosen solutions.

9.2 The pan-European dimension

Memoranda of Understanding (MoUs) agreed between national operators, for example, through the GSM and ERMES systems have been an important factor in assisting the coherent deployment and operation of pan-European services, in particular, the ability to 'roam' using a mobile terminal or SIM-card - even if full implementation of roaming (including, the case of GSM) is still some way off (see above).

Such arrangements must remain at the centre of a common approach to pan-European personal communications; however, in order to maximise their impact the development of further specific approaches for mobile and personal communications services will be required.

9.3 The new environment set by the Telecommunications Review

The 1992 Telecommunications Review, which formed the basis for the timetable established in Council Resolution 93/C213/02 of 22 July 1993[29], now provides the opportunity to define an appropriate environment for personal communications.

The goal of full liberalisation of public voice telephony service will present a number of highly significant opportunities for development of personal communications, including the possibilities for operators to transport voice traffic between fixed (as well as mobile) network destinations, and freedom to combine and retail services offered on both fixed and mobile networks. This environment is, inter alia, likely to spur development of shared network intelligence which is essential for the integration of personal communications across different user and network environments (see Annex D).

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29 Council Resolution of 22nd July 1993 on the review of the situation in the telecommunications sector and the need for further development in that market (93/C 213/01, OJ C213, 6.8.93).

10. CONCLUSIONS

Member states have in general interpreted the liberalisation trend set in the 1987 Green Paper.

Most Member States have issued licences to more than one operator (e.g. GSM), on the intention to promote a more competitive environment.

Competition has resulted in greater benefits to both the users and the providers of mobile services.

An open, competitive market has stimulated the growth and development of mobile services promoting a rapid take up of better and cheaper services, in particular, in relation to GSM.

Market structure is being regulated along the lines of different mobile technologies.

National Regulatory Authorities in the Union and elsewhere have adopted policies which structure the market along the lines of different existing mobile radio systems.

This may limit the ability of the sector to meet market requirements, if it is not balanced by greater flexibility in service provision, and the ability to offer a combination of services.

Absolute barriers to entry remain in a number of Member States.

A number of Member States still maintain exclusive and special rights in the sector. These barriers must be eliminated if the mobile market is to develop fully.

Licence award systems differ substantially.

Mobile operators are awarded licences on the basis of national procedures and nationally focused evaluation criteria. Selection procedures are not uniform and in many cases lack transparency. Member States often retain considerable discretion due to the fact that neither the invitations to tender nor the evaluation procedures give a clear indication of the relative weight of the assessment criteria.

Distortions are caused by differing licence conditions.

There are major distortions to competition and market structure both within and between technologies, resulting from differences in licensing procedures and the basic licence terms such as those covering for interconnection and the use of infrastructure.

Presently, Member States follow significantly different regulatory approaches. The duration of licence terms and the conditions placed on mobile operators differ from country to country and from operator to operator. This in many cases is causing or has the potential to cause significant distortion of competition.

Efficiency of spectrum use will become more and more vital.

The spectrum scarcity in mobile communications calls for the adoption of frequency efficient technologies. However, reliance on the most efficient technologies does not dispense the need to accurately plan the use of radiofrequencies inside specific frequency bands and between these and neighbouring / contiguous bands. An acceptable approach must be ensured in the assignment of frequencies between new and previous technologies in order to minimise mutual interference and maximise frequency re utilisation.

Numbering is of special significance to the provision of mobile services

Numbering raises significant new issues and requirements. Among these will be the need for personal numbers to facilitate personal mobility across all networks and environments.

Safety and environmental conditions will gain prominence/infrastructure sharing will become an important issue.

Substantial public concern exists about possible health hazards resulting from electromagnetic exposure, and problems of electromagnetic interference with regard to other sensitive equipment, such as hearing aids, heart pacemakers and Anti-lock Braking Systems.

Radio towers and other radio installations may also raise environmental concerns and issues in town planning. The promotion of infrastructure sharing seems to be a way forward.

The agreement on full liberalisation of public voice telephony services in 1998 presents an opportunity to define concepts for full user mobility on radiocommunications and fixed networks.

Full liberalisation of public voice will allow the combination of services via mobile and fixed networks and therefore facilitate full end-to-end service in a personal communications environment. Based on the convergence of intelligent networks and digital mobile communications networks, this will promote more efficient and effective network and service operation and will offer full mobility services to the user.

Towards the Personal Communications Environment:

Green Paper on a common approach in the field of mobile and personal communications in the European Union

ANNEX C

REVIEW OF WORLD-WIDE DEVELOPMENTS

TABLE OF CONTENTS

1 DEVELOPMENTS IN THE UNITED STATES

1.1 Technology and market trends

Commercial cellular mobile services began in the United States in 1983 using the analogue AMPS (Advanced Mobile Phone Service) standard. At mid-1993 there were over 13 million subscribers in total - about 5 per cent of the population. Subscriber numbers are growing by more than 30 per cent per year and 40 to 50 per cent of new subscribers are non-business users attracted by flexible tariff packages. Average subscriber revenues are in excess of $70 per month and the total US service market is worth approximately $9 billion annually.

The shift to digital cellular services in the US has been delayed by two factors. Firstly, the present analogue operations are cost effective and, because of technical improvements in the existing analogue technology[1], excess capacity is available using current spectrum allocations. Also, uncertainty over the choice of American second generation digital technology has prevented the emergence of a clear upgrade path. Two competing digital cellular standards are being promoted:

- a time division multiple access (TDMA) technique has the support of the United States Cellular Telecommunications Industry Association and large cellular equipment manufacturing organisations, and
- a code division multiple access (CDMA) technique is supported by Qualcomm Incorporated, a US defence contractor.

There has been concern in the US[2] that delays in introducing digital technology are allowing the GSM standard an opportunity to dominate non-European markets which adopted AMPS as their analogue service standard, thereby undermining US technological leadership. On the other hand, the Federal Communications Commission's (FCC) decision to refrain from action to promote on a single second generation system standard has led to a considerable increase in the rate of experimentation and this may lead to rapid roll-out of innovative new mobile services in the US.

Migration to new, digital standards will be voluntary and its timing will depend on the cost and spectrum efficiency of digital operations, relative to current analogue services. The transition can be expected to take place first in areas where cellular penetration is greatest. US equipment manufacturers have also suggested the possibility of producing dual analogue/digital mode handsets and the availability of these might lead to an extended period of analogue/digital coexistence. The cellular operators expect 40% of analogue mobile technology to be converted to digital systems before 2000.

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1 Notably Narrowband AMPS (N-AMPS) which only requires 10 KHz for one voice channel so is more spectrum efficient than the original AMPS.

2 See "Global Competitiveness of US Advanced-Technology Industries: Cellular Communications", US International Trade Commission 1993.

The FCC has announced the frequency allocation for US Personal Communications Services. In September 1993 the FCC allocated a total of 160 MHz for PCS services with 120 MHz for public (i.e. licensed) services and the remainder for low power PCS devices which do not require licences.

Commercial mobile data services have been available in the United States for more than seven years and now cover about 97% of US metropolitan areas. Such services primarily meet the needs of corporate users and closed user groups.

The US continues to play an important role in the supply of mobile systems, equipment and handsets throughout the world, with AT&T, Northern Telecom and Motorola winning 37% of the non-US market for analogue systems in 1991 and 40% of the non-US market for digital systems. Motorola continues to be the largest supplier of handsets with a 23% share of the 1990 world market[3].

1.2 Licensing and selection procedures

The United States was one of the first countries to licence mobile services. Analogue paging services arrived on the market in the 1960s and analogue mobile telephony licences were first granted in 1981. For analogue mobile telephony, the FCC decided to create regional duopolies by dividing the United States into 306 Metropolitan Statistical Areas and 428 Rural Statistical Areas. Two types of licences were issued for each area: 'A Block' licences were given to the local fixed network operator, generally the local Regional Bell Operating Company (RBOC) and 'B Block' licences were awarded to unrelated competitors. While artificially limiting market structure, the FCC believed that local duopolies would promote technological advance, broaden the service choice and introduce price competition[4].

The FCC declined to licence a single national mobile operator, despite the economic efficiencies which might have been achieved by doing so. However, there were no restrictions on the number of 'B Block' licences which could be held by competitive mobile operators, allowing companies to build up coverage in contiguous mobile areas. Consequently, McCaw and GTE now jointly cover 70% of US subscribers.

At the same time, regulatory restrictions placed on the RBOCs as a result of the divestiture of AT&T in 1982 may have placed them at a competitive disadvantage compared with 'B block' licence holders. The Modified Final Judgement (MFJ), which enacted such divestiture, prevents the RBOCs from providing long-distance (inter-LATA[5]) services. Hence, mobile calls requiring transmission to a different LATA must be handed over to a long distance operator. This restriction creates difficulties for the RBOCs' mobile service provision as mobile licence coverage is different to the LATA coverage in more than 1,300 locations. This imposes an

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3 Global Competitiveness of US Advanced-Technology Industries: Cellular Communications, US International Trade Commission 1993.

4 Federal Communications Commission Reports, Cellular Communications Systems, 86 FCC 2d (1986).

5 Local Access Transport Area.

additional hand-on cost on the RBOCs which is not imposed on competitive mobile operators[6].

The means of selecting the second licensee in each area varied. Licences for the largest 90 MSAs were awarded through comparative hearings. Remaining licences were granted through lotteries, with successful applicants enjoying the right to sell their licences. The lottery process accelerated the deployment of mobile services, allowed smaller firms to enter the market and larger operators to consolidate their position by purchasing licences[7]. However, it also encouraged speculative applications for lotteries from organisations with limited interest in providing cellular services.

Existing analogue operators will migrate to digital technology to better use the allocated spectrum. As mentioned above, the FCC has not introduced a requirement in the US for a specific digital technology[8] to be introduced by a specified date comparable to that found in the European Union for the introduction of GSM technology.

There are no direct foreign mobile service providers in the US. At the time of the award of the original analogue licences there were few non-US players able to compete for such licences. Additionally, Section 310 of the 1934 Federal Communications Act limits foreign ownership of a cellular licence to a maximum of 25%. BT has divested itself of its 22% holding in McCaw through a sale to AT&T. This was previously the largest foreign holding in a US mobile operator.

Current approach to personal communications services

Reflecting the approach taken with analogue cellular, the FCC has allocated spectrum for PCS based on a division of the United States into 51 Major Trading Areas (MTAs) and 492 Basic Trading Areas (BTAs)[9]. Instead of automatically allocating spectrum to incumbents or using a lottery system, spectrum will be auctioned during 1994. Existing cellular operators can bid for licences *outside* their existing areas, or where existing cellular services serve no more than 10% of the population of the PCS service area. They can also bid for up to 10 MHz of spectrum *inside* their existing service areas. PCS licensees will be allowed to

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6 Applications can be made by the RBOCs for waivers in individual cases of the prohibition on inter-LATA carriage. However, such applications are cumbersome and take an average of 19 months to process. See Global Competitiveness of US Advanced-Technology Industries: Cellular Communications, US International Trade Commission 1993.

7 Global Competitiveness of US Advanced-Technology Industries: Cellular Communications, US International Trade Commission 1993..

8 This can be contrasted for the mandatory use of the AMPS analogue technology required by the FCC, when first licensing mobile systems.

9 Each Major Trading Area will have two licence allocations of 30 MHz. Each Basic Trading Area will have one 20 MHz and four 10 MHz licence allocations. There will be over 2,500 licence allocations in total. MTAs and BTAs, originally defined by Rand McNally, are *not* identical to Metropolitan and Rural Statistical Areas as defined for the analogue cellular service, however, MTAs generally cover urban areas and BTAs rural ones.

aggregate their allocated spectrum, but not to hold more than 40 MHz of spectrum in any particular area.

PCS licensees are free to choose the standards that they will operate to. As with the existing cellular operators, the industry is divided between supporters of TDMA techniques and those supporting CDMA. It is likely that examples of both technologies will emerge, including DCS 1800 derived from the GSM standard.

1.4 Role of satellite-based personal communications

The development of satellite personal communications in the US must be seen in the general context of mobile satellite services and the absence of a US-wide terrestrial network. When compared to Europe or Japan there are many more areas of the US where the number of subscribers is insufficient to justify the deployment of a terrestrial system and where a satellite mobile system is the only suitable mobile technology.

The main developments in the US have been the award of a monopoly license in the mid-eighties for a geostationary system, and, recently, the various initiatives with regard to low-earth orbit satellites (LEOs). In the mid-eighties, the FCC concluded that the US market was not big enough to support more than one licensee for geostationary mobile satellite services. It ruled that all applicants should form a consortium (AMSC[10]) and that no other systems should operate within the US for land mobile and aeronautical applications. In other words, Inmarsat was barred from providing domestic services on the US market. AMSC began a data-messaging service in 1992, and will launch its first satellite in 1994.

Renewed attention on the satellite-based personal communications market was generated by new proposals for non-geostationary orbits. Applications are expected to be for both voice ("big LEOs") and non-voice ("little LEOs") systems. These are being promoted by US manufacturing industry, which is looking for new markets, now that demand for military applications is decreasing. The US government has negotiated through the 1992 World Administrative Radiocommunications Conferences, notably WARC 92, (see Annex B for further detail) world-wide frequencies for these mobile satellite services. After securing such agreement, a process of negotiated rule-making started, under the auspices of the FCC, that eventually will result in the awarding of one or more licensees to exploit these services.

There are more than 5 applicants for "big LEOs", and 3 for "little LEOs". Proposals for the provision of global services include projects like Motorola's Iridium, Loral's Global star and Odyssey. It remains uncertain, however, how many systems the market and available spectrum can support.

The US policy of retaining a domestic monopoly for satellite-based mobile services appears to rest on a presumed scarcity of frequencies and a modest market potential. It would seem to be at odds with the recently started procedures for licensing arrangements for satellite PCSs on the domestic market. The US

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[10] AMSC: American Mobile Satellite Corporation. The major stockholders are Hughes Communications, Inc., McCaw Cellular Communications, Inc., and Mobile Telecommunications Technologies Corp. Together they own approximately 90% of the shares.

approach seems to seek effective control of global mobile satellite ventures, while closing the vital domestic market to foreign competitors.

2. DEVELOPMENTS IN JAPAN

2.1 Technology and market trends

Japan was the first country to license an analogue cellular service. Nippon Telegraph and Telephone Corporation (NTT) the monopoly domestic carrier began its service in 1979. Subscriber growth was modest during the early and mid-1980s, but accelerated following regulatory changes embodied in the Japanese Telecommunications Business Law of 1985. This permitted market entry by new common carriers in fixed-wire, mobile cellular and paging operations. A large number of new, though often commercially linked, carriers entered the market.

NTT remains the largest mobile communications services supplier. There were 1.7 million cellular mobile telephony subscribers at mid-1993 and some 40% of this market is held by new carriers. A similar pattern can be seen in the paging market. In September 1992 there were 6.3 million paging subscribers in Japan. In all 47 prefectures there were at least two competing paging operators with 36% of the market held by new carriers.

Three mobile communications groups dominate the Japanese market: NTT, IDO and DDI. They use two analogue cellular standards (N-MATS and JTACS) which operate in the 800 and 900 MHz frequency bands.

- NTT's mobile communications subsidiary, NTT DoCoMo, is licensed in 9 specific regions in Japan giving it the commercial advantage of de facto nationwide coverage. It operates an N-MATS system, provided by Motorola, which has extended the capacity of NTT's earlier system.

- Eight regional mobile operators owned by DDI (Daini Denden Inc.) compete with NTT in regions other than Tokyo and Chubu using JTACS systems.

- Regional mobile operators owned by IDO (Nippon Idou Tsushin Corporation) compete in the Tokyo and Chubu areas with both N-MATS and JTACS systems.

IDO and DDI signed a roaming agreement for their JTACS systems in 1991, but their tariff structure means that subscribers requiring national coverage are likely to use NTT. Direct interconnection of these networks is to be permitted from 1993. This should reduce their interconnection costs and allow tariff reductions.

Japan accounts for some 40% of the cellular installed base in the Asia/Pacific region, but subscriber numbers are currently growing more slowly than in other national markets. However, two additional consortia - Tu-Ka and Digital Phone - have been licensed to provide regional cellular networks using digital technology. This will intensify competition in the market with consequent subscriber growth. As well as the growth in the number of operators and subscribers, competition in

Japan has dramatically reduced mobile service prices, stimulated the introduction of new services and products, and increased the level of investment in the sector[11].

2.2 Licensing and selection procedures

As in other industrialised countries Japan faces a shortage of radio frequencies which is constraining the expansion of existing networks. The Ministry of Posts and Telecommunications (MPT) is responding by encouraging operators to shift to fully digital technologies. The present analogue cellular operators have indicated that they will upgrade their networks for digital operations. MPT has allocated additional channels for the digital services of these operators from the unused regions of the 800 MHz band. New licences have been awarded to the Tu-Ka group (mainly owned by DDI and Nissan) and to the Digital Phone Group (led by Japan Telecom, together with foreign participation) to offer digital services in the 1.5 GHz band. NTT launched its 800 MHz digital service in 1993. Competitors will begin operations in 1994.

To date the licensing regime for new entrants has been restricted to regional operations only. Wider coverage has been provided through alliances which has worked to the advantage of NTT. As the market matures this constraint is likely to be lifted so enhancing nationwide mobility.

2.3 Current approach to personal communications services

With its large internal market and considerable technological expertise Japan has made the political decision to develop a dedicated national digital cellular standard. Development work is now underway on three types of new, digital system in Japan. These are:

- the Personal Digital Cellular (PDC) system;
- the Personal Handy Phone (PHP) system; and
- the N-star mobile satellite system, scheduled for full service in 1995.

An initial PDC specification was developed by the Technical Group of the Japanese mobile carriers in 1991. After various amendments these standards were due to be finally approved in November 1993 and will be adopted by all five operators. The system will use two frequency bands: 800 MHz and 1.5 GHz and is designed to co-exist with the existing analogue system. It remains under development in terms of capacity and services: a half-rate codec algorithm is in preparation and integration with national plans for personal numbering is being considered.

The Japanese approach to personal communications is based on the Personal Handy Phone (PHP) system standard. These systems should be considerably cheaper than PDC-based cellular services, and have more in common with a two-way telepoint concept. They will use low power base stations and handsets and will not provide uninterrupted handover. Licenses will be awarded in the 1.9 GHz band. The service will offer a genuine, wireless alternative to the current local loop and is of considerable interest to NTT's regional domestic fixed-wire competitors.

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[11] See, for example, "Communications in Japan 1993" - White Paper by the Japanese Ministry of Posts and Telecommunications.

3. DEVELOPMENTS IN THE PACIFIC AREA AND ASIA OTHER THAN JAPAN

Like Europe and the US, the Asia/Pacific region is undergoing a mobile service boom, brought about by general economic performance and by the emergence of the mobile telephone as a symbol of personal economic success. At the start of 1993 there were some 2.4 million cellular subscribers in the region - a 67% increase on 1992. Demand for cellular telephony is driven by relatively wealthy users based in urban centres. In countries with undeveloped fixed networks cellular telephony provides an efficient overlay network linking concentrated trading communities and offers reliable international access.

Increases in cellular communications use have been paralleled by growth in paging systems. Paging is an enormous success in the Asia-Pacific region. There is a broad acceptance of the technology in Asian-Pacific markets where paging is used widely by consumers as well as for business purposes. Operators and manufacturers have responded by marketing an extremely broad range of pager styles and functionality's. Value added services and suppliers have proliferated, further fuelling market growth.

Telepoint has been a success in Hong Kong and Singapore where high population densities allow virtually 100% coverage at relatively low cost. Low prices and cultural factors have played an important role. High pager penetration encourages acceptance of telepoint technology offering outgoing calls only. A public transport/pedestrian orientation means adoption is not constrained by the lack of a "hand-off" capability.

Countries in the Asia/Pacific region have historically imported technologies from abroad to fulfil their mobile communications needs. For the next generation of systems many Asia-Pacific countries have adopted, or are now considering adopting, digital cellular technology. As the region is presently less economically cohesive than North America or Europe there is no "top-down" push for the creation of a uniform standard for the region.

Operators are presented with three competing digital cellular technologies: Europe's GSM, North America's USDC and PDC from Japan. While, in certain countries a single standard has been selected, some governments have preferred a dual approach, adopting GSM in the 900 MHz band and USDC in the 800 MHz band. At present GSM is the most popular choice for new systems.

The region demonstrates a wide range of regulatory structures from vigorous competition in Hong Kong to continued monopoly provision in Taiwan. Markets too, are heterogeneous in character, ranging from the highly developed economies Australia and Hong Kong to the newly emerging markets of China and Vietnam.

Australia is presently the largest cellular market in the region with over half a million subscribers. Market growth has been driven by the willingness of the highly urbanised, car-oriented population to embrace mobile communications technology. There are three licensed operators: Telecom Australia, Optus and Vodafone Pty. All will adopt GSM technology and this "tripoly" will continue until 1997. At that time the Government has suggested that it will fully open up the mobile market.

The Korean Government has committed itself to the US CDMA standard in partnership with Qualcomm of the United States. The present monopoly mobile

operator Korea Mobile Telephone will implement a CDMA system in 1994. The planned second operator should be licensed in mid-1994.

