Electronic Communications Committee (ECC)
within the European Conference of Postal and Telecommunications Administrations (CEPT)

FIXED SERVICE IN EUROPE
CURRENT USE AND FUTURE TRENDS POST-2002

Lisbon, February 2002

INDEX TABLE

Important note:

All analysis provided in the report is based on contributions from the following CEPT countries:

Austria
Belgium
Croatia
Czech Republic
Denmark
Estonia
Finland
France
Germany
Hungary
Ireland
Italy
Latvia
Lithuania
Luxembourg
Norway
Portugal
Slovak Republic
Slovenia
Sweden
Switzerland
Turkey
United Kingdom

The summary of the responses on national FS use in tabular form is given in Annex 1 to the report.

Fixed service in Europe current use and future trends post-2002

1 INTRODUCTION

1.1 Background to the study

This study was launched with the major aim to update and revise the previous ERO Report on Fixed Service Trends post-1998. That report was prepared as a result of a study, undertaken by the ERO and a team of experts between February 1997 and February 1998, as a work order for the European Commission. The report was highly appreciated by the industry as evidenced by large numbers of copies requested and shipped between the years 1998-1999.

It became apparent that the report touched upon a very sensitive and dynamic sector of telecommunications, which was posed to see significant growth over the coming years. Therefore, the report recommended in one of the conclusions that a further review of fixed service developments should be carried out after the year 2000. It would be necessary in order to assess the trends, to note actual progress made and changes to the environment occurring after the completion of the original study in early 1998.

Therefore, this report builds on the results of the original ERO Report on FS trends post-1998 by revising it and updating the information on FS use.

1.2 Objectives of the study

This study of spectrum requirements for the fixed service had three objectives, namely:

i. To provide a comprehensive overview of the development of civil fixed services since the last ERO Report in 1998, also to foresee further trends for the post-2002 environment;
ii. To provide a useful reference for administrations, manufacturers and telecom operators on issues surrounding the developments of civil fixed services in Europe;
iii. To provide a rationale for the general trends with information highlighting the basis for these observations.

1.3 Methodology

This study was conducted by a group of experts from the CEPT WG FM Project Team 34 on Fixed and Fixed Satellite Services, with active support from the European Radiocommunications Office (ERO). The group met several times while working on the report, which was developed in several iterative approaches.

The major source of factual data used in the development of this report, was the questionnaire on FS use and future trends, conducted through CEPT administrations in summer/autumn of 2001. In total 22 administrations and 3 operating companies responded to this questionnaire.

The results obtained from the questionnaire enabled the evaluation of the FS situation in Europe for the year 2001. On the other hand, comparison of data obtained in 2001 with the data originally obtained in 1997 has allowed the dynamic evaluation of FS developments over those years since the original report was drafted in 1997.

2 EUROPEAN FS MARKET AND ITS REGULATION

2.1 General market trends

Liberalisation of telecommunications has been taking place on a global basis over last few years with new operators entering increasingly competitive markets and offering an increasing range of telecommunications services. Many operators, both incumbents and newcomers, are also forming strategic alliances in order to expand their markets beyond primarily national boundaries and to enter new areas.

This new market environment has enabled real competition in telecommunications, which has had an impact not just on the provision of telecommunications services, but also on the supporting infrastructure, whether wireless or cable.

Aside from mobile communications, which are by now well and long established users of radio technologies, many other “traditional” telecom operators started to look more attentively to wireless communications to facilitate speedy implementation, flexibility and economical provision of their networks. This trend may be observed both in the provisioning of fixed wireless access for customer connections and in other areas like, for example, in supporting infrastructure for public mobile networks or for other telecommunication networks. This new demand for using radio technologies comes in addition to a considerable fixed radio network infrastructures already for long time in use by incumbent operators, as part of their PSTN network, national broadcast distribution (feeder links to regional VHF/UHF transmitters) networks, etc.