Taiwan is the second largest regional market and, along with that of Singapore, has a single monopoly operator. The national cellular network was launched by the Directorate General of Telecommunications (DGT) in 1989 using the AMPS standard. At the start of 1993 the existing network was within 3% of its ultimate subscriber capacity and the need to move towards a digital network is recognised. The Government has decided to implement both USDC and GSM systems. USDC to provide an upgrade path for the present AMPS network while a GSM system will facilitate roaming with mainland China.

China can be identified as the key regional market in the longer term because of its size and rapid economic growth. At the start of 1993 there were 160,000 mobile subscribers to the networks operated by Chinese local telephone companies on behalf of the Ministry of Posts and Telecommunications (MPT). MPT is carrying out trials of GSM[12]. Leading equipment suppliers have set up joint ventures in China.

4. DEVELOPMENTS IN THE MEDITERRANEAN AREA, NEAR EAST, AFRICA, LATIN AMERICA

4.1 Mediterranean area and Near East

In late 1991 telecommunications organisations from the countries of the Gulf Co-operation Council[13] (GCC) agreed to adopt a regional network of mobile and paging systems using common standards. GSM was selected as the common standard for the pan-GCC mobile network and to date Qatar and the UAE have awarded contracts for the construction of GSM systems. Other GCC countries will introduce GSM systems by 1995.

A number of other countries in the Middle East have either decided on a GSM system or are considering its adoption. These include: Egypt, where a service was scheduled to be offered by late 1993; Iran; Jordan; and Lebanon.

4.2 Africa

As in central and eastern Europe, African governments view cellular as a rapid way of fulfilling unsatisfied demand for telecommunications in urban centres and of generating additional telecommunications revenue. Cellular services are also being promoted as a solution to deficiencies in fixed network deployment. Several North African countries are considering implementing GSM once this is implemented in Southern Europe. The Algerian, Moroccan and Tunisian PTTs currently offer NMT 450 services which will be upgraded, subject to available finance.

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[12] China is emerging as one of the fastest growing cellular markets in the world. It shows the greatest potential for GSM technologies outside Europe. The MPT is carrying out GSM trials in three provinces.

[13] GCC countries are Bahrain, Kuwait, Oman, Quatar, Saudi Arabia and the United Arab Emirates (UAE)

Other countries in Africa are considering the introduction of analogue or digital mobile telephone networks where none presently exist. However, financing difficulties, political instability and uncertainty over demand have delayed moves towards cellular systems. Cameroon recently became the first African nation to launch a digital GSM cellular system.

In South Africa the present analogue mobile system is running out of capacity and the government has introduced competition by issuing two licences for digital mobile systems. Both operators will introduce services based on GSM technology. As current deficiencies in fixed network deployment and penetration reflect earlier politically-driven investment priorities, the issue of cellular deployment is also politically charged. Currently main line penetration per 100 inhabitants is ten times greater among the white population than amongst the much larger non-white population.

4.3 Latin America

During the 1980s and early 1990s Latin American governments adopted a strategy of privatisation of state-owned telephone operators through the direct sale of majority interests to consortia of foreign and domestic investors. New owners have been allocated continuing monopoly rights, including over the provision of mobile services, and must meet strict performance and investment targets. While direct Government control over the sector has been reduced, penetration rates and investment volumes have increased dramatically.

Chile was the first country to privatise its operator (in 1987) and has been followed by Argentina, Mexico and Venezuela. Eight other Latin American countries are now considering privatisation. Privatisation of the basic services operator has also led to vigorous growth in the mobile sector. Governments are less prone to accept arguments against competition once they have sold their interests, and this is a powerful incentive to increase investment in cellular services.

In Latin America the prospects for GSM to date are limited. Traditionally, this has been a market for AMPS and it is likely that most existing cellular operators will choose to migrate to USDC. Where this pattern may not hold will be in those countries where early licensing of a second operator takes place. Two countries believed to be considering the adoption of GSM are Columbia and Argentina.

5. CENTRAL AND EASTERN EUROPE

5.1 The special potential of mobile communications for Central and Eastern Europe

Countries of the former Soviet Bloc have inherited an extremely poor level of infrastructure development and the need to improve rapidly both the quantity and quality of telecommunications infrastructure has been widely documented. Symptoms of poor infrastructure development include: low numbers of telephone main-lines per 100 inhabitants, long waiting times for connection and poor call completion rates.

Mobile communications technologies and systems have a special potential in these countries. This is based on two key factors:

- speed of deployment and the flexibility of mobile service provision, and
- the cost structures of mobile communications systems which will, in certain circumstances and increasingly over time, allow cheaper deployment of radio-based systems than of fixed-wire systems

Radio-based systems allow swift provision of telephone connections in urban areas. These services are particularly attractive to business users whose efforts are vital in the transition to a market economy and who are willing to pay a premium price for a combination of speed of provision and service reliability, with mobility an additional benefit.

Once mobile networks are in place, a proportion of the additional revenue generated becomes available for re-investment in the telecommunications sector. This can be used to support the extension of the mobile network from urban to rural areas or for the development of the fixed network. In addition, in some countries, mobile licenses are being sold to foreign operators to generate hard currency.

Beyond the immediate fulfilment of the service requirements of business users, radio-based communications technology also has the potential to provide cheaper connection to the public network than may be possible with existing fixed-wire technology. Telecommunications operators in central and eastern Europe may use radio to serve greenfield sites or regions where wired access is relatively expensive.

5.2 Market and technology developments

The deployment of analogue cellular technologies in central and eastern Europe began in November 1990 with the deployment of the "Westel" network in major urban centres of Hungary. Beginning with a service in Budapest it has expanded to other major cities, to tourist areas and along main arterial road routes. These areas of high demand for mobile services are crucial in the development of the telecommunications-intensive service sector and this pattern of deployment is being repeated in other countries of the region.

Implementation of mobile telecommunications networks in central and eastern Europe and the CIS is typically through joint ventures between domestic and foreign companies. Domestic participation is dominated by national PTTs which bring local labour, switching and base station sites, and which are familiar with local circumstances. Foreign operators offer capital, and specialised technical and marketing expertise. North American telecommunications operators, in particular, the Regional Bell Holding Companies, continue to be active participants in mobile network development.

Paging systems have also developed within the framework of joint ventures. Unlike cellular, paging joint ventures do not necessarily include the local telecommunications operator and are more likely to be subject to competition.

Systems using the Scandinavian analogue NMT 450 standard were the preferred technology for mobile networks entering service during the early-1990s. These frequencies are relatively free of other users in the region. However, most countries have declared their intention to licence digital cellular systems in the near future. In

particular, spectrum constraints in the 450 MHz band mean that available capacity may be fully utilised in these networks during 1994. These implementations will use GSM technology. Again Hungary has led the way by offering GSM licences to two consortia: Westel 900 led by US West; and Pannon GSM involving TOs from the Netherlands, Denmark, Sweden and Finland.

By adopting GSM and the other mobile standards being implemented in the rest of Europe, these countries have the potential to participate in the spread of seamless and cost effective pan-European mobile services. This will increase the level of economic cohesion between the European Union and central and eastern Europe and will offer additional revenue generating possibilities in these countries through "roaming" of high volume foreign users.

While decisions favouring the licensing of GSM systems have been made in principle this is subject to a number of constraints in practice. The focus of most operators is on rolling-out existing networks and not on the implementation of new, digital technologies. While this could be compensated for by the allocation of additional licences, this may conflict with existing licence conditions. For Russia and other CIS countries, restrictions on the export of sensitive technologies continue to be a major barrier to GSM implementation. While licences may have been allocated the actual date of GSM introduction remains unclear in these cases.

Development of widespread personal communications use in central and eastern Europe depends primarily on overall economic growth. Until a general economic upturn in these countries, the market will remain dominated by a small number of "hard-currency" users able to pay the premium tariffs which are high even by Western European standards. The introduction of greater levels of competition - in fixed or mobile services - will provide incentives for the operators to extend their customer base to customers with a lower revenue-earning potential.

For cellular operators (other than those using NMT 450 technology) there remain difficulties with military and emergency service use of the necessary frequencies. Unless spectrum allocation problems are addressed these countries will not be able to benefit from European and world-wide co-ordination initiatives. It is possible that licence fees will be used to fund the necessary frequency reallocation.

Opportunities also exist for radio-based local loop implementations to overcome poor levels of fixed infrastructure deployment. Deutsche Telecom has implemented temporary systems based on NMT 900 technology in advance of fixed network roll-out in Germany's eastern Länder. The Hungarian Telecommunications Company is pursuing a similar approach. It has experimented with CT2 technology and will participate in a DECT trial supported by the Commission in 1994.

In January 1993 Russia licensed GSM systems to serve 12 cities and their surrounding areas. For most of these US West will be the lead contractor/operator in partnership with two Russian organisations. Russian industry groups were awarded a number of the licences and the Moscow licence was allocated to a joint venture between the Moscow City Telephone Network and Bell Canada. Licence conditions stipulate that a specific percentage of fixed installations must be covered by the operators. Following these initial licences the Russian Government has announced that an additional 20 regional licences will be offered for GSM services and over 40 licences for NMT 450 services.

5.3 Co-operation mechanisms

Mobile telecommunications development in central and eastern Europe is receiving finance from four types of source:

- joint venture capital of foreign firms;
- loans to these joint ventures by commercial banks;
- the self-financing capability of existing operators and of mobile joint ventures; and
- loans from international financing institutions (IFIs).

The three main IFIs are the European Investment Bank (EIB), the European Bank for Reconstruction and Development (EBRD) and the International Bank for Reconstruction and Development (World Bank). In recent years these organisations have committed 1220 Million ECU for telecommunications development in central and eastern Europe and the CIS[14].

Over 90% of the funding has gone to telecommunications organisations. However joint venture cellular networks in Poland, Hungary and the Czech and Slovak Republics have all received some funding from the EBRD.

The EBRD has placed particular emphasis on supporting network and service development to serve the business market, hence its involvement in cellular networks. The broader strategy of the international financing institutions has been to take on infrastructure projects at an early stage to contribute to investor confidence. At the same time they have emphasised the roles of regulatory and sectoral reform in the establishment of a viable telecommunications services sector, and of tariff reform as a vital aspect in ensuring the required level of self-financing.

The European Community has assisted in the telecommunications reform process in central and eastern Europe through the PHARE Programme which has provided assistance through technical consultancy to operators and regulatory agencies in Poland, Hungary, Bulgaria the Czech and Slovak Republics and in Slovenia. In addition, it has funded rural telecommunications network development in Poland. The European Community has also instituted a parallel programme to PHARE, called TACIS, to provide technical assistance to countries in the CIS.

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[14] Commitments for telecommunications development represents approximately 18% of their total funding to the region (although it is 40% of the EBRD's total) and have mainly been allocated to support fixed network development. Funding has been directed towards projects with high commercial viability with business customers as the main target group. Projects are typically for overlay networks providing better international and trunk access to major urban centres.

6. THE WORLD-WIDE POSITION OF EUROPE IN DIGITAL MOBILE TECHNOLOGIES

While the mobile world market like the European market, is still dominated by analogue cellular technology, Europe is now gaining a major advantage, with the world-wide implementation of the GSM standard (the Global System for Mobile communications).

6.1 Adoption of GSM by operators

In the past, analogue cellular technology has become a considerable world-wide success. It has repeatedly outperformed its predicted growth and at mid-1993 there were an estimated 27.3 million subscribers. The United States accounted for 48% of the market, Europe 25% and the Asia/Pacific region 15%. Nine different analogue standards are in operation, but three of these dominate the world installed analogue base: AMPS, NMT and TACS.

- The US Advanced Mobile Phone Standard (AMPS) dominates the United States market and is used by 60% of analogue cellular installed base.

- The European Nordic Mobile Telephony Standards (NMT 450 and NMT 900) are the longest established standards with 13% of the installed base.

- The European Total Access System (TACS) variants have 16% of the installed base.

For cellular operators attention is now focused on ways to ensure continued market growth. They must improve their technological base so that many more customers can be served, to a higher standard, within the limitations of available frequencies. Operators are again choosing from three standards, each using digital technology:

- GSM, conceived as a global digital mobile standard, with its origin in Europe;

- The American USDC, the successor to the Advanced Mobile Phone Standard, which is developing in two, variants using TDMA and CDMA technology;

- The Japanese PDC standard.

As the first digital cellular standard to reach the market GSM has moved into position ahead of its two competitors. Originally developed for European markets the GSM standard has been adopted by a large number of countries outside Europe. It has become the preferred digital technology in Asia/Pacific (either as a unique standard or jointly with USDC) central and eastern Europe and the CIS and in the Middle East (see **Exhibit C1**). On the other hand all North American and Latin American countries are expected to adopt one or other of the USDC variants[15]. To

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[15] However, a number of trials in PCS in the United States will be based on the GSM standard and this may lead to a change in the situation.

date the Japanese digital standard has not been accepted by carriers in the Asia/Pacific outside Japan.

6.2 GSM has the potential for becoming a world standard for digital mobile communications

Notwithstanding the support of the United States and Japan for competing standards, GSM has the opportunity to become a de facto World standard for digital mobile communications in the 1990s. This potential will be realised if sufficient countries outside North and South America and Japan adopt the standard, increasing the installed base and enabling near-World roaming. Adoption depends firstly on GSM's availability, technical qualities and cost. Secondly, it will reflect the position of the proponents of different technologies and potential users and their broader international economic, geographical and social impact and inter-relationship.

GSM as the first digital cellular system to reach the market is well placed in availability terms. Relative costs will depend on the achievement of a sufficient market size to realise economies of scale, and on the efficiency of the manufacturers of the products.

However, GSM must overcome a number of problems for it to become a successful world-wide standard. These are:

- the resolution of current intellectual property rights disputes, being addressed within the forum of ETSI;
- ensuring that the adoption of different encryption algorithms does not hinder GSM's chances of becoming a world-wide technology. A common technology, conforming to the same standard, which can be used on a global basis will be the key to GSM's world-wide success;
- the production of a wide range of hand portables - at present the hand portable market is still constrained by supply problems.

Exhibit C1: Adoption of GSM technology world-wide - 108 licences already allocated or planned in 62 countries at end 1993.

	Countries allocating one licence	Countries allocating two licences	Countries allocating more than two licences
EU	Luxembourg	Belgium, Denmark, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, United Kingdom.	
Other Europe	Andorra, Austria, Croatia, Czech Republic, Estonia, Iceland, Latvia, Romania, Slovakia, Slovenia, Switzerland, Ukraine.	Finland, Hungary, Norway.	Sweden, Russia.
Other countries	Bahrain, Brunei Darussalam, Cameroon, Cyprus, Egypt, Fiji, Iran, Israel, Kuwait, Lebanon, Morocco, Nigeria, Oman, Pakistan, Qatar, Saudi Arabia, Singapore, Sri Lanka, Syria, Taiwan, United Arab Emirates, Viet Nam.	China, Indonesia, Malaysia, New Zealand, Philippines, South Africa, Thailand, Turkey.	Australia, Hong Kong, India.
	35 licences and countries	44 licences in 22 countries	29 licences in 5 countries

Source: CEC studies, regulator/operator information

6.3 The world market potential of other European digital mobile technologies: DECT, TFTS and others

A major lesson from the international acceptance of GSM is that there is considerable world-wide potential for suitable standards which have been adopted throughout Europe. Other European digital mobile technologies can achieve similar acceptance if these conditions are met.

In principle suitability depends on the extent to which technologies specified for the European market find equivalent conditions outside Europe, or the ease with which they can subsequently be adapted to the conditions which apply in other markets.

Furthermore, unequivocal acceptance of technologies in Europe is vital so that manufacturers can be sure of a large European market. Technology which achieves this acceptance increases the likelihood that they it be chosen by operators outside Europe. There will be a broad base of competing manufacturers and, as a consequence, infrastructure and terminal costs will be reduced in comparison to other technology choices.

DCS-1800 based on GSM should be able to build on the world-wide success of GSM. A major precondition for exploiting this potential will be wide-spread implementation of DCS-1800 based systems in Europe, as required evidence of its commercial and technical viability.

The Digital European Cordless Telephone standard (DECT) has been specified by ETSI to be suitable in a wide variety of situations and to offer a broad range of functions. This flexibility will encourage international use. Three types of applications are foreseen:

- business communications, including the provision of cordless private branch exchanges and cordless local area networks;
- small business and residential use where one or more handsets would use a common base station located on or near the premises; and
- public access - a telepoint type system in a neighbourhood or other public location.

The European TFTS (the Terrestrial Flight Telecommunications System) is the first digital terrestrial based telephone system for aeroplane passengers which will provide a cost effective alternative to satellite systems in the Europe continent. As it is based on a terrestrial network it should provide lower tariffs once deployed. The quality of the service will also be higher and will avoid current satellite-based time lags.

6.4 The position of the European mobile equipment manufacturing industry

The rapidly expanding World market for mobile communications can be expected to lead to changes in the competitive position of players in the telecommunications equipment industry. Suppliers with strengths in digital mobile switching, base station, and mobile terminal supply will gain compared to suppliers focused on "traditional" non-mobile telecommunications equipment.

With the establishment of GSM as a European and World standard there will be significant, new opportunities for European equipment manufacturers which chose to invest heavily in the development of GSM products in the late 1980s. With a buoyant home market in Europe and strong GSM growth in the Asia/Pacific region these manufacturers are well placed to benefit from World mobile communications growth.

The GSM system's non-proprietary nature is a key element in its acceptance by operators. The consequence for equipment vendors is that competition in GSM equipment supply will be keener than with other cellular technologies. Some manufacturers will enjoy success, while those unable to innovate and to control production costs may fail to benefit.

There are three identifiable segments in the equipment supply industry and successful vendors must be clear as to their strategies in addressing each, or a combination, of these. On the network side a combination of mobile switching technology and radio base station technology must be offered to win orders from operators. This can be provided from within the same vendor's organisation or through the formation of appropriate strategic or tactical alliances.

On the other hand, mobile terminals can be expected to move from being viewed as telecommunications equipment to mass-market consumer electronic products, whose consumer appeal and design will become increasingly important. They will often be integrated with other consumer goods, such as personal digital organisers. European companies wishing to compete successfully in this market must reach levels of efficiency in production achieved by Asian manufacturers of high-volume consumer goods. The associated dynamics of manufacturing design and marketing of products with short life-cycles must also be mastered.

7. GLOBAL SATELLITE-BASED PERSONAL COMMUNICATIONS SYSTEMS

7.1 Current projects

Most satellite PCS proposals (including those for Low-Earth-Orbit satellite systems (LEOs)) that have now been publicly put forward are largely but not exclusively American[16]. Non-US led projects include those in the former Soviet Union and European projects, such as the European Space Agency's project, EMS and Archimedes. In addition Inmarsat is now developing a satellite personal communications service, Inmarsat-P, possibly combining Geostationary (GEO) and Medium Earth (MEO) Orbits.

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[16] In August 1993, the investors in Iridium Inc. included Motorola, Lockheed, Raytheon and Sprint Corp. from the US, Nippon Iridium from Japan (a DDI led consortium), Mawarid from Saudi Arabia, Krunichev from the former Soviet Union, STET from Italy, Muidiri from Venezuela, United Communications Industry Corp. from Thailand and China Great Wall Industry Corp. from China.

In Globalstar, Loral is co-operating with the European space alliance: Alcatel (France), Aerospatiale (France), Alenia (Italy) and DASA (Germany). In Odyssee, Matra Marconi Space from France is working together with TRW.

7.2. Major issues involved

Any policy with regard to satellite-based personal communications systems must take into account the interests of users (these systems may offer a valuable addition to terrestrial based services), the interests of the manufacturing industry, and of service providers (satellite and other). In this context the Commission[17] has raised a number of issues in the satellite PCN area, relating to:

- regulation
- competition policy
- standardisation and intellectual property rights
- economic and industrial considerations
- multilateral framework and geo-political relations; and
- third generation mobile communications policy.

Policy in this area cannot limit itself to regulatory questions within the European Union, but must also address the wider trade issues and issues related to the competitiveness of European industry.

7.3. The issue of US dominance in the sector

Discussion of LEOs in Europe accelerated after WARC 92, in which the United States supported a major effort to allocate frequencies for these systems. Immediately after WARC the Commission initiated a discussion with Member States on the outcome of WARC 92 with regard to LEOs. The Commission subsequently met US officials in the United States and organised a hearing on LEOs in November 1992.

This initial exploratory action resulted in Spring 1993 in the publication by the Commission of its Communication on Satellite Personal Communications Systems, together with a proposal for a Council Resolution. In the Communication the Commission emphasised the importance of a pan-European strategy with regard to satellite PCSs. The Resolution was adopted by Council on 7 December 1993[18] and represents the starting point for a consistent policy in this area, both within the European Union and at an international level.

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[17] See the Commission Communication of 27 April 1993 and the proposal for a Council Resolution on Satellite Personal Communications, COM(93)171

[18] 93/C339/01; OJ C339/1, 16.12.93

8. CO-ORDINATION IN THE INTERNATIONAL TELECOMMUNICATIONS UNION (ITU)

8.1 Recent reform of radio communications co-ordination in the ITU

National spectrum management takes place within a complex framework of international conventions, treaties and regulations which are the responsibility of the ITU. The basic instrument of the ITU is the International Telecommunication Convention which has international treaty status. Regulations and plans for spectrum allocation and usage, known as ITU Radio Regulations, are agreed through regular World Administrative Radio Conferences (WARCs). Ratification by individual countries is voluntary, acknowledged in the ITU Constitution by the recognition of *"the sovereign right of each State to regulate its telecommunications..."*

ITU activities fall into three main areas:

- radio spectrum management
- provision of a forum for consultation between administrations, telecommunications organisations, including the definition of world-wide technical standards for equipment; and as
- a focus for technical assistance to developing countries.