The most significant increases of FS assignments over the past years came in particular from the area of infrastructure support for public mobile networks, where the reported number of point-to-point (PP) links increased by 141% between 1997-2001. This demand is expected to increase further with the expected growth in capacity and number of connected nodes (base stations) in continuously growing and optimised GSM networks and even more so with the introduction of IMT-2000/UMTS. Provisioning of infrastructure support through various point-to-multipoint (PMP) technologies (e.g. universally licensed FWA networks and tailored PMP backbone networks) is also being considered, or already implemented in some countries as a viable alternative option in the environment with high density of served base stations (e.g. dense urban areas).

Another major trend evidenced by the results of the FS questionnaire is an increase in volume of general FS links used for wide variety of purposes: ad-hoc infrastructure, corporate (private) radio links, links for individual access to telecommunication networks. The number of such links generally defined by respondents as “point-to-point radio relay” or “private digital RRL networks” has increased by 70% between 1997-2001.

The above trends of significant growth of fixed services overcome the few areas where growth is either insignificant or negative. The overall positive trend in number of FS links is also likely to continue for the foreseeable future. In that respect it may be noted, that CEPT has already made several successful moves towards ensuring favourable conditions for such growth, by developing ERC (now ECC) Decisions, recommendations with relevant channel arrangements and identifying additional bands for high density applications in the FS, including FWA and infrastructure support.

2.2 Role of Fixed Services

Fixed radio links provide a transmission path between two or more fixed points for provision of telecommunication services, such as voice, data or video transmission. Typical user sectors for fixed links are telecom companies (infrastructure, trunk networks – see example in Figure 1), corporate users (private data networks, connection of remote premises, etc. – Figure 2) and private users (customer access to PSTN or other networks – Figure 3).

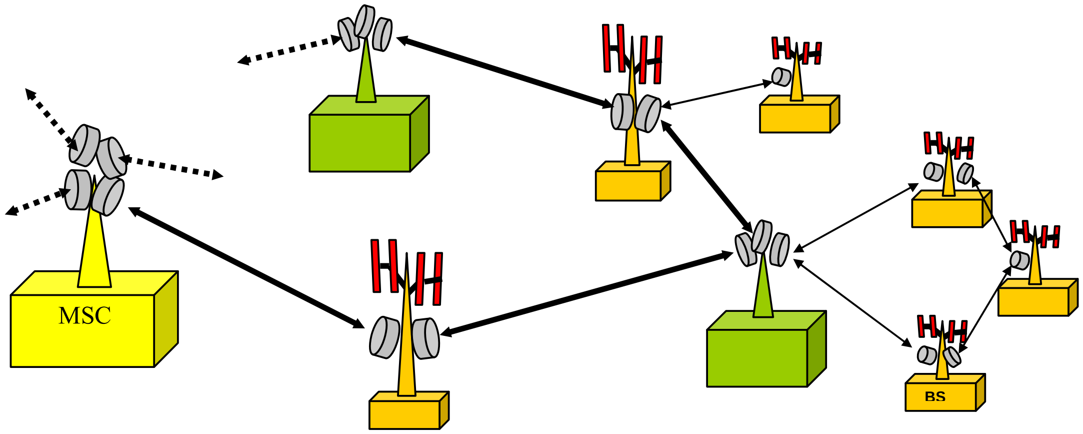


Figure 1: Example of fixed links deployment within the infrastructure of mobile network

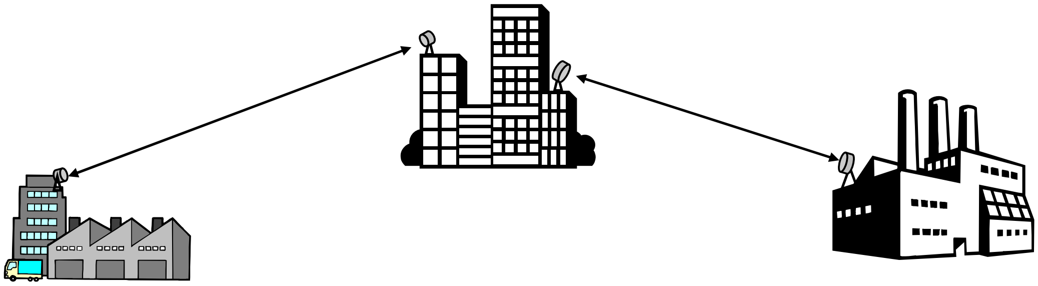


Figure 2: Example of a private radio relay link (e.g. for LAN, PABX inter-connection of premises)