For radio spectrum management, the WARCs have provided a forum in which to also agree spectrum allocation to services and frequency plans.

Since its recent reform[19], the ITU has created a Radiocommunication Sector integrating former CCIR activities (relating to the management of radio spectrum), with activities of the former International Frequency Registration Board (examining and registering notices for orbital positions of geostationary satellites and carrying out the calculations needed to ensure interference-free transmissions). The previous cycle of WARCs, which convened infrequently, have been replaced by World Radiocommunications Conferences (WRCs) held at two yearly intervals.

Available radio frequency spectrum is divided into bands allocated to several defined classes of services. At each WARC adjustments are made to the ITU Table of Allocations. New classes of "service" are defined and appropriate technical constraints upon services are agreed. ITU Radio Regulations define:

- 38 categories of service (for example, broadcast service, fixed service, mobile service and several satellite services); and
- degrees of priority:

  Primary services have first choice of frequencies and may claim protection against harmful interference from secondary services;

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[19] In 1989 the ITU set up a High Level Committee to consider its future in the light of general evolution in the telecommunications sector. Subsequently, a major organisational reform of ITU activities was initiated

- Secondary services cannot claim protection against a primary or permitted service to which a frequency band is also allocated;

- Permitted services have equal rights to a primary service except that, in the preparation of frequency plans, the primary service has prior choice of frequencies.

The allocation of frequencies may be uniform world-wide or may vary according to ITU region. For radio regulatory purposes, the ITU divides the world into three regions. Region 1 consists of Europe, Africa, the former USSR and Mongolia, Region 2 consists of the Americas and Region 3 consists of the remainder of Asia and Oceania.

By allocating frequencies to different services on an equal primary basis, providing differing allocations across regions and allowing the possibility of national allocations (through footnotes to the Table of Allocations) there is flexibility - but also potential for divergence - in frequency usage within national borders.

8.2 World Radiocommunications Conferences (WRCs) and European representation

There have been considerable changes to the European representation at WARCs, now the WRCs.

Since the WARC 92 in Torremolinos, the Commission is closely associated with the Member States and CEPT's European Radiocommunications Committee (ERC)[20] in preparing European positions for the Conferences. Co-ordination is proceeding on the basis of European Common Positions (ECPs) prepared by Ad hoc preparatory groups set up by the ERC, in which the Commission can participate. Community institutions will continue to play a role in the preparation of EPCs with a view to their submission to the WRCs, taking account of Union interests. Member States present at the Conferences, on the basis of agreed ECPs, a co-ordinated position. The Commission attends the Conferences with observer status.

The decisions taken at WARC 92 will have a substantial impact on the future environment for the development of mobile and personal communications in the European Union. (See Annex B for further detail).

9. ACCESS TO THIRD MARKETS

9.1 Position of third country manufacturers in the European market

A number of third country equipment manufacturers are active in the European and other GSM markets. In particular North American infrastructure suppliers and North American and Japanese terminal equipment manufacturers have established a presence in these markets.

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[20] See Annex B

Motorola is the fourth largest supplier of GSM infrastructure. It has sold base station equipment to operators in Germany, Norway, Portugal, Sweden and the UK. Northern Telecom has combined its expertise in switching with the base station and radio expertise of Matra Communications to form Nortel Matra Cellular which has made sales in Austria.

Motorola is the leading world-wide manufacturer of cellular handsets with 23% of the total world market. In the European GSM market it enjoys a similar position (and has assumed the role of price leader). Other non-European manufacturers with a significant share of the cellular handset market are NEC, Panasonic and Mitsubishi.

9.2 Position of third country operators in European mobile communications

At present there are a number of third country operators (mostly from the United States) which are active as mobile operators in the European market. These participate principally through the formation of joint ventures. A number of different strategies are being used and these depend on the specific national market addressed and the approach of the entrant company.

Some operators have entered the market by concentrating on setting up joint ventures in the countries of central and eastern Europe, where levels of infrastructure deployment and service quality have been low. US West has employed this approach successfully in Hungary, the Czech and Slovak Republics and Russia.

Others have chosen to participate in consortia bidding for second national GSM licence or other new licences issued by European Union Member States or EFTA countries. Successful licence consortium members include: Hutchison Whampoa which owns 65% of Hutchison Telecommunications, a UK DCS-1800/PCN licence holder; US West which owns 50% of Mercury Personal Communications, the other UK DCS-1800 operator; Pacific Telesis which owns 26% of Mannesman Mobilfunk in Germany and 23% of Telecel in Portugal; and Nynex which owns 20% of the Hellas GSM operator in Greece.

A final strategy which has emerged is the share participation in the mobile operator owned by the national telecommunications organisation. Pacific Telesis has acquired 25% of the Belgian mobile operator through this approach.

9.3 Issues of access to third country markets; ownership restrictions in the United States

While there is a significant non-European presence in the European mobile sector, as described above, European participation in a number of third country markets remains restricted. This is particularly the case in the United States which is to embark on a series of spectrum allocations (through auctions during 1994) for personal communications services in which European involvement will be limited by US regulations.

Section 310 of the Communications Act significantly inhibits the operation of mobile and satellite services and the provision of telecommunications and broadcast services by imposing limits on foreign ownership. As a result the FCC does not grant licences to operators owned by foreign governments or their "representatives" (a category into which most European Telecommunications Organisations fall) nor

to suppliers of broadcast, common carrier or aeronautical services in cases where the foreign ownership exceeds 20% (or 25% indirectly).

In addition foreign firms may face obstacles to the provision of common carrier services as a result of FCC authorisation procedure under Section 214 of the Communications Act of 1934. This requires the FCC to attach such conditions to the authorisation as it thinks are in the public interest, without there being any definition of this concept. The FCC has used the concept to delay - or impose conditions on - authorisations for foreign firms.

Obstacles are also created to international services through the FCC's "Dominant Carrier" rule. This rule - although recently amended so that carriers with a foreign ownership of 15% or more are no longer automatically classified as "dominant" - classifies carriers affiliated with a monopoly foreign carrier in the destination market being presumed dominant for the route involved. This subjects them to additional regulatory requirements only placed AT&T in the US.

From the history of treatment of common carrier telecommunications service providers these will only avoid discrimination if radio communications is not involved.

Furthermore, uncertainties about the extent to which federal regulation of major US common carriers may be reduced ("streamlined") and about possible involvement of sub-federal authorities in regulating "enhanced" (value-added) services, have led to concerns that foreign value added service providers may face new barriers to market entry or be insufficiently protected from predatory behaviour from US network operators. As the linking of mobile service provision with value added services (such as voice mail and electronic messaging) is vital to the personal communications strategy of any operator this is a serious concern.

9.4 The multilateral framework: the impact of the GATT Agreement

Many aspects of the European market for telecommunications are being influenced, directly or indirectly, by the issues discussed in the context of the GATT Uruguay Round. European Community positions within the Uruguay Round were expressed in conformity with Community's competence over trade set out in Article 113 of the EC Treaty.

For personal and mobile telecommunications services (as with other aspects of trade in goods and services) the Community's position in the negotiations covering basic telecommunications services, following on from the successful conclusion of the Uruguay Round, will remain closely linked to developments in the European Union's internal regulatory framework and the need for consistency between its internal and external positions.

Within the overall scope of the GATT, it is the negotiations on trade in services which are of most relevance to questions relating to this market. These have focused on the elaboration of a framework of principles applicable to trade in all services. This framework has been modified or complemented by sectorial annotations or annexes in order to take into account the specific aspects of different sectors.

For telecommunications the annex covers, in particular, appropriate conditions for access to and use of the network. The principles established in Directive

90/387/EEC on Open Network Provision (ONP) and Directive 90/388/EEC on competition on Telecommunications Services form the basis for the Community's position.

The European Community has bound a range of telecommunications services in its negotiating schedule and preparations are also underway for further negotiations on the liberalisation of "basic" telecommunications services, extending beyond the end of the Uruguay Round. After a period of public consultation following the publication of the Mobile Green Paper, those approaches which receive appropriate support will be incorporated into Union's regulatory framework. This will help to shape the Community's negotiating position.

Trade in mobile and personal communications services and equipment with third countries should be handled on the basis of common procedures by all Member States, based on the principles of the GATT framework. Other issues with a direct impact on trade and Union exports should also be subject to co-ordinated positions, notably as regards issues of the export of sensitive technologies[21] and of the measures necessary to obtain equivalent access to the markets of third countries.

The new GATT agreement should provide a mechanism for extending liberalisation of trade in telecommunications services, focusing on access to and use of networks in third countries in a balanced way.

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[21] In this context exportation of GSM encryption technology is a major issue.

10. CONCLUSIONS

The provision of cellular mobile radio telecommunications services is expanding rapidly World-wide.

This expansion is driven principally by the demands of business users for premium, mobile communications. However, the target base of subscribers is now widening in industrialised markets as service providers encourage the growth of personal mobile communications. Personal mobile communications will become a significant competitive mass market throughout the world before the end of the century.

The United States remains the largest single market for cellular mobile services.

Although the US transition to digital technology has been delayed by contention over which of two competing technologies to adopt, the FCC is acting to establish a flexible, market-led environment for the development of personal communications services. Competition between existing and new licence holders in services, availability and technology could lead to rapid roll-out of innovative new mobile services in the US. US interest in satellite-based systems is also intense and, with one exception, the consortia offering low-earth orbit (LEO) systems are US-led.

GSM is emerging as the World reference technology for digital mobile systems.

GSM technology is now being adopted in Europe, Asia, the Middle East, in Central and Eastern Europe and in the CIS, having been the first system to reach the market. The effects of scale economies and additional international roaming possibilities which GSM offers will cement its position as the World reference technology. US backing threatens to lead to the adoption of US technology in Latin America where the American analogue standard is widely implemented. High costs are hindering adoption of the Japanese digital standard outside Japan.

With the establishment of GSM as a European and World standard there will be significant, new opportunities for European equipment manufacturers.

Given a buoyant home market in Europe and strong GSM growth in the Asia/Pacific region, European manufacturers who chose to invest heavily in the development of GSM products in the late 1980s are well placed to benefit from World mobile communications growth. Of the six major GSM infrastructure suppliers five are European (Ericsson, Alcatel, Siemens, Philips and Nokia) and only one (Motorola) comes from outside Europe.

The eventual success of GSM on a World-wide basis will depend on long run relative prices for infrastructure and terminals.

Although international economic, geographic and social inter-relationships remain important in the choice of a particular standard; relative availability, technical qualities and, especially, the cost of GSM in comparison to other digital systems will determine its final potential. ETSI's harmonised technical specifications should result in greater freedom for multi-vendor equipment procurement and economies of scale, so driving infrastructure prices down. The influence of Japanese and Asian terminal equipment manufacturers will place further downward pressure on handset prices and will represent a major challenge for European equipment manufacturers.

For Central and Eastern Europe and the CIS, GSM will become the digital mobile technology of choice

Provided that the necessary frequencies in the 900 MHz spectrum can be cleared rapidly, GSM will be adopted widely in these countries as the preferred mobile standard.

For the European Union there will be a need to strengthen co-ordination of policy in the International Telecommunications Union

In particular work on Third Generation mobile systems will need major policy attention. WARC 92 has opened major world-wide frequency bands but has split off the American market from the rest of the World. For the European Union Community it will be important that co-ordinated positions are taken with regard to future frequency allocations so that Europe's service and equipment industries can benefit.

ANNEX D
EXTENSION OF THE PRINCIPLES OF EUROPEAN UNION TELECOMMUNICATIONS POLICY TO THE MOBILE SECTOR

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EXTENSION OF THE PRINCIPLES OF EUROPEAN UNION'S TELECOMMUNICATIONS POLICY TO THE MOBILE SECTOR

INTRODUCTION

On 22 July 1993 the Council of Ministers adopted Resolution 93/C213/01 setting out an overall timetable for the future development of telecommunications up to the end of the decade.

The Council Resolution also identified "the development of a future Community policy in the field of mobile and personal communications"[1] as a major goal of Community Telecommunications policy in the short term.

In extending the principles of Union telecommunications policy to mobile and personal communications, the provisions of the European Community Treaty and the consensus achieved around the positions proposed both in the 1987 Green Paper on the development of the Common Market for Telecommunications Services and Equipment[2] and the 1992 Telecommunications Review[3] on which Resolution 93/C213/01 was based, form a valid basis on which to proceed.

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1 The Council Resolution established the schedule for full liberalisation for public voice telephony services, namely 1 January 1998, with additional transitional periods of up to 5 years for Spain, Ireland, Greece and Portugal and if justified, of up to two years for Luxembourg. See Council Resolution 93/C213/01 of 22 July 1993 on the review of the situation in the telecommunications services sector and the need for further development in that market, O.J. C213, 6.8.93

2 Commission Communication of 30 June 1987, COM(87) 290 final.

3 Commission Communication of 28 April 1993 on the Consultation on the 1992 Review of the Situation in the Telecommunications Services Sector, COM(93) 159.

1 GENERAL PRINCIPLES

Building on the general consensus achieved on the future development of telecommunications, Union policy towards mobile and personal communications can draw on a number of basic principles, which have been successfully applied to fixed network telecommunications and satellite communications.

1.1 The provisions of the EC Treaty

These principles have been derived from the provisions of the EC Treaty ("the Treaty"), in particular:

Article 3(c) requiring the creation of an internal market characterised by the abolition, as between Member States, of the obstacles to the free movement of goods, persons, services and capital;

Article 3(g) requiring the institution of a system ensuring that competition in the internal market is not distorted;

Article 3(l) strengthening the competitiveness of Community industry;

Article 3(n) encouraging the establishment and development of trans-European networks;

Article 5 under which the Member States are bound to fulfil their obligations under the Treaty;

Articles 30 to 37 concerning the free movement of goods;

Articles 52 to 66 concerning the freedom to provide services and the freedom of establishment;

Articles 85, 86 and 90 setting out the Community competition rules;

Articles 110 to 115 concerning the common commercial policy;

Article 100(a) concerning the adoption of directives for the approximation of provisions laid down by law, regulation or administrative action in the Member States as directly affect establishment or functioning of the internal market.

Articles 129b concerning the establishment and development of creation of Trans-European Networks.

1.2 Application of the provisions of the Treaty to the telecommunications sector

The 1987 Green Paper led the European Community to establish the basic approach to what is now the European Union's telecommunications policy through:

- the liberalisation of the supply and provision of terminal and network equipment
- the liberalisation of telecommunications services
- the separation of regulatory and operational functions

- ensuring open access conditions to networks, as well as interworking and interconnection through Open Network Provision (ONP)

- promotion of European standardisation, through the creation of the European Telecommunications Standards Institute (ETSI)

- the full application of the Community Competition rules to the undertakings concerned

Beyond the Treaty Articles and the principles of the 1987 Green Paper, the Commission has issued Guidelines on the application of competition rules to the telecommunications sector[4], as well as subsequent Communications of the Commission and proposals for legislation and draft Commission directives.

Community policy in the field of satellite communications was set out in a Green Paper on a common approach in the field of satellite communications and the subsequent Council Resolution of 19 December 1991[5], as well as subsequent Communications and proposals for legislation.

2 EXCLUSIVE AND SPECIAL RIGHTS

A key element of the consensus over Community telecommunications policy has been the elimination of monopoly rights over terminal and network equipment and over the provision of telecommunications services, where these are incompatible with the Treaty.

2.1 The treatment of special and exclusive rights in the telecommunications sector

In relation to the manufacture and supply of telecommunications terminal equipment, exclusive and special rights were required to be abolished as a result of the adoption by the Commission of Directive 88/301/EEC[6] ("the Terminal Equipment Directive"). The scope of application of that directive extended to restrictions on the manufacture, supply, importation, connection, bringing into service and maintenance of both terminal and network equipment. No distinction was made between equipment for use on the wired network and equipment used in or with a wireless network.

The provision of mobile terminal and network equipment has consequently been open to competition since the end of 1988.

The provision of mobile communications services was expressly excluded from the scope of the Commission's Directive of 28 June 1990 on competition in the market for telecommunications services, ("the Services Directive")[7]. This Directive liberalised all

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4 OJ C233, 6.9.91.

5 Towards Europe-wide systems and services - Green Paper on a common approach in the field of satellite communications, COM(90) 490 final, 20.11.90 and Council Resolution 91/C8/01 of 19 December 1991 on the development of the common market for satellite communications and services., OJ C8, 14.1.92

6 Commission Directive 301/88 of 16 May 1988 on competition in the markets for telecommunications terminal equipment, 0J L131, 27.5.88

7 Commission Directive 90/388 of 28 June 1990 on Competition in the Markets for Telecommunications Services, OJ L192, 24.7.90.

telecommunications services other than basic voice telephony services and the provision of the physical network infrastructure. This allowed for the competitive provision of value added data services and some voice services from the end of 1990 and data communications services from 1 January 1993.

The Services Directive effectively identified those exclusive and special rights and the regulatory safeguards (particularly, the licensing conditions) which Member States could at that time maintain in conformity with Community law and, in particular, the competition rules.

Liberalised services could be subject to licensing conditions, providing such schemes were transparent, based on non-economic criteria, and non-discriminatory. Restrictions in such licences should be limited to the "essential requirements" i.e. network security and integrity, and, in justified cases, interoperability and data protection. In the case of data services for the general public, other regulatory safeguards could be imposed in the form of public service requirements under the form of trade regulations or in order to guarantee that the provision of basic voice telephony for the general public would not be undermined.

The objective of the Services Directive was to clarify the application of the Treaty rules to State measures relating to undertakings within the scope of Article 90 in the telecommunications sector, in so far as these measures regulate the provision of telecommunications services between fixed network termination points of the public network.

The exclusion of mobile communications from the Services Directive does not prevent the application of the EC Treaty to the mobile sector. The Treaty's competition rules, as well as the rules relating to the free movement of goods and services, can and have been applied to the provision of mobile communications services and equipment[8].

2.2 The application of the Treaty to exclusive and special rights in mobile communications

The full application of the Treaty rules to the mobile sector implies the absence or abolition of existing exclusive and special rights in the mobile telecommunications sector. Moreover, mobile and personal communications must be viewed in the context of the overall objectives of the Treaty and the new environment resulting from the agreement on the abolition of the remaining exclusive and special rights over the provision of voice telephony services by 1 January 1998. The relevant rules are, in particular, Article 59, 85, 86 and 90.

a) The rules on the free movement of services

Article 59 of the Treaty requires the abolition of all restrictions on the freedom to provide services within the Community. The grant of exclusive and special rights over the operation of mobile networks and over the provision of mobile communications services may prevent the development of pan-European mobile operators and service providers, as well as potentially preventing the entry of experienced mobile operators and service providers from one Member State into other national markets.

8 *Eirpage*, Commission Decision 91/562/EEC, OJ L306/22.

b) *The competition rules*

While subject to the specific situation in each market segment, the existence of exclusive rights in the mobile sector may result in a significant limitation in the supply of mobile communications services. It may also have the effect of slowing down the introduction of new, advanced services and competing technologies. In the case of analogue cellular services, for example, exclusive rights in certain Member States, have led to very uneven service development, with problems arising such as network saturation. Such problems have been compounded in those Member States which have also sought to maintain exclusive rights in relation to GSM.

In particular, the cumulative effect of the grant of a series of exclusive or special rights to a single operator, without appropriate safeguards, extend dominance in one market segment into a neighbouring market segment in contravention of Article 86 EC and may mean that the operator has little incentive to encourage a shift from one technology to another, in contrast to a competitive supplier who might see subscribers to the older technology as a key target in its marketing strategies.

The existence of a single network operator, or of a limited number chosen in a discretionary manner or enjoying a particular advantage, in each Member State may restrict competition by obliging both end users and service providers to obtain both network access and service provision from a single or limited source, without there being necessarily any technical justification for such a tie. This restriction on customer choice can be aggravated by regulatory restrictions on competition at the level of service provision. In the case of radio-based communications, the competitive concerns are heightened by the bottleneck created by limited spectrum availability.

Exclusive rights such as these which result in such restrictive effects are incompatible with the competition rules and in particular Article 90 in conjunction with Article 86.

The use of a discretionary licensing award procedure, (i.e. one not based on objective, transparent, non-discriminatory criteria, respecting the principle of proportionality), aggravates the restrictive effects of exclusive and special rights; slows down technical innovation and prevents all market participants enjoying an equal opportunity to access scarce frequency resources.

c) *Possible derogations from the Treaty rules*

Under Article 90(2) the non-application of the Treaty provisions can only be justified in cases, where their application to undertakings enjoying special and exclusive rights *"would obstruct in law or in fact the performance of a task of general economic interest"*. As an exception to the general philosophy of the Treaty removing barriers to the creation of the internal market and promoting a system of fair competition, the scope of this Article is interpreted narrowly.

In the Services Directive, the continuation of the voice monopoly was justified under Article 90(2) because of the universal service mission at that time assigned to public operators in all Member States. Specifically, the voice telephony monopoly would ensure that operators retained a sufficient revenue base for the provision of universal service.

On the other hand, the broad public consultation during 1992 lead to the conclusion that the monopoly would no longer be required after the necessary period of adaptation. This conclusion was shared by the Council.

Council Resolution 93/C213/02 confirms, as a result of the 1992 Telecoms Review that the basic voice monopoly will no longer be justified from 1 January 1998 onwards (with the exception of additional transitional periods of up to 5 years for Spain, Ireland, Greece and Portugal and where justified 2 years for Luxembourg) even to guarantee the provision of voice telephony for the general public via the fixed network.

Pending full liberalisation as agreed by Council, the scope of the voice telephony reservation as an exception to the general rule of competition must be narrowly interpreted. The definition of the voice telephony derogation does not extend to cover analogue and digital cellular telephony services.

- The scope of the definition in the Services Directive limits voice[9] telephony to the direct transport and switching of speech over the public telecommunications network between two network termination points. Mobile services are provided between one network termination point and a mobile base station rather than another network termination on the public network. Additionally, the use of mobile networks to interconnect with leased lines, for example, to deliver traffic within corporate networks or closed user groups, would also fall outside the definition of voice telephony for the same reason.

  Mobile services do not therefore fall within the definition of "voice telephony" in Directive 90/388/EEC.

Moreover, on the basis of such agreement in Council, the maintenance of exclusive or special rights in the mobile sector could not extend after the dates agreed in Council in order to protect the reserved voice services .

- The provision of a universal public voice service and network is unlikely to be undermined by further liberalisation in the mobile sector before the 1 January 1998. 95% of mobile traffic originates or terminates on the PSTN, thereby providing the fixed network operator with a substantial revenue flow. Mobile services as presently supplied are therefore a complementary source of revenue for the TOs rather than a means of by-passing their networks and services.

- Finally, experience in competitive mobile markets both in the Union and outside shows that the rapid growth in mobile services has not undermined the provision of universal service. Indeed, mobile services can make an important contribution to the achievement of the universal service goal, for example, by providing cost effective access in remote regions, or by providing access to emergency services when away from a fixed network connection.

There is a need to create an environment favourable to the rapid growth of mobile services and the evolution towards a personal communications environment. Exclusive

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9 Voice telephony is defined in Commission Directive 90/388/EEC (Services Directive) as the commercial provision for the public of the direct transport and switching of speech in real time between public switched network termination points, enabling any user to use equipment connected to such a network termination point in order to communicate with another termination point

and special rights in the mobile sector is creating a situation which is incompatible with the Treaty and in particular the objectives of the internal market and the Treaty competition rules. Moreover, these exclusive and special rights do not respond to the current need to create an environment favourable to the rapid growth of mobile services and the evolution towards a personal communications environment. Action is therefore needed to tackle the pattern of exclusive and special rights within the mobile sector. While action must take into account the specific characteristics of each market segment, the general principles of a Union approach should include :

- the abolition of exclusive and special rights in the mobile communications sector ;
- to the extent that Member States continue to take a technology-based approach to the licensing of mobile communications, as a general principle at least two operators in the same geographic market for each mobile technology should be licensed on the basis of objective, non-discriminatory and transparent licensing procedures, which are in accordance with the principle of proportionality ; and
- ensuring that market forces play a key role in determining the future numbers of market participants at both the operator and service provider level, subject to the overall application of the EC Treaty.

3 LICENSING CONDITIONS APPLICABLE TO THE OPERATION OF MOBILE COMMUNICATIONS SYSTEMS

3.1 Basic Union principles

Community law requires the abolition of restrictions on the freedom to provide of services within the European Community[10], as well as establishing the general goal set out in Article 7A of the Treaty of the creation of the internal market. Within the framework of the Treaty and the caselaw of the Court of Justice, certain restrictions on that freedom are nevertheless permitted if they fall within the exceptions on non economic grounds provided in Article 55 and 56 of the Treaty or if they fulfil essential requirements in the general interest and are applied without discrimination and in proportion to the objective sought.

This approach has been carried through into the telecommunications field, where Community law according to Directive 90/388/EEC and Directive 90/387/EEC of 30 June 1990[11] (the ONP Framework Directive), allows Member States to impose a limited number of conditions, which usually take the form of licensing conditions for the provision of specific services or systems. Such licensing conditions must be justified, proportionate to the objective sought, transparent and non-discriminatory.

a) General principles

The requirement of transparency means that licences should be published.

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10 See Commission interpretive communication 93/C334/03 concerning the free movement of services across frontiers, OJ C334, 9.12.93

11 Council Directive 90/387/EEC of 28 June 1990 on the establishment of the internal market for telecommunications services through the implementation of open network provision, OJ L192/1, 24.7.90

The requirement of non-discrimination means that the same licence conditions should in principle apply to publicly and privately owned mobile operators. At the same time differential licensing conditions may be appropriate between operators facing different market conditions (for example, a significant difference in the date on which each is allowed to enter the market).

Furthermore, the principle of non-dicrimination on grounds of nationality established in Articles 7 and 59 of the Treaty, requires that licences must not impose restrictions on ownership by nationals of Member States or undertakings controlled by nationals of Member States [12].

Mobile systems not intended for use by the general public (for example, private mobile radio systems used by closed user groups) should not be subject to more stringent restrictions than other non public systems using fixed network infrastructure.

b) Justifiable restrictions in national licenses

The Services Directive, the ONP measures and the two Directives ensuring the mutual recognition of type approvals for terminal equipment[13] have identified the limited range of restrictions which may be imposed within national authorisations for services or equipment intended for use by the general public. These restrictions are limited to those justified by:

- *essential requirements* (namely, network security, network integrity, prevention of frequency interference, the effective use of the frequency spectrum and, in justified cases, interoperability of services and data protection, and in the case of terminal equipment, user safety and the safety of the employees of the Operator).

- *public service requirements in the form of trade regulations* (concerning conditions to ensure the availability, permanence and quality of the service)[14]

- *the need to safeguard reserved monopoly services, where maintained in accordance with Community law*

In the absence of harmonised licence conditions at a Community level for the operation and provision of mobile communications, national licensing conditions for mobile systems intended for the general public should also be limited to these categories.

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12 Articles 4 and 36 of the Treaty establishing the European Economic Area from 1 January 1994 extends those principles to prevent restrictions being imposed on ownership by nationals of EEA States or undertakings controlled by nationals of EEA States (the EEA includes the Member States and Austria, Finland, Iceland, Liechtenstein, Norway and Sweden)

13 Council Directive 91/263/EEC of 29 April 1991 on the approximation of the laws of Member States concerning telecommunications terminal equipment including the mutual recognition of their conformity; OJ L128/1, 23.5.91, as modified by Council Directive of 29 October 1993 supplementing Directive 91/263/EEC in respect of satellite earth station equipment (93/97/EEC; OJ L290/1, 24.11.93.

14 The Services Directive, limited the imposition of trade regulations to basic data services, namely the provision of packet and circuit-switched data services for the public, subject to verification by the Commission of their compatibility with Treaty. The provision of such basic services were seen as forming a particular task entrusted by the Member States to telecommunications organisations.

studies carried out for the Commission[15] confirm that the majority of current national mobile licensing conditions are consistent with one or more of these three categories. Where this is not the case, such restrictions should be removed.

3.2 Essential requirements

As discussed in 3.1 above, restrictions imposed by National Regulatory Authorities in the licences of mobile systems intended for the general public must not restrict access to public mobile networks or services, except on the basis of the essential requirements in the general interest established in Community law.

Restrictions linked to *network security, integrity* and *interoperability of services* are likely to apply, in particular, to interconnection with other networks and services.

The *prevention of frequency interference* and the *effective use of frequency spectrum* are specific concerns for all radio-based communications.

It is essential that the proliferation of mobile communications, and accompanying base stations, antennae and handsets does not lead to unacceptable interference with other satellite or radio communications systems, or electromagnetic devices, such as hearing aids or vehicle electronics, in accordance with Directive 89/336/EEC[16] concerning electromagnetic interference, and in accordance with coordination procedures agreed at a European and international level (See section 4 below). Restrictions may go beyond the equipment itself and extend to the qualifications and training of those installing and maintaining mobile networks and equipment

Conditions in licences should seek to put both direct and indirect pressure on mobile operators to use less congested parts of the spectrum and employ technology or network configurations which maximize spectrum efficiency. This could be combined with requirements to ensure gradual migration from less efficient to more efficient technologies as these emerge.

Data protection and privacy issues are of general application, but the radio-based nature of mobile communications raises specific problems of interception of messages and the need within mobile networks to constantly track each subscriber's location. Mobile services should be subject to the same rules as those proposed for fixed and satellite networks and services[17]. The issue is considered further at section 5 below.

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15 See *Study on the application of ONP to mobile telephony, mobile data networks and paging services*, PA Consulting , December 1992 and *Licensing and Declaration procedures for mobile communications in Member States of the EC*, KPMG Peat Marwick Stanbrook and Hooper, August 1993

16 Council Directive of 3 May 1989 on the approximation of the laws of the Member States relating to electromagnetic compatibility (89/336/EEC, OJ L139/19, 23.5.89) and Council Directive of 28 April 1992 amending Directive 89/336/EEC on the approximation of the laws of the Member States relating to electromagnetic compatibility (92/31/EEC; OJ L126/11, 12.5.92)

17 See, in particular, the forthcoming amended proposal for a Council Directive covering the protection of personal data and privacy in the context of public digital telecommunications and in particular the Integrated Services Digital Network (ISDN) and Public Digital Mobile Networks, - to be published.

3.3 Public service requirements in the form of trade regulations

The terms upon which mobile services are offered is primarily a contractual issue between operators, service providers and customers. Nevertheless according to the Article 3 of the Services Directive in the case of data communications services, certain additional licence conditions referred to as public service requirements in the form of trade regulations, designed to ensure the permanence, availability and quality of a service may, subject to verification of compatibility with the Treaty, be imposed on the operation of services intended for the general public[18]. The same range of conditions should be considered for mobile systems intended for use by the general public where the number of licences which can be granted is limited on the basis of the essential requirements.

Such conditions are commonly applied in national licences[19], and relate, inter alia, to price levels, minimum service quality, geographical coverage, access to emergency services, provision of facilities for the customers with special needs, billing, and conditions ensuring the financial standing and technical competence of the licensee.

In contrast, the imposition of conditions in a licence which reflect a Member State's economic assessment of the capacity of a specific market or which would limit licences to specific operators, cannot normally be justified under Community law even if the objective sought may be legitimate (e.g. permanence of service), where other more proportionate means of achieving that objective could be used.

In order to avoid a disproportionate regulatory burden restricting the free provision of services or distorting competition in the Union, mobile systems not intended for the general public should not be subject to public service requirements in the form of trade regulations.

3.4 Duration

Variations[20] in the length of licences in different Member States for similar services can lead to considerable market distortions, both between services and between operators thus creating significant barriers to the development of internal market. The presence of an established operator or technology can act as a significant barrier to new market entry, whilst very long licence terms can restrict the dissemination of new technologies and services and may foreclose the introduction of systems making more efficient use of the frequency spectrum and therefore may contravene the competition rules. Moreover, the existing patchwork of licences makes the short-term creation of pan-European mobile communications market more difficult.

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18 Commission Directive 90/388/EEC (Services Directive) already foresees such conditions for the provision of packet or circuit switched data services for the general public (Article 3), subject to verification by the Commission of their compatibility with the Treaty.

19 See KPMG Study Chapters 5 and 8

20 The KPMG Study identifies variations within analogue cellular networks of between 10 to 25 years with many operators enjoying an indefinite licence period. In one case a private operator was granted a 10 year licence whilst its public competitor had an indefinite term. In GSM licence periods range from 5 years (renewable) to 25 years. See chapter 5.

In accordance with the principle of subsidiarity, the duration of licences should remain an issue for national rather than Community determination. In general, however, in accordance with the Community competition rules and the rules on the free movement of services, Member States in setting licence terms should take full account of market forces and the need to avoid restricting the introduction of new technologies and services.

In order to ensure no unfair restrictions on competition or undue limitation of new technologies and services, initial licence terms and 'standstills' on further licences should be based on the period required to ensure a sufficient start up period and/or a commercial return on the investment made in the service or network concerned.

3.5 Other conditions imposed on Mobile Operators

a) *Protection of reserved services.*

In relation to fixed network services, the Services Directive envisaged the possibility for additional restrictions which might be required to ensure the performance of the task of general economic interest assigned to the TO. This was specified in the case of data services (which have now been liberalised) and implicit in relation to the provision of voice telephony, and in particular, the provision and exploitation of a universal service.

Until voice telephony is fully liberalised in 1998[21], minimum regulatory safeguards may be envisaged to ensure that the public voice monopoly via the fixed network is not substantially undermined. However, this would not normally justify either, as discussed at section 2 above, the maintenance of exclusive or special rights in the mobile sector, or the imposition of other conditions in the absence of evidence of substantial network by-pass actually occurring. The same is true for restrictions on the use of mobile networks to provide services which are already open to competition, for example, services to closed user groups or corporate networks.

b) *License fees.*

The levying of excessive fees on operators in the form of licence or frequency fees can potentially create barriers incompatible with the internal market, and raise important competition issues, where the practical effect is to deter market entry or deny users a fair share of the benefits which lower fees might be expected to produce. They can also, if in the form of a percentage of profits or of turnover, place considerable burdens on new operators during the launch phase of their services.

One-off and annual fees levied on mobile operators should comply with the principles established within ONP of non-discrimination, transparency and proportionality.

In assessing whether fees charged are proportional, account must be taken of the balance between coverage of administrative costs involved in licence and frequency management and the real commercial value of the resource being allocated. Fees should not be levied in a discriminatory fashion.

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21 With additional transition periods of up to 5 years for Spain, Ireland, Greece and Portugal and where justified 2 years for Luxembourg

c) *Changes of ownership.*

Provisions restricting changes in the ownership of the licensee must be justifiable in terms of the needs to ensure continuing compliance with the essential requirements or public service requirements in the form of trade regulations imposed in licences.

3.6 Promotion of competitive service provision : obligations on Mobile Operators

The role of mobile network operators in controlling a bottleneck resource creates a difficult problem for Union policy. On the one hand, Union telecommunications policy is seeking to promote competition, and, in particular, innovative combined service offerings in order to meet market demand and to take the first steps towards a personal communication environment. On the other hand, the commercial autonomy of mobile system operators should be respected as far as possible, with regard to their basic freedom to choose with whom they contract.

In view of:

- the relatively rigid market structure that is likely to exist in the Community market because of the length of current licences granted for analogue and digital mobile technologies;

- the limitations which those mobile operating licences currently impose on combined offerings of services provided under different licences, thereby preventing existing operators from satisfying demand for such combined offerings; and

- the fact that many mobile network operators not only control the bottleneck facility on which competing service providers rely, but also provide mobile services themselves and are therefore likely to favour their own services ;

it appears that action is required to promote the development of effective competition through third party provision of mobile communications services.

Competition policy in the area of selective distribution normally precludes any limitation on the number of distributors appointed unless justified under the competition rules. This means that mobile network operators should, in line with their obligation to provide open, transparent and non-discriminatory conditions for interconnection (See section 6 below) be obliged to accept all reasonable requests by Service Providers to deal, within the limits of normal commercial practice and the Treaty competition rules (including requests from service providers integrated into other mobile network operations).

In addition to the remedies provided by the competition rules, it should be possible to bring any refusal to deal to the attention of the National Regulatory Authorities or other competent body.

3.7 Conditions applying to Service Providers and the provision of mobile communications services

In contrast to the operation of mobile systems, where the use of a scarce physical resource - the frequency spectrum - provides the basic justification for licensing and

other regulatory safeguards being imposed on mobile network operators, the provision of mobile and personal communications services should not be subject to licensing.

a) Service provision not to be subject to licensing

Service providers, whether independent or forming part of or integrated into mobile network operations, should not be subject to any licensing procedures and may be required only to make a declaration or notification of their activities to the National Regulatory Authority(ies) of the Member State(s) where they choose to operate.

In order to promote the maximum level of competition in the provision of mobile services, given the relatively rigid current licensing structure for mobile systems, restrictions should not be imposed which oblige or prevent service provision via independent service providers or via an integrated part of a mobile operator's business. Existing restrictions of this type should be abolished.

Further, subject to the application of the Treaty competition rules, Service Providers should not be restricted from offering innovative combinations of different mobile services, such as voice and paging services, or from providing mobile communications services throughout the European Union.

b) Ensuring compliance with essential requirements and public service requirements in the form of trade regulations

The imposition of regulatory controls and licence conditions on service providers, whether independent or integrated into or forming part of mobile network operations, would be disproportionate to the objectives sought at the level of service provision.

In practice, compliance with the essential requirements and public service requirements in the form of trade regulations will be secured through the obligations placed on the mobile operators whose services are being provided. The imposition of additional safeguards on service providers would add to their administrative overheads, potentially restrict technical and service innovation, and limit competition both within and between different mobile technologies.

Regulatory safeguards currently imposed on service providers should be replaced by an agreed voluntary *Code of Conduct*. This code should, in particular, identify on the basis of voluntary participation by Service Providers, measures and standard business practices, designed to safeguard the essential requirements.

It should also embody standards with regard to permanence, availability and quality of service, as well as guidelines concerning technical, financial and commercial practices. In relation to commercial practices, the Code should promote commercial behaviour which is entirely consistent with the Community competition rules, in particular, to avoid market sharing or anti-competitive pricing arrangements between operators or between service providers, and/or resale price maintenance between operators and service providers as well as preventing anti-competitive cross-subsidies between service revenues and mobile terminals. The Code of Conduct may include commitments in relation to the qualifications and training of staff.

The Code should also seek to ensure a high level of consumer protection, in particular by encouraging transparency in terms of pricing of services and customer contracts,

and where appropriate should provide mechanisms for dispute resolution and remedies[22].

Any national declaration procedure for Service Providers may also require them to indicate whether they participate in the Code of Conduct.

4. FREQUENCIES

4.1 Application of Union policy to radiofrequencies

The basic principles of Union policy with regard to access to radiofrequencies are found in the ONP Framework Directive, and in general principles, such as the separation of operational and regulatory activities, established by the Telecommunications Services Directive and the 1987 Green Paper.

Article 2(10) of the ONP Framework Directive provides for ONP conditions relating to usage "including access to frequencies where required". To the extent that such conditions exist in the Member States, they must be objective, non-discriminatory, transparent and proportional to the objective sought.

4.2 Community initiatives in the field of frequencies

At the same time, in a series of measures linked to the creation of the internal market for telecommunications, the Council has adopted technology-specific measures to promote the coordinated introduction of pan-European services. These specific measures were related to GSM (Global System for Mobile communications), DECT (Digital European cordless telephone) and ERMES (European Radio Message System) paging services[23]. A coordinated Community response was needed in each case to prevent national barriers in the form of frequency allocation or the manner of frequency assignment preventing the emergence of such pan-European services, as well as ensuring that competition is not distorted by national frequency policy. The Commission, reinforcing action undertaken within the European Conference of Post

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22 The concept of a consumer is defined in Article 2 of Directive 93/13/EEC of 5 April 1993 on Unfair Terms in Consumer Contracts, OJ L95/29, 21.4.93 as "any natural person who is acting for purposes which are outside his trade, business or profession".

23 See Council Recommendation 87/371/EEC of 25 June 1987 on the coordinated introduction of public pan-European cellular digital land-based mobile Communications in the European Community OJ L196/81, 17.7.87; Council Directive 87/372/EEC on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile Communications in the European Community OJ L196/85, 17.7.87; Council Recommendation 90/543/EEC of 9 October 1990 on the coordinated introduction of pan-European land-based public radio paging in the Community, OJ L310/23, 9.11.90; Council Directive 90/544 of 9 October 1993 on the frequency bands designated for the coordinated introduction of pan-European land-based public radio paging in the Community, OJ L310/28, 9.11.90; Council Resolution of 14 December 1990 on the final stage of the coordinated introduction of pan-European land based public digital mobile cellular communications in the Community (GSM), 90/263/EEC, OJ C263/9, 31.12.90; Council Directive 91/287/EEC of 7 June 1991 on the frequency bands to be designated for the coordinated introduction of digital European cordless telecommunications (DECT) into the Community, OJ L 144/45, 8.6.91; and Council Recommendation 91/288/EEC of 3 June 1991 on the coordinated introduction of digital European cordless telecommunications (DECT) into the Community, OJ L144/47, 8.6.91.

and Telecommunications Administrations (CEPT)[24] has also played a significant role in recent initiatives relating to the introduction of Digital Short Range Radio, Terrestrial Flight Telephone Systems and Road Transport Telematic Systems

4.3 Community approach to frequency planning and coordination at a European level

The basic approach to frequency planning, allocation, and co-ordination has been set out in Council Resolution 90/C166/02[25], which requires, inter alia, that the co-ordination of radiofrequencies must respect the principle of separation of regulatory and operational duties, while opinions from service providers, industry, users and standards bodies in researching the frequencies best suited to future applications should be sought.

Resolution 90/C166/2 calls for the promotion of the most efficient use of frequency spectrum, taking timely account of service provider and user requirements in the light of new standards and technologies.

Radiofrequency use must take place in accordance with the radioregulations of the International Telecommunications Union (ITU). Within this environment, work should proceed towards the timely allocation of sufficient frequency resources for the emerging mobile and satellite applications.

A further objective of efficient frequency planning should be to technically maximise the number of potential mobile operators, which implies there may be the technical potential for more than 2 operators of a given service.