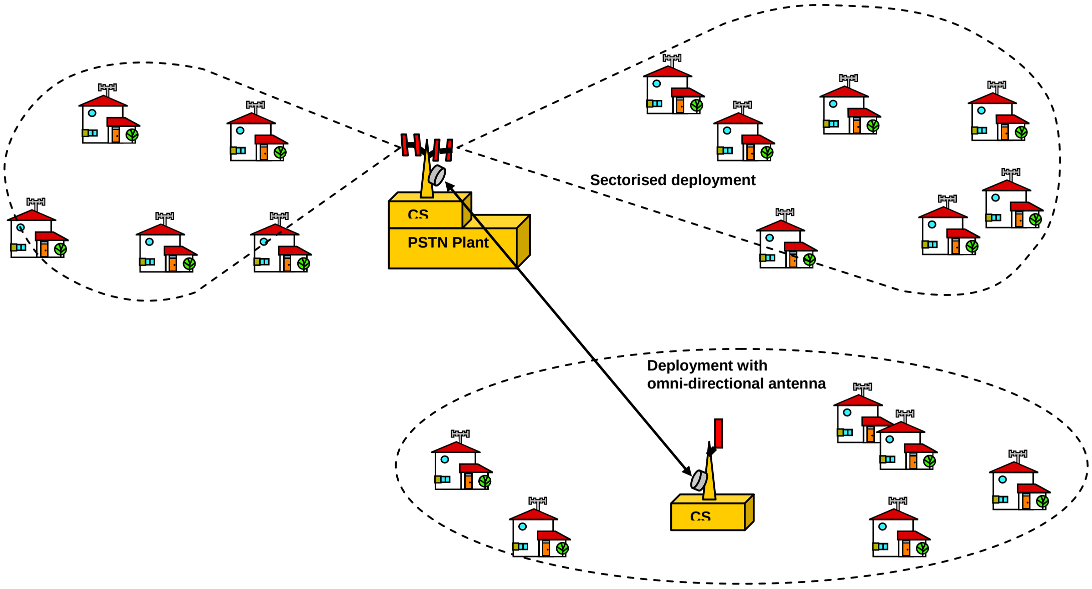


Figure 3: Fragment of a PMP FWA network connecting numerous subscribers per cell (note also eventual requirement for infrastructure support links for inter-connection of central stations)

Fixed radio links, instead of cable and fibre, are often the preferred solution where constraints such as cost, local topography (e.g., mountainous terrain or paths across water) and the need for access to remote rural regions are fundamental considerations. In many such cases fixed radio links are the only practical solution.

Also in today's competitive environment the ability to roll out a network rapidly by using radio as transmission media provides an operator with the flexibility to install and scale transmission paths only as and when required. This is particularly important as it allows the possibility to reduce and better distribute the required investments, by testing the service and directing revenues as they appear into further development of a network where most use occurs.

It is appropriate to note that being the integral and indispensable part of overall telecommunication infrastructure, fixed services provide a significant contribution to national economies in financial terms. The recent analysis in France showed that the overall telecommunications turnover in France increased by 10.5% in 1999 and by 14% in 2000, while the volume rate was even higher at 12.4% and 17.9% for the same two years respectively. The growth of fixed service in France over those two years reached 10.3% in volume.

The FS use figures obtained from the questionnaire during this study, compared with the usage figures obtained in previous study in 1997 are even more compelling, see Fig. 4, showing overall increase of number of reported FS links in Europe by 70% between 1997-2001. This means an average increase of 17.5% links per year.