Failure to promote mechanisms for the most efficient use of the spectrum or to ensure migration to new efficient technologies would undermine the competition principles in the Treaty. In particular, it would delay the dissemination of new and advanced technologies, and reinforce the competitive advantage of existing inefficient operators.

A coordinated approach to frequency allocation is also vital to minimise the possibility of frequency interference, in particular, in border areas.

The framework for frequency coordination in Europe has been defined in Council Resolution 90/C166/02, Council Resolution 92/C318/1, and the Conclusions of the Council on 7 December 1993, in response to the Commissions Communication on the New Approach to Frequency Coordination[26]. These identify the European Radiocommunications Committee, and its European Radiocommunications Office (ERC), as the basic forum for such coordination[27]. Given the importance attached to this forum by the Community, the Commission intends to develop, as soon as the appropriate legal framework is in place and in a manner consistent with Treaty

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24 For more detailed consideration of CEPT's role in the frequency field, see Annex B.

25 Council Resolution 90/166/02 of 28 June 1990 on the strengthening of the Europe-wide cooperation on radio frequencies, in particular with regard to services with a pan-European dimension, OJ C166, 7.7.90

26 A new approach to the coordination of radiofrequencies in the Community, communication from the Commission concerning the proposal for a Council Decision on the implementation by the Member States of measures concerning Radiofrequencies, COM(93) 382,10.9.93.

27 For more detailed consideration of the ERC and ERO, see Annex B.

obligations, a relationship with these two bodies similar to that which it has developed with the European Telecommunications Standardisation Institute[28].

This will advance priority work areas in the frequency field and ensure that Union interests are safeguarded. Once again, a key concern will be to ensure efficient, transparent procedures at a Community level which prevent the creation of barriers to the internal market. This will involve monitoring not only of the decisions taken by these bodies, but also the speed and extent to which ERC Decisions are actually implemented by the Member States.

4.4 Priorities in the field of frequency co-ordination

A number of immediate priorities for radiofrequency co-ordination for mobile communications in Europe result from the requirement to implement in the Union decisions taken at the World Administrative Radio Conference - WARC 92. These reflect the general worldwide trend discussed in Annexes A, B and C towards personal communications services.

As regards radiofrequencies for systems intended for the general public, short term priorities should include the establishment of decisions, and their practical implementation by the Member States, designating European and Community frequencies within the bands agreed at WARC for future use by terrestrial mobile communications and satellite-based communications systems.

In particular, this should include a firm commitment to common bands for DCS-1800 services, for future Universal Mobile Telecommunications Services (UMTS), and for frequency bands for satellite-based personal communications systems (including Low Earth Orbiting (LEO) Systems).

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28 See, *A new approach to the coordination of radiofrequencies in the Community*, Communication from the Commission, COM(93)382, 10.9.93. The main elements of the new approach envisaged by the Commission in the Communication of 10 September 1993 are as follows:

- As a first step, a decision as to whether Community action is required in particular areas of radio-frequencies will be decided according to defined criteria;

- The Council based on a Commission proposal, will adopt an annual work programme relating to work in the frequency field, including Work Requirements to the ERO to carry out the necessary technical work aiming at identifying appropriate frequency ranges.

- If binding measures are needed, Community legislation would not be proposed in a given area if the measures proposed by these technical bodies are in conformity with Community interests; all Member States implement the measures within a reasonable time scale and all measures are transposed into national law as follows:

  * all measures are implemented in conformity with the requirements set out for the appropriate transposition of Community Directives in national law,

  * Member States transmit to the Commission within a reasonable period, the text of the laws, regulations and administrative provisions necessary to comply with each ERC Decision,

  * the Commission will publish in the Official Journal references to the implementing texts, in order to achieve adequate transparency.

If any of the above conditions are not met, the Commission will propose a Community instrument for adoption.

Decisions should also firmly identify standards to be used, either existing or in development, as well as firm schedules for the progressive availability of the frequencies concerned leading to full implementation by the Member States.

As regards systems intended for own use or for the use of closed user groups (private mobile radio and mobile data services), an immediate priority should be a decision designating frequency bands, (including a time schedule for their availability), for systems using the European digital trunking standard (TETRA). This will be of particular importance, in the context of the increasing co-operation between police forces and between public authorities within the framework of the Treaty on European Union and the Schengen Agreement[29].

4.5 Community approach to frequency planning and coordination at an international level

Council Resolution 90/C166/02 also calls for developing common European positions in relation to the use and harmonisation of the frequency spectrum at an international level. While NRAs take individual national decisions on the assignment of frequencies and reach certain collective decisions within the forum of the CEPT, the scope of such decisions is limited by agreements at the international level within the ITU, in particular those taken at WARC 92. Those agreements have the force of a treaty. It should be recalled that, Member States are required to ensure that international commitments, entered into after the date of entry into force of the EC Treaty are applied in a manner consistent with Community law and policy. It is therefore usual practice that the Member States enter into the minutes of such conferences that they will apply the results of the conference in accordance with Community law.

A common European position was followed at WARC 92, where important decisions were taken concerning mobile and other, more specific allocations at both lower and higher frequencies. These changes, will in time, permit wider use of the band 1-3 GHz for mobile services, both terrestrial and satellite based[30].

The Commission intends to follow such an approach at future WRCs, so that the global Community priorities are integrated into worldwide planning as a means of boosting the competitive position of industry in the European Union. Community priorities in relation to regional frequency coordination should be reflected in the Community's approach to WRC '95 and WRC '97.

5. DATA PROTECTION AND PROTECTION OF PRIVACY

In the absence of a co-ordinated Community approach towards both data protection and data privacy issues, ten Member States have adopted their own laws placing restrictions on telecommunications services and data processing designed to ensure adequate data protection. The level of protection varies considerably from Member State to Member State creating significant distortions for the internal market. Most of these laws target general data protection and privacy issues, rather than being

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29 Other areas to be addressed should include wireless Local Area Networks and Wireless Local Loop and communications for use in transport systems, for example, systems allowing communications whilst travelling by train.

30 For more detailed considerations of the results of WARC 92, see Annex C, section 9.

specifically targeted at either the fixed or mobile networks or the most modern digital technologies.

Concerns about such barriers and the issue of data protection in general were raised in the 1987 Green Paper, where data protection and privacy was identified as a major sectoral goal. In 1990 the Commission tabled a package of proposals (including two draft directives) concerning personal data and information security, as a central element in the Single Market programme[31].

The general data protection Directive establishes principles which will apply horizontally to all aspects of data protection within the internal market. A specific telecommunications data protection Directive, adapts these as far as is necessary to the data protection and privacy issues inherent in digital telecommunications technology.

When adopted, this specific telecommunications Directive will:

- Limit the period of storage of sensitive billing data which would allow a subscriber to be identified;
- Require per line or per call elimination at the caller's request of Calling Line Identification ;
- Limit call forwarding to a third party number only with the consent of the third party; and
- Provide a right not to receive unsolicited calls

Further development of this framework may be needed to address the issues raised by mobile communications. Whilst the move from analogue to digital technologies will in general substantially reduce the possibilities for unauthorised interception of mobile communications through the use of highly sophisticated encryption techniques, it also adds urgency to the need for a clear framework for effective data security, storage, processing and privacy. This will require a precise monitoring of the effective operation of the General Data Protection Directive and the specific Telecommunications Directive. This framework should develop, in particular, in relation to:

- *The protection of personal details concerning subscribers* (for example, there is a need to ensure use by service providers is restricted to registration and billing purposes only; the need to ensure that data relating to credit-worthiness and billing information is not communicated to third parties)
- *Security of the call*

31 Amended proposal for a Council Directive on the protection of individuals with regard to the processing of personal data and on the free movement of such data, COM (92) 422, 15.12.92 ("the general data protection directive") and the forthcoming Modified proposal for a Council Directive concerning the protection of personal data and privacy in the context of public digital telecommunications network, in particular the Integrated Services Digital Network and digital mobile networks (not yet published)

- *The confidentiality of the subscriber's movements* (Need to ensure that a caller or third party is not aware of called party's location[32]; need to limit disclosure of called party's location to roaming partners and / or service providers strictly for billing purposes only).

At the same time, access to and storage of operational and call data processed in the context of mobile telecommunications networks, is a vital component of effective service provision. Access must therefore be subject to the Community competition rules, within the limits of data privacy established above.

With regard to the future approach towards personal communications, consideration should be given to appropriate solutions, providing, for example, the necessary degree of flexibility in relation to caller identification for the different market participants and different services, This should take into account of experience in other areas, in particular, in relation to caller identification in digital fixed networks and experience in relation to videotex services.

Security of information systems has been addressed in a more general context in the framework of the European Communities action plan on this issue, established by Council Decision 92/242/EEC[33]. With regard to mobile and personal communication systems, major issues are raised by authentication, prevention of fraud, protection of network management, databases and service providers[34].

6 INTERCONNECTION AND INTERFACES

Assuring adequate interconnection of networks and services, and the related commercial and technical interfaces, has been a fundamental concern of Community regulatory and competition policy.

From the review of the environment for the future development of the mobile sector in Annex B, two sets of interfaces emerge as vital for the future development of mobile systems:

- the interface between the fixed network and the mobile network, and between mobile networks
- the interfaces between the mobile operator and the service provider.

With the exception of the interface provided from the TO to Mobile Operators[35], these interfaces are not subject to specific regulations within the Community framework. Regulatory principles for these interfaces are necessary because :

- both interfaces are potential bottle-necks : for a mobile operator, the limited number of infrastructure providers/fixed network operators represents a bottle-neck, particularly, if

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32 Within GSM, tariff principles have been agreed to bill the called subscriber for additional charges incurred when his or her terminal is roaming or where a call forwarding facility is being used, precisely in order to prevent a caller knowing that the person is at a different location or roaming outside his or her subscription territory.

33 Council Decision of 31 March 1992 in the field of security information systems (92/242/EEC;OJ L123/19,8.5.92)

34 See also the forthcoming Green Paper on the Security of Information Systems.

35 Proposal for a Council Directive on the application of Open Network Provision (ONP) to Voice Telephony.

there is an obligation only to connect to other mobile systems, within a Member State or on a trans-border basis, through the existing fixed networks; and for a service provider, the limited number of mobile operators represents a bottle-neck.

- the issue of vertical integration arises : allowing the same organisation to operate fixed and mobile networks and to provide services raises competition issues, which also require regulatory safeguards to be put in place.

In addition, the fixed public network constitutes not only a physical bottleneck for other mobile systems and services, but also a technological one. The varying progress made throughout the European Union in the introduction of advanced signalling systems and the delays experienced has the potential to severely hamper inter-system roaming for GSM and other mobile technologies. For this reason, regulatory restrictions on direct interconnection between mobile operators in different Member States, and the provision of own or third party infrastructure must be addressed. (The issue of infrastructure provision is returned to in section 9 below).

Access to intelligent network functions, both within mobile and fixed networks intended for use by the general public, will also be a key feature in the evolution towards a personal communications environment.

At the same time, these concerns must be balanced with the need to reduce regulatory safeguards to a minimum in an increasingly competitive market. Therefore, subject to the application of the general ONP principles discussed below, the terms and conditions on which interconnection is granted should be a matter for commercial and technical agreement between the parties concerned

6.1 The basic principles for interconnection in the Union

The basic principles for the interconnection of mobile communications networks with the public fixed network should be in accordance with the competition rules and with the principles set in the ONP Framework Directive and the proposal for a Council Directive on the application of Open Network Provision to Voice Telephony[36] (the Voice Telephony Directive) and Council Directive 92/44/EEC[37] (the Leased Lines Directive)[38].

These measures require that interconnection conditions between the fixed and mobile networks and between mobile networks and service providers must be based on

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36 Proposal for a Council Directive on the application of Open Network Provision (ONP) to Voice Telephony, COM(92)247, 17.8.92. Common position adopted 1 July 1993

37 Council Directive 92/44/EEC of 5 June 1992 on the application of Open Network Provision to Leased Lines, OJ L165/27, 9.6.92

38 The application of the ONP Framework in strictly legal terms is currently still linked in general to network operators enjoying exclusive or special rights. In the context of the implementation of Council Resolution 93/C213/01 of 22 July 1993 on the review of the situation in the telecommunication sector and the Council Resolution of 7 December 1993 on Universal Service, the Commission has declared at the Council of 7 December 1993 that within the review of the Open Network Provision Framework foreseen within the regulatory adjustments required by these resolutions by 1 January 1996, it is likely that the application of Open Network Provision will be based on market position and no longer on exclusive and special rights.

The discussion of ONP Principles in the sector should be read with this Declaration in mind.

objective criteria, be transparent and non-discriminatory, and be compatible with the principle of proportionality[39]. They must also respect the essential requirements. Interconnection and other related charges must be cost-orientated, fully justified and approved by the National Regulatory Authority (NRA).

The principle of transparency requires that NRAs have full access to interconnection agreements and that such information be made available to the Commission on request.

These ONP measures address four key areas for the development of mobile communications networks and services, namely:

- interoperability
- interconnection
- access to leased lines, and
- access to voice telephony services (i.e. the fixed public network).

a) Interoperability

Interoperability in this context is equivalent to the term 'interworking' and refers to the end-to-end interaction between similar systems. At a Community level, it has been agreed that end-to-end interoperability of terminal equipment is a requirement for the public voice telephony service, and appropriate provisions are included in the relevant Common Technical Regulations drawn up in accordance with Directive 91/263/EEC[40]. In the terms of this Directive, Voice telephony is known as a 'justified case'.

The implications of voice telephony being a justified case are that, in a multi-network environment when calls may be routed over several linked public networks, steps should be taken to ensure that the end-to-end quality of the call is not unduly impaired. This implies 'rules' (which may be voluntary or mandatory) governing both the quality of individual networks and the routing of individual calls.

Up to now, ITU recommendations have proved adequate to secure end-to-end quality for international calls. However, the traditional architecture of the international telephone network is challenged by the introduction of mobile systems, and new 'rules' must be formulated.

In a strongly competitive market, this type of voluntary recommendations established in an international context may prove inadequate, so that additional action may be required in order to ensure the quality of services.

b) Interconnection

Principles for interconnection are contained within the various Directives and recommendations drawn up within ONP. ONP was developed among other reasons, to ensure competitive equality when services were liberalised.

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39 Where an operator has both a fixed and a mobile network there needs to be adequate separation, in particular concerning their accounting practices.

40 Directive 91/263/EEC of 29 April 1991 on 'The approximation of the laws of the Member States concerning telecommunications terminal equipment, including the mutual recognition of their conformity', OJ L128, 23.5.91

Community regulatory policy places no line-of-business restrictions preventing fixed network operators from offering competitive services over their own networks, but does require that there is fair competition for all competitive service providers at the interface to the fixed network.

The interconnection of mobile communications must be consistent with certain basic principles of transparency, non discrimination and equality of access to the fixed network. ONP conditions concern technical interfaces, tariffs, and supply and usage conditions.

c) *Provisions of the ONP Leased Lines Directive*

Whilst the ONP Leased Lines Directive does not single out mobile services specifically, it provides important foundations which benefit mobile services of all types to the extent that they rely on leased line capacity[41]

An important safeguard is the requirement that:

> *"national regulatory authorities shall ensure that telecommunications organisations adhere to the principle of non-discrimination when they make use of the public telecommunications network for providing services which are or may be provided by other service providers. When telecommunications organisations use leased lines for the provision of services not covered by special and/or exclusive rights, the same type of leased line must be provided to other users on request and under equal conditions."*(Article 8(2))

In the mobile environment, this means that where a fixed network operator also offers a mobile service, the leased line facilities made available to its integrated mobile business must be provided on equal conditions to the leased lines offered to other third party mobile service providers. The important elements of cost, delivery time and types of technical interface are all included in this requirement.

The Directive also sets up a new type of conciliation procedure, so that users complaining of actual or potential injury caused by an infringement of the provisions of this Directive, particularly regarding intra-Community leased lines, have the right of appeal to their national regulatory authority and also to the Commission.

d) *Provisions of ONP Voice Telephony Directive*

The Common Position of ONP Voice Telephony Directive, which is expected to come into force in early 1995, places obligations on the operators of fixed

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41 Council Directive 92/44/EEC requires, inter alia:

- abolition of technical restrictions on the interconnection of leased lines with each other or with the public switched network
- publication of information about leased line offerings
- tariffs which are cost-oriented and independent of the type of application for which the lines will be used.
- harmonised provision throughout the Community of a minimum set of leased lines, including analogue lines, digital 64 kbit/s and 2Mbit/s lines

networks to provide access to mobile network operators[42]. The Directive makes no distinction between interconnecting circuits used for the exchange of traffic and interconnecting circuits used for the exchange of signalling information; both are covered by the provisions.

6.2 The future role of ONP in mobile systems and interfaces

a) The fixed/mobile interface

The Common Position on the Voice Telephony Directive sets out a framework for interconnection of mobile and fixed networks.

The essence of this framework is that interconnection is a matter of commercial agreement between operators, in accordance with Community law, subject to general supervision by the NRA (which may involve setting *a priori* requirements). The NRA also has a role in dispute resolution.

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42 The Common Position by Council of 1.7.1993 provides that:

- Fixed network operators must accept all reasonable requests for interconnection from mobile network operators in the same Member State.
- Member States may decide that certain mobile network operators have the right to request interconnection with fixed networks in other Member States. Names to be notified to the Commission for publication in the Official Journal.
- Notified Mobile network operators may request interconnection to the fixed networks in other Member States, but in this case there is, currently, no obligation to meet such reasonable requests.
- Fixed network operators, however, cannot refuse a request for interconnection from a mobile network operator in either the same or another Member State, without prior agreement of his national regulatory authority.
- Right of the NRA to intervene to set conditions, which ensure that interconnection conditions are non-discriminatory, fair and reasonable; offer the greatest benefit to all users; provide for dispute resolution; and also set conditions concerning standards, essential requirements and/or quality.
- Non discrimination: TOs must not discriminate when they make use of the fixed network for providing other services which are or may be supplied by other services providers.

According to the Common Position, Member States currently decide which fixed network operators in their territory are subject to the Directive, and notify the names to the Commission for publication in the Official Journal.

Mobile-to-mobile interconnection is currently not included in this framework.

According to Council Resolution (94/C 48/01) of 7th February 1994 on universal service principles in the telecommunications sector, the Commission should investigate "where under universal service obligations a basic voice telephony service can only be provided at a loss or provided under cost conditions falling outside normal commercial standards" and "draw up common access charge principles, in close consultation with the high-level committee of the national regulatory authorities".

The common position on the Voice Telephony Directive states that "if interconnection agreements include specific compensation provisions for the telecommunications organisation in situations where different operating conditions, e.g. price controls or universal service obligations, are imposed upon the respective parties, such compensation provisions shall be cost oriented, non-discriminatory and fully justified, and shall only be applied with the approval of the national regulatory authority acting in accordance with Community law".

Three enhancements to this framework need to be considered in order to meet the needs identified for mobile communications:

- To ensure fair competition, the scope of application of ONP principles as laid down in the Framework Directive, and the specific provisions of the Voice Telephony Directive dealing with interconnection and tariffs must be reviewed.

- To stimulate Union-wide mobile networks and services, Member States should remove regulatory barriers to the interconnection of mobile services across frontiers

- To encourage roaming, the rights of access by mobile network operators to the signalling systems of the fixed network should be clarified.

b) The mobile/mobile interface

Mobile - mobile interconnection is outside the scope of the proposed Voice Telephony Directive, and is currently only subject to national licensing arrangements.

Once exclusive and special rights for the provision of mobile networks are removed, it seems inappropriate to impose comprehensive ONP conditions on the interconnection between mobile operators. Only the general provision and principles of the ONP Framework Directive (Directive 90/387/EEC) should apply. At this stage, it is not considered necessary to establish further specific Directives at Community level, concerning these interfaces and related interconnection conditions, provided these are subject to strict supervision by National Regulatory Authorities to ensure full application of those principles and the establishment of suitable dispute resolution and control procedures.

Mobile network operators should have the right to directly connect with other mobile operators both within Member States and between Member States for the provision of all services within the scope of their operating licenses.

Bilateral negotiations on commercial and technical issues are the most appropriate mechanism for dealing with mobile-mobile interconnection, subject to NRA oversight in the event that agreement cannot be reached. The NRA should have a power to intervene to set conditions in accordance with the principles indicated above.

In the case of mobile systems, such as PAMR and mobile data networks, licensed only for own use or use by closed user groups, (Private Mobile Radio), there should be no restrictions on interconnection with the public fixed network, other than those permitted by Community law namely, restrictions based on the essential requirements: network security, integrity and interoperability of services, the prevention of frequency interference and the effective use of frequency spectrum, and data protection and privacy. The general principles of ONP outlined above with regard to access to the fixed public network should apply.

The activities which may be carried on via such interconnections must be all those permitted under the licence authorising that private network. In principle, any conditions applied should not be more onerous than those applying to other closed user groups operating over the public fixed network.

c) *The mobile operator/service provider interface*

The ONP principles of non-discrimination, transparency and equality of access should apply to the Mobile Operator - Service Provider interface. The relationship will also be subject to the application of the Community competition rules.

One difference to the mobile-fixed interface is, however, that this is in most cases essentially an administrative/management interface rather than a technical one. While the principles of the ONP framework should apply, application of more detailed ONP requirements will not normally be necessary.

There should be no requirement for structural separation, beyond any requirement for arms length dealing applied as a normal competition principle, between the functions of mobile network operation and service provision. However, the application of ONP principles would imply the following when a mobile network operator also offers services directly and therefore also act as a service provider:

- clear accounting rules for cost allocation between network operation and service provision
- equality of access to the mobile network for all service providers
- non-discrimination in interconnection conditions for all service providers
- transparency of interconnection requirements
- minimum set of mobile network operator offerings to facilitate pan-European service provision

The NRA should have the power to enforce these principles where required.

6.3 Access to intelligent network features

Annex A highlights the trend towards personal mobility, personal communications systems and the convergence towards combined offerings of services provided via a mobile network and those provided over fixed networks.

The necessary condition for achieving such mobility is access to the intelligent network (IN) functionality (interfaces / software codes / signalling systems) already located in mobile networks and, increasingly being implemented in the fixed network.

In principle, access arrangements to these functionalities should be subject to commercial and technical agreement between the mobile and fixed network operators, subject to the application of the general principles of the ONP framework and Treaty competition rules.

In particular cases, where mobile and fixed networks are owned and operated by the same organisation, the application of the ONP principles of non-discrimination and equality of access needs to be safeguarded particularly to prevent discrimination against other network operators.

a) *Access to the IN functions of the fixed network*

When a mobile network operator owned in full or in part by a fixed network operator with a dominant position in the supply of voice telephony services is given access to the IN functions of the fixed network, the same types of access should be given to all other mobile operators.

b) *Access to the IN functions of mobile networks*

Fixed network operators should also have rights to negotiate access to the IN functions of a mobile operator. Since the proposed Voice Telephony Directive does not impose obligations on mobile operators, the basic principles of the ONP Framework such as transparency, non discrimination and the justification of refusals to supply lines should apply.

6.4 The role of standards in interconnection

A major objective of the Community has been the promotion of European standards, in order to ensure interconnection.

At the same time the principle of proportionality requires that voluntary application of standards should be given preference and that recourse to mandatory as opposed to voluntary standards should be strictly limited to those interfaces and situations, where mandatory standards are absolutely necessary to ensure interoperability.

These concerns have been reflected in the approach followed in the ONP framework with regard to encouraging the standardisation process, whilst at the same time restricting to a minimum the transformation of European standards into mandatory standards.

In order to facilitate interconnection of mobile networks and services, the establishment of technical standards concerning the interfaces discussed above should be promoted and resulting standards published, where required, in accordance with the provisions of Article 5(1) of the ONP Framework Directive.

In accordance with Article 5(1) of the ONP Framework Directive, the principle of the voluntary application of standards should apply. Only in cases where it is strictly necessary to ensure basic interoperability and freedom of choice for users and subject to the principle of proportionality, should references to standards be made binding under the provision of Article 5(3) of the ONP Framework Directive.

7. THE LICENCE APPLICATION/ADJUDICATION PROCESS

7.1 Limiting the number of operators to allocate limited resources

Whilst efficient frequency planning will maximise the number of potential operators, the technical limitations which the frequency spectrum imposes on the number of mobile networks means that in most cases Member States currently have to set up procedures in order to determine to whom frequency spectrum will be allocated. This involves a choice both of individual operators for a particular service, but also a more general choice between technologies as to how much spectrum each technology should be allocated.

Whilst it is accepted that frequency considerations will continue to limit competition between mobile networks, the removal of exclusive and special rights in the mobile sector requires the application of existing Union principles to the licensing award procedures. This will overcome the barriers to greater competition and to the development of the internal market which result from current discretionary and nationally-focused award procedures for licences and frequencies.

Licence awards must respect the competition rules and must be based on open, non-discriminatory, and transparent procedures. Where this is not the case, or where there are arbitrary restrictions on the range of undertakings from whom applications can be received, the award procedure can have a detrimental impact on the market structure in that Member State and in the European Union.

In particular, the automatic grant of licences to certain public operators or restrictions on licence applications from operators active in other telecommunications sectors or in other Member States may distort competition.

Unless such restrictions are justified, for example, in order to prevent the extension of market dominance on one market to a neighbouring market or service, inappropriate restrictions should not be applied. Such restrictions on the range of applicants can reduce efficiency and limit consumer benefits, which would normally be derived from the resulting economies of scope and scale, as well as commercial experience in other markets.

Where the number of operators is limited by a Member State, this limit is a potential restriction on the freedom to provide services and must be justified under European law. In particular, any limitation on numbers must normally be justified on the basis of either the essential requirements, such as the efficient use of frequency spectrum, and/or public service requirements in the form of trade regulations, and must be consistent with the Community competition rules.

Any limitation should respect the principle of proportionality, by imposing the solution which is least limiting and must give priority to competitive provision.

7.2 Principles for licensing award procedures

Licensing procedures must respect the principle of the separation of regulatory and operational functions established in Union telecommunications policy.

In order to guarantee that licensing procedures are open, non-discriminatory and transparent[43], Member States should ensure that :

- all applicants are subject to the same assessment procedures, unless there is an objective reason for differentiation;

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43 The Studies carried out for the Commission indicated that current licence award procedures were in a number of cases a major barrier to the development of mobile communications. A particular concern was the tendency in specific market segments towards automatic licensing of the Telecommunications Organisation and separate tender procedures for other licences, which has the effect of strengthening the dominance of the TO in a manner which could be inconsistent with Article 86. See KPMG, Chapter 5.2 where the lack of openness in award procedures, uncertain adjudicating methods, no time limits and few rights of appeal were identified as key industry concerns.

- all assessment criteria are known to the applicants in advance;
- reasonable time limits are set and applied for each award procedure ; and
- effective and rapid appeal procedures are established for unsuccessful applicants.

Furthermore, the criteria used in any award procedure must also be consistent with Community law, and, in particular, should ensure compliance with the essential requirements and public service requirements in the form of trade regulations. Without such a framework, it will be difficult to verify that licences were not being granted on the basis of non-objective criteria, effectively leading to the continuation of special rights.

It should be recalled that according to EC case law and to both the Services Directive and the ONP Framework Directive, the essential requirements are *non-economic* reasons in the general interest which may cause a Member State to restrict access to networks and services. Public service requirements in the form of trade regulations should be limited to permanence, availability and quality of the service.

In both cases, these limitations must be objective, non-discriminatory and transparent. Licence numbers may not therefore be restricted on the basis of a subjective economic assessment of the awarding body of the number of operators a specific market can hold.

Whilst such assessments may be relevant to considering the technical or financial capability of applicants to provide a service of sufficient quality over the licence period, a general economic assessment can only be accepted if consistent with any public service requirements in the form of trade regulations which might be imposed in the licences granted.

In general, market forces, rather than regulatory authorities at a national or Community level, should decide future market structures, subject always to the application of the Community competition rules and the overall safeguards found in the Treaty.

7.3 Choice of licensing procedures

What ever method of allocation used - first come / first served, comparative bidding, auctioning or lottery, or any other method which may emerge, - it must be chosen and implemented in a way that ensures that the final selection offers the maximum guarantees for full respect of the essential requirements and the achievement of the goals laid down in any public service requirements in the form of trade regulations. In particular, the method chosen should ensure that users enjoy a fair share of any benefits, especially in terms of lower pricing levels.

Within the framework set out above, Member States shall remain generally free to decide what specific award procedures they wish to adopt[44].

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44 The studies carried out for the Commission show considerable divergence in the approach to mobile licensing in the Community and throughout the world. Approaches include the use of 'first-come, first-served' (used for uncontroversial and small scale licensing, e.g. private mobile radio), comparative bidding ("beauty parades, widely used throughout the Community"), auctions (used outside the Community and for GSM in Greece) and,

The allocation of licences on the basis of *'first-come, first-served"* effectively removes all discretion from the Member State, beyond ensuring compliance with certain minimum technical and financial criteria. Such an approach is consistent with the open market philosophy of the internal market, but is perceived as being mainly suited to use with systems having smaller scale, such as PMR.

Comparative bidding or 'the beauty parade' is the most commonly used method for the allocation of mobile communications licences in the Union. At its best it meets many goals of Union policy by allowing Member States to select those potential operators who can most successfully meet the objective of the essential requirements such as efficient frequency use, and any public service requirements in the form of trade regulations such as quality of service and availability, meet consumer needs, and provide an affordable service to customers.

Auctioning licences and the accompanying frequency spectrum arguably allows the market to choose which services and technologies obtain valuable and scarce frequency resources. It also acts as an incentive to use spectrum as efficiently as possible in order to maximise the return on the investment which the up front auction fee represents. Finally, auctioning removes Member State discretion and often meets national policy objectives in terms of maximizing revenues.

However, the studies carried out for the Commission and other comments express considerable doubt concerning reliance on auctions. It is argued that auctions can lead to excessive transfers to the public budget or for other purposes to the detriment of lower tariffs for the user, and that they may favour publicly owned operators who may benefit from cheaper credit, and may be subject to less stringent rate of return levels than privately-owned competitors.

Furthermore, competitive safeguards may be needed, in order to ensure that the highest bidder is genuinely committed to the provision of mobile communications.

The Commission does not at this stage take a view on the merits of one of these systems over another, but submits the issue to consultation. However, in the case of lotteries, - a method which has not been widely used in the Union - the Commission does not believe they can offer effective guarantees as to efficient spectrum use, technical competence and financial standing of the successful party.

7.4 Automatic exclusion or inclusion of certain operators from licensing award procedures

The fundamental objective of the internal market, as well as the priorities of Community competition policy, require the removal of unjustified barriers to the development of mobile communications services. A key element in this is the removal of artificial restrictions on qualification for licensing procedures for mobile communications licences, either, for example, by the automatic disqualification of bids from the existing fixed or mobile network operators or the automatic grant of at least one licence to the public operator for each mobile technology without any adjudication procedure[45].

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lotteries (previously used in launching analogue mobile services in the USA). See *KPMG Study*; *Coopers & Lybrand* and *Eutelis*.

45 See KPMG, Chapter 5.2.

Subject to the Community competition rules and conditions relating to technical competence and financial standing, licensing procedures should be open to all nationals of Member States of the Union and enterprises controlled by nationals of the Member States or of the European Economic Area (EEA).

The automatic grant by a Member State of one or more licences to a specific operator would be inconsistent with the concept of open, non-discriminatory and transparent licensing procedures.

8. UNION-WIDE OPERATION

Despite the Community initiatives to date, mobile communications in the European Union is still structured around a series of parallel, separate national networks. There are no genuine trans-European mobile operators or mobile service providers under current licensing and regulatory structures in the Union

8.1 Union-wide provision of services

The GSM network represents the first digital pan-European infrastructure and is supported by a number of commercial and technical roaming agreements which are to permit subscribers to obtain GSM services, via other GSM networks outside their country of subscription.

Whilst Union policy strongly supports industry-led initiatives to promote cross-border roaming, the bottleneck imposed by current national licensing of mobile networks could be overcome by the removal of restrictions on mobile service providers. Mobile Service Providers established in one Member State should be able to establish themselves and/or offer services throughout the Union.

To achieve this, and consistent with the provisions of Article 59 of the Treaty, any national declaration required made by the Service Provider in its home State should be subject to full mutual recognition in all Member States. Additionally, commercial relationships entered into by Service Providers and mobile network operators in one State should be fully recognised in all other Member States, covered by those agreements, and should not be used as a ground to restrict the activities.

In particular, the provision of services on the basis of roaming agreements should not be subject to any restriction or to any surcharge or equivalent measures unrelated to the actual cost of providing the roaming facility itself; whether imposed as a result of regulatory activity or other action.

8.2 Mutual recognition of mobile operating licences

The principle of mutual recognition, established on the basis of Article 59 of the Treaty should apply, in the absence of harmonised licence conditions at a Union level, wherever practicable. On the basis of the freedom to provide services in the Community, a general principle of mutual recognition of licences and other regulatory measures under which services are provided in one Member State has been established through the case law of the Court of Justice, as a means of reducing restrictions to a minimum and, in particular, removing the unnecessary duplication of regulatory

safeguards on the provision of pan-European services[46]. This avoids, in the absence of harmonised licence conditions at a Union level, further licences and other administrative measures being required in other Member States. The only exception is where such licences can be justified on the basis of non discriminatory requirements in the public interest and such interests are not already protected by the rules in the operator's home Member State. Such an approach is consistent with the removal of special rights in the sector, as it limits Member State discretion with regard to operators already licensed in other Member States.

Nevertheless, where legitimate technical grounds as set out, limit the number of licences allocated, the principle of full mutual recognition can no longer be fully applied.

The Commission has proposed two directives for the mutual recognition of licences and national authorisations in the field of telecommunications and in particular in the field of satellite communications. This proposed scheme currently excludes mobile communications (except for satellite based mobile communications), and in any event, makes mutual recognition subject to availability of frequencies.

8.3 Mutual Recognition for licences awarded on the basis of first come / first serve

The principle of mutual recognition of national licences concerns, in particular, those cases where licences are awarded on a first come / first served basis, subject to the availability of the required frequency resources.

This should concern, in particular, satellite-based mobile communications services, as put forward in the proposal for a Directive on the mutual recognition of satellite service licences[47].

It could also apply to local or regional systems, usually PAMR and PMR systems, covering, for example, border regions where the systems operated by taxi businesses or haulage companies could then be used on both sides of the frontier.

Additionally, the scope of such a system of mutual recognition should be broad enough to ensure that where 'private' fixed links, provided either by the operator or by a third party on its behalf, form the backbone of such PAMR or PMR systems, a similar right to establish fixed links is also extended to other Member States.

8.4 Open procedures where licence numbers are limited

Where, however, because of spectrum availability, Member States rely on award procedures based, for example, on comparative bidding, the principle of mutual recognition cannot be fully applied. In such cases, national award procedures should nevertheless ensure that licence applications by nationals or companies controlled by nationals of Member States or of the EEA are possible on a non-discriminatory basis.

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46 See Commission interpretive communication 93/C334/03 concerning the free movement of services across frontiers, OJ C334/03, 9.12.93

47 Proposal for a European Parliament and Council Directive on a policy for the mutual recognition of licences and other national authorisations for the provision of network satellite services and/or satellite communications services, COM(93) 652, 4.1.94 - to be published. The proposed directive will also apply to mobile satellite services.

8.5 Co-ordinated Community licensing

Articles 3(n) and 128(b) of the EC Treaty recognise as a goal of the Community the encouragement of the establishment of trans-European networks. This objective, introduced as a result of the Treaty on European Union is wholly consistent with the Community's policy dating back to the 1987 Green Paper of promoting pan-European networks and services.

In order to consolidate the advantages which mobile communications currently enjoys, and to foster the development of a pan-European focus in the evolution towards a personal communications environment, a new approach should be developed at a Community level. This approach should allow, in particular cases, for future technologies and services to evolve on the basis of a single 'experimental operating licences' covering both network operation and frequency allocation, issued in a coordinated manner between Member States and/or at a Community level. Any such experimental licensing system should take due account of the interests of the Member States and of existing licensed operators.

In particular, and in accordance with the Council Resolution of 7 December 1993 on the introduction of satellite-based personal communications in the European Community, licences for such future satellite based personal communication systems should be awarded on this basis.

Another case should be the licensing of future 3rd Generation UMTS systems. Allocating such systems on a Europe-wide basis would substantially reinforce European momentum towards the development of such systems.

8.6 Mutual recognition of type approval

The principle of mutual recognition of type approvals for mobile terminal equipment is already incorporated into Community law, within the framework of Directive 91/263/EEC[48], which established the mechanism for the mutual recognition of terminal equipment type approvals based on Common Technical Regulations (CTRs).

In practice, if CTRs exist, they are mandatory. Where CTRs have not yet been agreed and where one or more harmonised standard(s) based on a European Telecommunications Standard (ETS) or one or more ETS could be identified (on an interim basis pending adoption of a CTR), which covers at least the essential requirements set out in Article 4 of Directive 91/263/EEC, such ETS could be used to perform the evaluation of conformity against the essential requirements. However this evaluation (type-approval) must be performed following one of the routes established in that Directive (for example, EC-type examination and Declaration of conformity by a manufacturer).

To facilitate the removal of obstacles to the free circulation of terminal and network equipment in the absence of CTRs, the establishment of interim type approval procedures on a temporary basis in the context of the European Radiocommunications Committee (ERC) taking account of the obligations flowing from Article 30 of the

48 Council Directive 91/263/EEC of 29 April 1991 on the approximation of the laws of the Member States concerning telecommunications terminal equipment including the mutual recognition of their conformity, OJ L128/1, 23.05.91 as amended by Council Directive 93/97/EEC of 29 October 1993 supplementing directive 93/263/EEC in respect of satellite earth station equipment, OJ L290/1, 24.11.93.

Treaty should be examined in order to facilitate full mutual recognition on the basis of confirmity with the essential requirements. This should be done in accordance with the procedures foreseen in the Directive and the principles of the Council Resolution on the new approach to technical harmonisation and standards and the communication on a global approach to certification and testing[49].

9 NUMBERING

In addition to radio frequencies, access to and allocation of numbers is a second essential resource for mobile network operators, service providers and for customers. The importance of this resource and its potential to restrict or distort competition in a manner contrary to the Treaty competition rules will grow as demand for numbering becomes more acute and as services evolve towards the personal communications environment. It is vital that fair access to numbers is achieved and that where technically feasible, customers can take numbers with them, as they switch between operators or service providers.

9.1 Community policy to date

At present, numbering arrangements remain the responsibility of the Member States within the overall framework of the international standards and the regional and country code allocations established within the ITU. Such standards cover, for example, overall number length and recommendations on number structure. Responsibility for number allocation currently lies either with NRAs or the incumbent Telecommunications Organisation.

Numbering policy within the Union has so far concentrated on limited harmonisation[50]:

- a common European emergency number - 112 in parallel to existing national numbers, and
- a common international access code - 00

9.2 Principles for the allocation of mobile service numbers

The Community framework for access to and the administration of numbering schemes for all voice telephony services has been set out in the proposed Voice Telephony directive. The approach, building on the general principles of ONP is analogous to that taken in the sphere of radiofrequencies[51].

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49 Council Resolution 85/C136/01 of 7 May 1985, OJ C136/1,4.6.85 and communication of the Commission on a Global Approach to Certification and Testing of 15 June 1989, COM(89)209, OJ C267/3,19.10.89.

50 Council Decision 91/396/EEC of 29 July 1991 on the introduction of a single emergency call number, OJ C217/31, 6.8.91 and Council Decision 92/264/EEC of 11 May 1992 on the introduction of a standard international telephone access code in the Community, OJ L165/27

51 A new approach to the coordination of radiofrequencies in the Community, communication from the Commission concerning the proposal for a Council Decision on the implementation by the Member States of measures concerning Radiofrequencies, COM(93) 382,10.9.93.

This implies that numbers are allocated on the basis of objective criteria and transparent procedures, must guarantee equality of access to number resources and be non-discriminatory.

Additionally, Member States shall ensure that the control of national numbering plans is the responsibility of the NRAs. NRAs shall ensure that national numbering plans, and all changes to them, are published, subject only to limitations justified on the basis of the Treaty or compliance with essential requirements, in particular, privacy or data protection.

9.3 Co-ordination of mobile service numbering at a Community level

The basic approach to numbering plans, allocation and coordination of numbering has been set out in Council Resolution 92/C318/02[52], which requires respect for the principle of separation of operational and regulatory activities and decisions to be based on wide consultation of interested parties. It also recognises the need for a coordinated and efficient approach to numbering at a European level. It identifies Europe-wide mobile services as a high priority area for developing coordinated management and allocation within a European numbering space.

The Resolution establishes a policy framework similar to that proposed in the field of frequencies, involving the wider European forum provided by CEPT, and in particular, ECTRA and the linked future European Telecommunications Office (ETO) and the European Numbering Office (ENO) within it.

ENO's tasks would be:

- research to support long term development of numbering plans taking into account the needs of national regulators, operators, service providers, users and other interested parties;
- coordination of the development of national numbering plans within and between the CEPT member countries;
- developing common approaches for the future management and allocation of numbers both nationally and internationally; and
- development of a common European position with respect to ITU activities and development of the links between numbering and standards.

In a similar approach to that taken in relation to frequencies, the Commission intends to develop, as soon as the appropriate legal framework is in place, a stable relationship with these two bodies in order to advance co-ordination in the numbering field and ensure that Union interests are safeguarded. A key concern will be ensuring efficient, transparent procedures at a Community level which prevent the creation of barriers to the development of the internal market based on an analysis to be made thereupon and to ensure the full practical implementation by Member States of decisions concerning numbering.

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52 Council Resolution 92/C318/02 of 19 November 1992 on the promotion of Europe-wide cooperation on numbering of telecommunications services, OJ C318/2, 4.12.92

Common positions must also be developed at a Community level towards numbering issues within international bodies, such as the ITU numbering fora, in order to safeguard Union interests.

9.4 Development of a European numbering space

At present, each country has its own unique country code within which it establishes a national numbering plan. Council Resolution 92/C318/08 also supported in addition to the existing national allocations, that Europe should introduce a European Numbering Space (ENS) i.e. a common numbering space which is not aligned to any individual country.

One of the key potential primary uses of a future ENS is mobile and personal communications services, in particular, where these provide pan-European or roaming capabilities.

In order to facilitate this possibility, suitable branded allocations for these services should be made available from within the ENS.

9.5 Personal and portable numbers

Within the framework of European coordination, priority should be given to the creation of a European Numbering Space, and within that, to the reform of national numbering schemes to ensure equality of treatment between mobile numbering and fixed network numbering schemes; to the issue of number portability across similar mobile services where this is technically feasible, and to the evolution towards personal numbering.

In this context, special attention should be given to harmonisation of access codes for mobile systems, directory services and for services of general interest, such as the emergency services.

In the future evolution towards personal communications, priority should be given to personal, portable numbers, independent of the network provider, the individual service type, the location (nationally or internationally) and the individual terminal equipment.

At this stage it will however be necessary to ensure that current and future numbering plans are sufficiently flexible to accommodate allocation of such numbers from either national numbering plans or from the European Numbering Space.

10 OWN INFRASTRUCTURE AND SHARING OF INFRASTRUCTURE

10.1 Use of own infrastructure for mobile services

As evidenced elsewhere (see Annex B), current regulatory restrictions on the self-provision of infrastructure are common to most mobile communications licences and raise major concerns.

a) Distortion of market structure resulting from current restrictions

- The requirement on most mobile operators to use the TO's leased line capacity for both internal network connections (for example, base station to mobile control centre) and the routing of long distance portion of calls

ties the mobile operator to the use of TO infrastructure without there necessarily being any technical justification for such a restriction.

- As interconnection charges and leased line rental represents 30% to 50%[53] of mobile operator's revenue base, the TO supplying these connections, usually on a monopoly basis, has considerable influence over the commercial viability and cost structure of mobile operators, who may or may not be its direct competitor. This concern is aggravated to the extent that leased line tariffs are not yet generally cost-orientated and in line with the Leased Line Directive[54].

- Restrictions on interconnection with other mobile networks, and particularly, networks located in other Member States, act as barriers to the provision of pan-European mobile services and trans-European networks.

- Finally, restrictions on self-provision of infrastructure constrain technical progress, notably, because effective pan-European roaming for GSM relies on the widespread availability of System 7 signalling - a technology which has not yet been universally deployed by TO's within the European union.

Such restrictions are difficult to justify under current Union telecommunications and competition rules, notably Article 90(2) EC. In particular, the Services Directive, whilst allowing monopolies over the physical telecommunications network and the basic voice service to continue, specifically excluded mobile radiocommunications from its scope. It would seem inconsistent with a narrow interpretation of the reserved services in that directive to extend the scope of this monopoly to the provision of internal infrastructure links for mobile radiocommunications systems and services.

Equally, the concern that international traffic would be diverted onto mobile networks and away from the fixed network, removing the source of transfers to uneconomic customers for the provision of universal service in the Union, appears to be unfounded on the basis of current usage patterns and experience in markets where such restrictions have been relaxed.

Under the Community competition rules Article 90 in combination with Article 86 of the Treaty is infringed in situations where national regulation prevents competitive provision of services, in circumstances, where the monopoly provider of the same or a similar service is unable itself to meet market demand for that service, or in doing so is inevitably led to favour its own offerings above those of its competitor[55]. In many Member States, restrictions on the use of own or third party infrastructure is slowing down the development of mobile services. It often also leads to the TO giving preference to its own mobile operations in terms of location of access to the public fixed network and in the availability of the links themselves.

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53 Studies show in competitive mobile markets in the Community interconnection costs as a percentage of overall revenue ranged from 30% to 50%.

54 Council Directive of 5 June 1992, OJ L165/27, 16.6.92

55 See Case C-41/90, Höffner & Elsner v. Macrotron, [1991] ECR 1-1979 and Case C-260/89, ERT v. Dimotiki [1991] ECR 1-2925

Finally, a number of Member States have already given the right to use own infrastructure to mobile operators. This has not produced a visible negative impact on the incumbent operator.

b) Community principles concerning the use of infrastructure

Mobile Network Operators should have full freedom to operate and develop their network to carry out licensed or authorised activities. This includes the freedom to choose over which facilities such services are offered.

The provision of facilities and the use of infrastructure forming part of the public fixed network must be subject to the general principles established within the ONP Framework Directive, the Leased Lines Directive and the proposed Voice Telephony Directive, namely, transparency, non-discrimination and equality of access, as well as being fully consistent with the Community competition rules.

In addition, mobile network operators should have full rights to establish and use their own infrastructure or that owned or operated by third parties for the activities allowed by their licences.

Mobile network operators should have the right to directly interconnect with other mobile operators either within the same Member State or in another Member State. Direct connections should be permitted via the public fixed network, own infrastructure or via infrastructure owned or operated by a third party.

Where own infrastructure requires the availability of radio resources such as links based on microwave transmission, Member States should make available suitable radiofrequencies.

10.2 Access to sites and sharing of sites and infrastructure

The environmental priorities established in the EC Treaty suggest that the proliferation of mobile communications services, as well as of technologies dependent on ever smaller cells, should not be accompanied by an unnecessary proliferation of base stations or radio masts.

Specific planning rules, the grant of rights of way and compulsory site purchase will continue to be issues for national regulation.

Procedures to obtain access to sites should, however, be subject to the basic principles of transparency, non-discrimination, and proportionality, and be based on objective criteria.

At the same time, in order to minimise the environmental impact of the growth in mobile communications, regulatory restrictions which prevent the sharing of sites and other infrastructure by mobile operators with each other and with fixed network operators should be removed.

Mobile network operators should be allowed to share infrastructure, other facilities and sites, subject to the application of the general principles of the ONP Framework Directive. Site and infrastructure sharing agreements must be transparent, non-discriminatory, and ensure respect for the essential requirements.

Not only will the removal of such restrictions be consistent with respect for the environment, but it will also promote more efficient use of mobile infrastructure. This is particularly the case in areas of low population density, which might otherwise not be served by the mobile network.

Member States may also require Mobile Network Operators to enter into agreements to share infrastructure or sites, where there are overriding grounds based on environmental priorities or public safety.

Such obligations must respect the principle of proportionality, must not substantially impede the licensed activities and must be consistent with the Community competition rules.

11 COMBINED OFFERING OF SERVICES VIA FIXED AND WIRELESS NETWORKS

11.1 The requirements of personal communications

Personal communications services will ultimately allow personal calling to individuals on the basis of a unique number, independent of their location, of the terminal used, the means of transmission (wired or wireless), or the choice of technology (see Annex A).

To meet these challenges, account must be taken of the need to create sufficient commercial freedom for the market to respond to demand for integrated supply of personal communications services, whilst accepting the likely continuation of existing licences for specific technologies for the foreseeable future.

The schedule set by the Council Resolution 93/C213/01 for full liberalisation of public voice service by 1 January 1998[56] now provides the opportunity to develop a consistent environment for personal communication services.

11.2 The Telecommunications Review schedule

The timetable established by the 1992 Telecommunications Review initiates many of the steps which are required in order to prepare the public fixed network and, in particular, the voice telephony service for the personal communications environment. In particular, it includes :

- Full liberalisation of public voice telephony services by 1 January 1998, including preparation of the necessary amendments to the Community regulatory framework by 1 January 1996. This will facilitate combined offering of services via fixed and wireless networks once full liberalisation has been achieved;

- Full application of, and where necessary adaptation, in the light of further liberalisation, of ONP principles. This will focus on interconnection and a framework for access charges[57];

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56 With additional transition periods of up to 5 years for Spain, Ireland, Greece and Portugal and where justified 2 years for Luxembourg.

- Implementation of the principle of mutual recognition of national licences and authorisations.

11.3 Combined fixed/mobile service provision

The basic conditions to launch the evolution towards personal communications are the removal (as identified in section 3.6 above) of restrictions on the combined offering by a single service provider of different mobile services, provided under different licences, and on the basis of different technologies/ standards.

Subsequently, in line with the timetable established for the full liberalisation of fixed network services, all restrictions on the free combination of services provided via the fixed and mobile networks should be removed.

In order to prevent the erection of new barriers to the internal market for personal communications, Member States should no longer include restrictions of this type in any new mobile communications licences issued.

11.4 Allowing mobile operators or independent service providers to resell or switch traffic on the fixed network after 1998

The agreement of liberalisation of public voice telephony service requires that mobile operators should be allowed to transport voice traffic between any combination of fixed and mobile destinations in the Union from 1998, an activity currently reserved to telecommunications organisations.

Consequently, mobile network operators and independent service providers should also be allowed from that date to bid for licences for the provision of fixed network public voice services, when such licences are made available and according to the conditions of such licenses.

11.5 Allowing fixed network operators to provide wireless services

The basic principles of Union Telecommunications policy, in particular, the requirement for non-discrimination, should also apply to fixed network operators. Such operators should be able to provide personal communications services, in parallel to mobile operators.

The removal of the barriers between operation of fixed and mobile networks, implied by the 1992 Telecoms Review schedule, also requires that current fixed network operators should be allowed to fully participate in the mobile area, both in the use of mobile technologies within the fixed network and as mobile players in their own right.

Such market participation by existing fixed networks operators should be subject to the Community policies relating to licensing and frequency allocation, as well as being subject to the application of the Community competition rules. From 1 January 1998 at the latest, fixed network operators should no longer be prohibited ab initio from

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57 In this context, the Commission has also published a Communication on developing universal service in a competitive environment. (See Communication of the Commission of 15 November 1993, COM(93) 543). In response, the Council adopted a Resolution on universal service at its meeting of 7 December 1993 (to be published).

participating directly or indirectly in licence award procedures for the operation and provision of mobile or personal communications services.

11.6 Union priorities in the area of licensing to prepare for the personal communications environment

In addition, to the priority areas for action in the frequency field needed to promote the evolution towards the personal communications environment, (identified at 4.4 above), Member States in allocating licences should place particular emphasis on those technologies most suited to providing the wireless parts of personal communications services. The following priorities should be set for licensing:

- Member States should allocate licences for operating mobile systems according to the DCS-1800 standard and allow for the development of micro-cellular extensions of the current mobile systems licensed according to the GSM standard in the 900 MHz bands.

- Member States should plan towards allocation of frequencies and licensing of satellite-based personal communication systems (including so called Low Earth Orbit (LEO) systems) and of future third generation services based on the future Universal Mobile Telecommunication System (UMTS).

12 ACCESS TO THIRD COUNTRIES

Union telecommunications policy has consistently supported the establishment of a fair international environment for both telecommunications services and equipment. This was reaffirmed in Council Resolution 93/C213/01 on the 1992 Telecoms Review, which recognised "the establishment of a fair international trade environment allowing access to third country telecommunications markets comparable to that existing in the Community", as a key factor in the development of the future regulatory policy.

In this context account must be taken of the substantial participation in existing mobile consortia within the European Union, of operators, from Third Countries, as well as the strong position of Third Country manufacturers on the Union's mobile equipment market (see Annex C).

At the same time, the current regulatory environment in overseas markets is handicapping operators in the European Union from entering certain mobile markets abroad. One example, is the provision in US legislation concerning the radio spectrum restricting foreign ownership of more than 20% (directly) and 25% (indirectly) of a US mobile operator.

Where such asymmetric market access currently exists, Community policy must actively pursue the on-going multilateral negotiations on basic telecommunications within the General Agreement on Trade in Services in order to open up foreign market access.

Within the limits of its international commitments and Community law, the Union must assess whether the current inequalities can be redressed within the framework of

Community legislation, for example, with regard to non-EU participation in mobile licences[58].

13 SATELLITE-BASED PERSONAL COMMUNICATIONS

Union policy has started to address the issues raised by Satellite-based Personal Communications Services (see Annex A, B and C).

The general principles of Union policy have already been set out in its 1990 Green Paper on Satellite Communications and the subsequent Council Resolution of 19 December 1991[59]. These principles, based on the Union's global policy towards telecommunications, have been developed in relation to Personal Communication Services by a Communication of 27 April 1993 and the subsequent Council Resolution of 7 December 1993[60].

In addition, a Directive extending the terminal equipment type approval regime to mobile satellite equipment was adopted on 30 October 1993[61]. The package of measures implementing the Council Resolution of 19 December 1991 is completed by the proposed directive on a policy for the mutual recognition of satellite service licences[62]; the proposed directive on competition in the market for satellite communications services and equipment, which when finally adopted will extend the scope of the Services Directive to the satellite field[63], and by a forthcoming Communication on access to space segment.

A key outstanding issue will remain, however, with regard to pan-European licensing. As indicated in Annexes A and B, satellite services impact by their nature a wide number of European countries and regulatory regimes, both in countries of uplink and in the country(ies) of downlinking. The industry suffers significant costs from the need to obtain regulatory clearance and/or licences from all Member States concerned. In the proposal for a Council Directive on the mutual recognition of satellite service licenses a procedure has been elaborated allowing for mutual recognition of national licenses, where the common conditions of licences for a specific service have been agreed at a Community level.

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58 Such an approach has been foreseen in the draft proposal for a directive on a policy for the mutual recognition of licences and national authorisations for satellite communications services

59 Towards Europe-wide systems and services - Green Paper on a common approach in the field of satellite communications, COM(90) 490 final, 20.11.90 and Council Resolution 91/C8/01 of 19 December 1991 on the development of the common market for satellite communications and services., OJ C8, 14.1.92

60 COM(93) 171 and Council Resolution of 7 December 1993 on the introduction of satellite personal communications services in the European Community (93/C 339/01; OJ C 339/1, 16.12.93).

61 Council Directive 93/97/EEC of 29 October 1993 supplementing directive 93/263/EEC in respect of satellite earth station equipment, OJ L290/1, 24.11.93

62 Proposal for a European Parliament and Council Directive on a policy for the mutual recognition of licences and other national authorisations for the provision of network satellite services and/or satellite communications services, COM(93) 652, 4.1.94 - to be published.

63 Proposal for a Commission Directive amending Directives 88/301/EEC on competition in the market for telecommunications equipment and 90/388/EEC on competition in the market for telecommunications services; not yet published.

A similar requirement for national licensing of satellite-based Personal Communications Services could severely hamper their development. Licences for satellite personal communications services should develop from the start in the Union on the basis of single operating licences issued in a co-ordinated manner by the Member States and/or at a Community level.

In addition, a co-ordinated European approach to licensing such services would be more effective in preserving European regulatory interests with regard to global mobile satellite systems.

It is therefore proposed that licenses for future satellite-based personal communications should be awarded ab initio in a coordinated manner and/or at Community level.

Such systems could also be given priority, in the field of mobile and personal communications, within the context provided by the Treaty for the establishment of trans-European networks.

14 PROMOTING THE UNIVERSAL MOBILE TELECOMMUNICATIONS SYSTEM (UMTS)

The future third generation UMTS system will ultimately provide an integrated technology base for the most economic and efficient delivery of personal communications services.

Work within the European Union is advancing both within the framework of Community research programmes, in particular, RACE and also within ETSI; whilst outside the Union work within the ITU has focused on this field under the Future Public Land Mobile Telecommunications Systems (FPLMTS) project (see Annexes A and C).

Within this future environment a smooth transition from second to third generation technologies should be assisted by the fact that the future regulatory structures proposed for the second generation technologies, such as GSM, DCS-1800 and DECT and ERMES are designed to prepare the service environment in the Union for personal communications.

If this approach were not be taken, it would not only undermine the twin goals of the achievement of the internal market and the promotion of trans-European networks and services, but also decisively restrict the potential of the Community's research programmes and of the European standardisation work in the field of third generation mobile systems, at a time when critical decisions are made at a global level on future positions on UMTS/FPLMTS.

In order to maximise the potential of European initiatives in the field of Universal Mobile Telecommunications Systems, a concentrated effort to support the evolution towards the universal mobile telecommunication system is needed. This should include as set out the development of coordinated licensing and award procedures between Member States and/or at Community level.

Such licensing would have to take specific national situations into account, as well as providing for a smooth transition from second to third generation services. The eventual transition to third generation systems should be taken into account by the Member States in the current licensing of second generation systems in order to ensure that provision of personal communications services can continue on the basis of the most efficient technologies.

At the same time, the European Radiocommunications Committee should be requested to define, as a matter of urgency, in its follow-up and implementation of the decisions taken at WARC 92, the firm allocation and scheduling of availability of UMTS frequencies.

15 CONCLUSIONS

Extension of Union's Telecommunications Policy to the Mobile sector is possible and provides a consistent framework for the future development of the sector and its evolution towards a personal communications environment.

The application of these principles implies a number of major changes in the sector:

Abolishing remaining exclusive and special rights in the sector, subject where required to the establishment of appropriate licensing conditions.

Current approaches to licensing mobile services on the basis of exclusive and special rights has had in many cases serious effects on the speed of development and penetration of mobile communciations services. It also potentially limits the ability of operators with specific experience in Member States' and other markets to tender on equal terms for mobile operating licences.

Removal of all restrictions on the provision of mobile services both by independent Service Providers and by direct service provision by mobile network operators.

This should include the freedom to offer a combination of services provided under different mobile licences; as well as the ability to provide services in different Member States, and the lifting of existing restrictions.

Full freedom for mobile network operators to operate and develop their networks for the purpose of the activities provided for in their licence or authorisation.

This should include the right to self-provide infrastructure for use in carrying out these activities or to use third party infrastructure for that purpose, as well as the right to share infrastructure.

Infrastructure and interconnection costs currently represent between 30 and 50% of total revenues of mobile network operators, making much of their cost structure dependent on the Telecommunication Organisations, with whom they directly or indirectly compete. Furthermore, the requirement to route traffic via the fixed network and prohibitions on direct interconnection of mobile networks leads to less efficient operation and may hamper innovative services, for example, where insufficient signalling functionalities are available in a particular fixed network.

In order to remove this dependence and to promote innovation, mobile systems should be permitted to make use of own or third party infrastructure, and should be able to connect directly to other mobile networks both within and between Member States.

Unrestricted combined offering of services via the fixed and mobile networks within the overall time schedule set by Council Resolution 93/C219/01 of 22 July 1993 for the full liberalisation of public voice telephony services via the fixed network.

This would imply the right for mobile operators or independent Service Providers to bid for resale licenses on the fixed network, as well as for the lifting of all existing entry restrictions for fixed network operators in mobile markets, subject only to full application of the Treaty competition rules, in particular, Council Regulation 89/4064/EEC on the control of concentrations and the provisions of the Treaty competition rules concerning abuse of dominant positions.

The principles developed in the Union's approach to mutual recognition and licensing should be extended to the sector, where possible.

The application of these principles must take account of the specific features of the sector. They should also in future promote a more European orientation, including the creation of mechanisms for coordination and licensing procedures at a Community level where appropriate in order to promote trans-European networks and services.

This should concern in particular satellite-based personal communication services (including Low Earth Orbit Satellite (LEOs) systems and the licensing of third generation systems (Universal Mobile Telecommunication Systems (UMTS/FPLMTS)).

Mutual recognition of type approval of mobile terminal equipment is critical and must be accelerated.

This includes the extension of Directive 91/263/EEC to cover mobile terminal equipment not capable of connection to the public network, which is currently outside its scope.

Accelerated application must include more rapid adoption of Common Technical Regulations (CTRs), in particular, for terminal equipment using new digital mobile technologies. Accelerated application of Directive 91/263/EEC and 93/97/EEC should also allow for mutual recognition of terminal equipment on the basis of fulfillment of the essential requirements for those types of equipment for which CTRs have still not been adopted. Establishment of interim-tupe approval procedures in the context of the European Radiocommunication Committee (ERC) should be encouraged in order to assist the achievement of the objectives of the Directives in this case.

A coordinated Union approach to frequencies and numbering must be intensified on the basis of the existing European framework.

This framework is linked to the European Radiocommunications Committee (ERC) and its associated European Radiocommunications Office (ERO) in the field of radiofrequencies, and the European Committee for Regulatory Affairs (ECTRA) and its future European Telecommunications Office (ETO) in the field of numbering, following the principles of the respective Council Resolutions and the Commission's Communication on a new approach to the co-ordination of radiofrequencies in the Community.

Memoranda of Understanding and framework contracts on cooperation should bc concluded by the Community with these bodies, once a firm legal basis for such cooperation has been created.

Clear priority areas for future work should be established, taking account of basic Union interests and need for full implementation in the Member States of agreements reached within these bodies.

The interconnection principles developed in Union Telecommunications Policy can be extended to the mobile sector.

These should, however, be adjusted in the context of the overall adjustment of the Community's regulatory framework up to 1 January 1996, in line with Council Resolution 93/C213/08 of 22 July 1993 setting the schedule for full liberalisation of public voice service.

This should be achieved within the context of the global review of the Open Network Provision Framework.

Safety, protection of privacy and environmental concerns should receive special attention

Safeguarding the public interest within the sector is of fundamental importance for European citizens, as well as a requirement of creating a stable commercial environment.

This addresses in particular the concerns over user safety, as well as protection of privacy and personal data within the new digital networks and systems. Priority must also be given to tackling the environmental issues raised by a proliferation of mobile systems which is important to ensure public acceptance of the future developments in the sector and avoid the creation of new barriers within the internal market.

Any approach towards mobile and personal communications must be linked to the global policy goals of the European Union.

This concerns, in particular, the development of trans-European networks, promotion of cohesion with the peripheral and less favoured regions, access to third country markets and the policy of the European Union towards the countries of central and Eastern Europe and at the international level.

Special attention should be given in this context to creating an environment conducive to the achievement of the Community's research and technology development goals in the area, in particular in the field of the future third generation system (UMTS/FPLMTS) and satellite-based personal communications (including Low Earth Orbit Satellites (LEOs).

GLOSSARY

ACTE (Approvals Committee for Terminal Equipment)	created by Directive 91/263/EEC, and, inter alia, responsible for the adoption of the ***Common Technical Regulations (CTRs)*** on which EU harmonised type approval procedures are based.
Allocation (of a frequency band)	Entry in the Table of Frequency Allocations of a given frequency band allowing the use of that band by one or more radiocommunications services under specified conditions. (see International Radio Regulations of the ITU; see also ***Assignment***)
AMPS	*Advanced Mobile Phone System (AMPS),* US ***Analogue Cellular System*** standard
Analogue Cellular System	Cellular system using analogue transmission techniques. Standards used in Europe are inter alia ***NMT***, ***TACS***, ***Radiocom 2000***, and ***C-Net***.
APC (Aeronautical Public Correspondence services)	Generic term for radiocommunications based services, allowing airline passengers to communicate from a plane whilst in flight. Systems are being developed on the basis of both satellite and terrestrial systems. Within Europe, the ***Terrestrial Flight Telecommunications System (TFTS)***, is now entering into service with a number of airlines
Assignment (of a frequency band)	of a radio frequency or a radio channel: authorisation given by an administration for use of a particular radio frequency or radio frequency channel, subject to specific conditions. See Article 1 of the ***Radio Regulations.***
Auctioning	Licence or frequency award procedures, where allocation is to the highest bidder. This method has been used in a number of countries outside the European Union and has been used for ***GSM*** in Greece.
Avoidance of frequency interference	Measures undertaken to ensure that the use of a transmitting device does not disturb receiving equipment to an extent which would cause significant loss of information intended for that receiver.
Cellular Systems	Mobile Radiocommunications networks, usually covering a large area, in which the area of service is divided into a number of smaller "cells" each having its own transmitter/receiver equipment (base station). The use of cells allows for the same frequency to be re-used in different cells, thereby substantially increasing the maximum number of subscribers within a given network. As subscribers move from one cell to another, the cellular system automatically reroutes the call or "hands on" to the base station in the next cell, in order to enable continuous communications. Initially, cellular systems were developed on the basis of analogue transmission techniques (see ***Analogue Cellular System***), but

	are increasingly switching to digital transmission techniques (***see Digital Cellular System***).
CEN/CENELEC	*European Committee for Standardisation* and *European Committee for Electrotechnical Standardisation*, major European standarization organisations. Responsible inter alia for the preparation of standards relating to electro-magnetic compatibility under Directives 89/336/EEC and 92/31/EEC.
CEPT	*European Conference of Postal and Telecommunications Administrations*. Following recent reforms, membership of CEPT is now confined to **National Regulatory Authorities**, and encompasses the twelve EU Member States, and most other European countries, including the countries of Central and Eastern Europe. Following these recent reforms, CEPT's activities are now divided between ***ECTRA*** (the European Committee for Telecommunications Regulatory Affairs); the ***ERC*** (the European Radiocommunications Committee) and CERP (the European Committee for Postal Regulation) dealing with postal affairs (see also ECTRA and ERC).
C-Net	***Analogue cellular system*** standard.
Code Division Multiple Access (CDMA)	Special coding technique for digital radio transmission whereby information in digital form is combined with a second coded digital stream to "smear" the information simultaneously across a wide radio frequency band width. By using a known coded signal at both transmitter and receiver, the original information can be recovered at the receiver. Currently used in some ***Digital Cellular Systems*** on an experimental basis (see also **TDMA**)
Comparative Bidding	Licence award procedure based on the review and comparison of the quality of the projects against defined criteria. This method is widely used throughout the European Union.
CT2	Cordless telephony equipment standard based on an ETSI interim standard. Current use primarily with ***Telepoint Applications.***
CTRs	*Common Technical Regulations* for type approval of terminal equipment according to the procedures of Directive 91/263/EEC.
DCS 1800	Standard for micro cellular communications systems developed by ***ETSI,*** building on the *GSM* standard, also referred to as **PCN** system standard. Such systems operate with very small cells, varying in size between a few hundred metres and a few kilometres.
Digital Cellular System	***Cellular Systems***, utilising digital (bit-based) transmission techniques.

Digital European Cordless Telecommunications (DECT)	New digital cordless standard developed by ***ETSI,*** supported by Directive 91/288/EEC establishing harmonised frequency bands for DECT and a Council Recommendation on its co-ordinated introduction.
Digital Short Range Radio (DSRR)	New digital standard developed by ***ETSI*** in the ***Private Mobile Radio (PMR)*** communications field, to be used over short distances.
DSI	*Detailed Spectrum Investigations* of radio usage, one of the key tasks given the ***European Radiocommunications Office***, aiming at the development of a common European Table of Frequency Allocations.
ECTRA	The *European Committee for Telecommunications Regulatory Affairs (ECTRA),* created as one of the three committees under the new ***CEPT*** structure. It currently includes three project teams covering licensing, numbering and testing. Council Resolution 92/C318/EEC of 19 November 1992 on the promotion of co-operation on Europe-wide numbering, identified several tasks for ECTRA in numbering co-ordination, including the creation of a European numbering space and the preparation of European positions for discussion within ***ITU***. ECTRA is setting up a ***European Telecommunications Office (ETO)***.
Electromagnetic Compatibility (EMC)	The ability of a device, unit or system to function satisfactorily in its electromagnetic environment without introducing unacceptable electromagnetic disturbances to anything in that environment.
Electromagnetic exposure	Exposure to electromagnetic radiation and its possible effects on human bodies. Effects are classified according to thermal effects (heating of body tissue) and athermal effects (any other possible effects).
ENO - European Numbering Office	The *European Numbering Office* called for in the Council Resolution 92/C318/02 of 19 November 1992 on the promotion of Europe-wide co-operation on numbering of telecommunications services will be located in Copenhagen, as part of the ***European Telecommunications Office*** *(see also **ECTRA**).*
ERC - European Radiocommunications Committee	The *European Radiocommunications Committee (ERC)* is one of the three committees created under the new structure of ***CEPT***. The *ERC* develops radiocommunications policies, assists ***ITU*** conferences and plays a general co-ordinating role in frequency matters. It has established the European Radiocommunications Office **(ERO)**

ERMES (European Radio Messaging System)	New digital paging standard developed by ***ETSI,*** supported by Directive 90/544/EEC establishing harmonised frequency bands for *ERMES* and a Council Recommendation on its co-ordinated introduction. *ERMES* will permit the reception of tones and/or numeric or alphanumeric messages.
ERO - European Radiocommunications Office	*The European Radiocommunications Office (ERO)* called for in the Council Resolution of 28 June 1990 90/C166/02 on the strengthening of the Europe-wide co-operation on radio frequencies, in particular with regard to services with a pan-European dimension was created by the ***ERC*** and started operations in Copenhagen in May 1991.
Essential Requirements	*Essential requirements* are non-economic reasons in the general interest which may cause a Member State to restrict access to the public telecommunications networks or public telecommunications services.
ETO - European Telecommunications Office	*The European Telecommunications Office (ETO)* is an office which is being established under the umbrella of ***ECTRA***.
ETS	*European Telecommunications Standard.* Standards established according to the procedures of the European Telecommunications Standards Institute (**ETSI**).
European Telecommunications Standards Institute (ETSI)	The European standards organisation in the Telecommunications field, having the task of producing European Telecommunications Standards (***ETS***), having European-wide application and acceptance, in the area of telecommunications.
Eutelsat	*European Telecommunications Satellite Organisation*, created by the Eutelsat Convention and the related Operating Agreement.
Exclusive Rights	An *exclusive right* exists where the operation of a mobile network or the provision of a mobile service within a given area is reserved by a Member State to a single public or private operator. (See draft Commission Directive of 1 December 1993 amending Directives 88/301/EEC and 90/388/EEC with regard to satellite communications).
First Come/First Served licensing	Licence award procedure, where licences are awarded in order of application, normally within the limits of the frequencies available. This method is used extensively for private mobile radio systems and satellite services.

Frequency Division Multiple Access (FDMA)	Special coding technique used for both digital and analogue radio transmission in which individual calls are connected by the assignment of a specific communications channel. The channel selected is maintained only for the duration of the call and is taken from a basket of many channels, which together make up the bandwidth of the radio frequency (-ies) set aside for that service.
Future Public Land Mobile Telecommunications System (FPLMTS)	See ***UMTS (Universal Mobile Telecommunications Systems)***
GPS	*Global Positioning System.* Satellite system used, inter alia, for maritime, air and terrestrial navigation providing extremely accurate location and positioning information for ships, planes, vehicles or individuals throughout the world that carry a *GPS* receiver.
Global System for Mobile communications (GSM)	The central standard, developed by ***ETSI***, for digital (2nd generation) mobile systems, using ***TDMA (Time Division Multiple Access)*** techniques. *GSM* has been supported by Directive 87/372/EEC establishing harmonised frequency bands for *GSM* and a Council Recommendation and Resolution on its co-ordinated introduction. The system supports ***Roaming***, and a broad range of features.
Green Paper(s)	*Green Papers*, in the European Union context, are European Commission consultative documents setting out basic policy goals for public debate. Key *Green Papers* issued in the telecommunications sector, are the *1987 Green Paper on the development of a common market for telecommunications services and equipment (COM (87) 290) and* the *1990 Green Paper on satellite communications* (COM (90) 490).
Hertz	1 cycle/second, measurement unit for radio frequencies. 1 kHz corresponds to 1000 Hz; 1 MHz corresponds to 1 million Hz; 1 GHz corresponds to 1 billion Hz (1000 MHz).
Inmarsat	The *International Maritime Satellite Organisation*, established by the INMARSAT Convention and the related operating agreement.
Intelligent Networks (IN)	Advanced network concept allowing the provision of services such as call forwarding, calling line identification and other advanced functions such as flexible routing. IN functionality will be a vital component in the evolution of ***Universal Personal Telecommunications (UPT)***.
INTELSAT	The *International Satellite Organisation*, established by the INTELSAT Convention and the related Operating Agreement.
ITA (Interim Type Approval)	Provisional approval for terminal equipment, established inter alia for ***GSM*** terminals.
IPRs	*Intellectual Property Rights*

International Telecommunications Union (ITU)	*International Telecommunications Union (ITU)*, the United Nations specialised agency for telecommunications. The structure of the ITU has recently been reviewed to adapt it to the changing information and telecommunications environment. Formal changes were agreed at an Additional Plenipotentiary Conference in December 1992 and came into operation in March 1993. These have separated the ITU into three sectors: Standardisation, Radiocommunications and Development.
Low Earth Orbiting satellite (LEOs)	Non-geostationary satellites in low-earth orbits. ***LEO*** concepts play a particular role in current proposals for ***satellite-based Personal Communications services.***
Lottery	Licence award procedure on the basis of lotteries, which has been used particularly in the United States.
Memorandum of Understanding (MOU)	MoUs in the telecommunications field in Europe have been entered into between operators and/or equipment manufacturers or other market participants for the roll out of new products and services. Within the mobile sector, MoUs have been entered inter alia for ***GSM, ERMES, TFTS*** and ***Telepoint***.
Micro Cellular Networks	***Cellular Systems*** where normal-sized cells in the cellular mobile radio network are split into very small geographical areas of between a few hundred metres up to a few killometres ("micro-cells"). This technique confers higher network capacities, lower power transmitters, higher frequency efficiency through greater frequency re-use and longer air-time (or lighter handsets) for a given battery technology.
Mobile Data	Specific radio-based communications services for numeric and alphanumeric data transmission. Such services are currently used primarily for closed user group applications, through for example, remote datebase access or data/ E-mail transfer between portable computers and a home network.
Mobile Network Operator	Operator of mobile network infrastructure, supporting the transmission and provision of radio-communications services. The activities of *Mobile Network Operators* in most cases also integrate mobile ***Service Provider*** functions (direct service provision to end-users) within their overall business.
NMT	*Nordic Mobile Telephone, **Analogue Cellular System*** standard.
NRA	*National Regulatory Authority.* Directive 88/301 and 90/388 both require Member States to ensure the separation of regulatory activities from the operation and provision of services by ***Telecommunications Organisations.***
ONP	The *Open Network Provision* concept defined in Council Directive 90/387/EEC. .

Paging

Radiocommunications based service involving non-speech, one-way, personal selective calling with a tone, vibration or visual alert. The system may either simply inform the user that somebody is trying to contact him or her or may also carry a numeric or alphanumeric message.

PCS - Personal Communications Services

Personal Communications Services (PCS) is used as a generic term for services which provide person-to-person calling, independent of location, terminal used, the means of transmission (wired or wireless) and/or the choice of technology.

PDAs (Personal Digital Assistants)

Portable computer-based and often hand-held devices combining a wide range of functions, such as diary, address book, word processor, calculator, etc. and which may support radio-based links for data transmission and/or to Local Area Networks.

PDC

Personal Digital Cellular, Japanese mobile digital standard, which has been developed in parallel with the *Personal Handy Phone (PHP)* standard (similar to a two-way ***Telepoint Application***) and the *N-Star Mobile Satellite System.*

Personal and portable numbers

Personal and portable numbers are numbers which are to be independent of network, service provider, location and terminal used, in contrast to current numbering which is country, network and operator specific.

Such personal numbers would be of general application (and therefore portable) across mobile and fixed network services, providing full personal mobility and therefore a key element in ***Universal Personal Telecommunications (UPT).***

Personal Communications Networks (PCNs)

see ***DCS-1800*** systems.

PIN (Personal Identification Number)

used in ***GSM*** and other subscriber card-based systems to ascertain identity of subscribers and check authorization of access.

Private Mobile Radio (PMR)

Private radio communications system, usually operating on a local or regional basis from a single *base station* and using a single or small number of radio channels. Users normally have to wait until a channel is clear before they can use it, as the base station can only communicate with individual mobiles. Larger users may manage many mobiles from a single base station (for example, taxi firms). Communication is generally limited to a single (closed user) group.

Public Access Mobile Radio (PAMR)

PAMR provides shared use of a common radio communications system for activities similar to ***Private Mobile Radio.*** By providing for shared use, ***PAMR*** can make more efficient use of the frequencies available by allocating conversations to free channels within a group of channels available. (See also ***TETRA***)

Public Service Requirements in the form of Trade Regulations

Category of licensing conditions aimed at ensuring permanence, availability and quality of services.

RACE - R&D programme in advanced communications technologies for Europe

The current phase of the RACE programme is defined in Council Decision 91/352/EEC of 7 June 1991 adopting a specific research and technological development programme in the field of telecommunications technologies (1990 to 1994). Within the Mobile and Personal Communications line, a number of projects participate in the work towards third generation mobile systems (**UMTS & MBS**). These include MONET, ATDMA, CODIT, MBS, SAINT, TSUNAMI and PLATON.

A number of other R&D projects in the RACE framework also contribute towards the definition of UMT/MBS namely, MAVT, MOBILE, MODAL and MOEBIUS.

Radiocom 2000

Analogue Cellular System standard.

RES (Radio Equipment and Systems) Committee

ETSI Technical Committee (TC), with broad responsibilities in the field of radiocommunications equipment and systems

Roaming

Facility, supported by commercial arrangements between operators and/or service providers, which enables a subscriber to use his/her radio telephone equipment on any other network which has entered into a roaming agreement in the same or another country for both outgoing and incoming calls.

RTT (Road Transport Telematics)

A range of programmes, aimed at developing the radio-based technology to provide road users with up to date information (traffic conditions, route guidance, etc.) and to support traffic management and control. Particular, examples of these projects are the EU-programme *DRIVE - Dedicated Road Infrastructure for Vehicle Safety in Europe,* and within the EUREKA programme - *PROMETHEUS.*

Satellite-based Personal Communications Services

Radiocommunications-based services, where there is a direct communication from hand held equipment to satellites, though potentially routed through terrestrial-based infrastructure for a portion of specific connections.

These new services will be based on new technologies, whose ***frequency allocations*** were agreed at WARC 92 (for example, ***Low Earth Orbiting Satellite systems***).

Second Generation Mobile Systems

A generic term encompassing digital mobile networks and technology currently being deployed. It includes, inter alia, ***GSM, DCS 1800, ERMES, DECT, TETRA, TFTS, DSRR.***

Service Providers

Service providers offer services to end users involving the use of mobile networks and services. The role of service providers may vary between that of airtime reseller to the provision of sophisticated value added services. Service providers may be independent or form part of a mobile network operation.

SES (Satellite Earth Station) Committee	***ETSI*** Technical Committe (TC), covering inter alia mobile satellite communications equipment..
Signalling System 7 (SS7)	Major digital protocol/ signalling system for managing and transmitting control and routing information in networks.
SMG (Special Mobile Group)	***ETSI*** Technical Committee (TC), with special responsibility for ***GSM, DCS 1800***, and the development of **UMTS**.
Special Rights	A *special right* exists where a Member State within a given area designates, other than according to objective, proportional, transparent and non-discriminatory criteria, several competing undertakings or limits the number other than according to such criteria or grants one or more of these undertakings a lasting particular advantage other than those advantages referred to in Article 92 of the EEC Treaty. (See draft Commission Directive of 1 December 1993 amending Directives 88/301/EEC and 90/388/EEC with regard to satellite communications - see also ***Exclusive Rights***)
Subscriber Identification Module (SIM)	A plastic card containing a microprocessor and memory issued for use with ***GSM*** and ***DCS 1800*** networks. The card contains details of the subscriber, the subscribers services (those to which he is entitled) and personal telephone directories. Only through the use of a legitimate card, can a user enable a piece of equipment for use on the network.
TACS	*Total Access Communications,* an ***Analogue Cellular System*** standard.
Time Division Multiple Access (TDMA)	Special coding technique for digital radio transmission whereby information in digital form is packaged and transmitted during pre-arranged time periods, the total number of active users having one time slot for each "frame" or repetition period. The packaged information is rearranged so that speech and data appears continuous. *TDMA* is the transmission technique used inter alia for the ***GSM*** system.
1992 Telecoms Review	A review and wide public consultation during 1992 and early 1993 led to the adoption by the EU Council of Ministers of Resolution C93/213/01 of 22 July 1993, providing for the liberalisation of the provision of public voice telephony services by 1 January 1998, subject to additional transitional periods of up to 5 years for Greece, Ireland, Portugal and Spain, and a possible delay of up to 2000 for Luxembourg. The Resolution also requested the publication of a ***Green Paper*** on mobile and personal communications, and the production of a ***Green Paper*** on telecommunications infrastructures and cable TV by 1 January 1995. The Council also requested that the necessary regulatory framework for the 1998 liberalisation deadline be prepared by 1 January 1996.

Telepoint Applications

Generic term for applications allowing subscribers over a wireless link between a handset or other radiocommunications device to place calls via the public network infrastructure, but not generally to receive calls.

Standards currently used for these applications include in particular *CT2* and, in future, ***DECT***.

Terminal Identification (The EIN - Equipment Identification Number)

Each piece of ***GSM*** mobile or transportable equipment (the terminal) has certain information programmed during manufacture which can be used to uniquely identify the unit and which the network uses to track stolen equipment and to disable in the event of certain malfunctions.

The Terrestrial Flight Telephone System (TFTS)

A digital ***APC*** standard developed by ***ETSI*** and now entering into service with a number of airlines. The system comprises airborne equipment and a series of ground stations through which telephone calls can be initiated by users whilst in flight.

Third Generation Systems

See entry on ***UMTS***.

TO (Telecommunications Organisation)

Telecommunications Organisations as defined in Directive 90/388/EEC means public or private bodies to which Member States grant special or exclusive rights for the provision of a public telecommunications network and, when applicable, service

Trans European Trunked Radio (TETRA)

Digital trunked mobile ***PAMR*** standard being developed by ***ETSI***. ***TETRA*** is a mobile communications system to be used for applications on a shared basis, such as by closed user groups.

Universal Mobile Telecommunications System (UMTS)

A technology and standard for third generation mobile digital systems, currently under development within ***ETSI*** and by the ***RACE*** programme. *UMTS* should support full personal communications services, delivered over a combination of fixed and mobile networks.

Work in the framework of the ITU in this field is carried out under **Future Public Land Mobile Telecommunications System (FPLMTS).**

Universal Personal Telecommunications (UPT)

Concept which should allow person-to-person calling across multiple networks at any terminal, fixed or mobile and irrespective of geographical location, based on personal and portable numbers. Essential concept for implementing full personal mobility in a communications environment.

Wireless Local Area Networks and Wireless PBX's

Private mobile communications system providing local area networking; where cabled connections between or within sites are replaced by radio links; a *HiperLan* system specified by ***ETSI*** refers to radiocommunications sub-systems intended to provide high speed, short distance links between computer systems.

Wireless Public Branch exchanges (PBXs) are telephone switching systems typically in customer premises providing radio-based links between subscriber equipment, private mobile communications systems and/or the public network.

Wireless Local Loop

The addition of a radio link to a fixed network in order to provide a wireless connection for part or all of the local loop (for example, between the curb and the home). (See also ***DECT***)

World Administrative Radio Conferences - WARC' 92

The World (Administrative) Radio Conferences (WARCs) are global meetings within the framework of the ***ITU***. Following the recent changes in ITU, these meetings are now referred to as World Radio Conferences (WRCs).

WARC '92 produced a number of agreements concerning mobile and other, more specific allocations at both lower and higher frequencies. These changes, will in time, permit wider use of the band 1-3 GHz for mobile services, both terrestrial and satellite based.