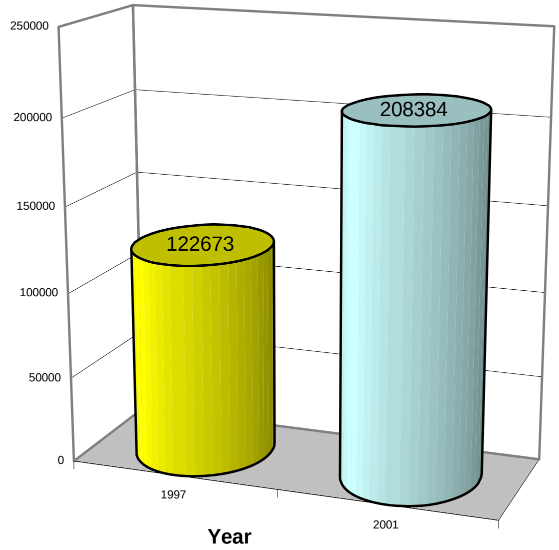


Figure 4: Number of reported FS links in Europe
(only those records accounted here, where both 1997 and 2001 usage figures were reported)

Although these growth figures somewhat contradict the recent overall downturn of telecommunication industries, they may be explained by the fact, that major growth in FS use was reported in the area of infrastructure support (77595 links in 2001 vs. 32182 in 1997). This trend should be attributable to the major success of the 2G mobile networks. These networks have developed rapidly over the last few years and the arrival of 3G (IMT-2000/UMTS) networks may mean further increase in FS use for such purpose.

2.3 Regulatory regime for FS

Besides providing data on actual use and future trends of FS in their countries, CEPT administrations were asked to describe the principles used in managing assignments of FS links.

From the replies received it appears that all CEPT administrations as a general rule apply central management, i.e. where the Administration is the responsible manager of the FS frequency assignments.

The exceptions are few, such as in France, were FS operations within the bands exclusively used by a particular authority or Ministry are subject only to notification procedure and in the UK, where some of the bands (15, 18 GHz) are currently managed by public network operators (for details see Annex 2).

However, within the framework of centralised management of frequency assignment for the FS, many administrations do carry out block allocation of frequencies in selected bands, i.e. where licensees are allocated a block of spectrum to assign links themselves.

This and other related information is shown below in a summary of responses from administrations in Table 1.

Country	**Block assignments**			**FWA licensing**		**Assignments for 3G infrastructure**
	PP	**PMP**	**FWA**	**Procedure**	**Restriction of service**	
Austria	plans	YES	YES	Auction	In the past	Block
Belgium	YES	YES	YES	Beauty contest	-	Block
Czech Republic		YES	YES	Beauty contest	No	Block/individual
Denmark	YES		YES	Beauty contest	No	Block likely
Estonia			YES	Various (1)	Subscriber access only	Under study
Finland	26GHz	YES	YES	First come	No	Block/individual
France	YES (2)	YES	YES	Beauty contest	No	Likely both
Germany	28GHz	YES (3)	YES	Various (1)	Subscriber access only	Block/individual
Hungary		YES	YES	Auction	Only at 3.5 GHz	Block/individual
Ireland			YES	Beauty contest	No	Under study
Latvia	YES	YES	YES	Various (1)	No	Block/individual
Lithuania		YES	YES	Beauty contest	No	Block/individual
Luxembourg	YES	YES	YES	First come	Subscriber access only	Block
Norway	YES	YES	YES	Beauty contest	No	Block
Portugal			YES	Beauty contest	Subscriber access only	Under study
Slovak Republic			YES	Beauty contest	No	Under study
Slovenia				Under study	-	Block
Sweden			YES	Beauty contest	No	Individual
Switzerland				Auction	No	Under study
Turkey	YES	YES	YES	Various	No	Block
UK		YES	YES	Various	Some	Individual

Table 1 : Current national practices in assignment of frequencies for various fixed services

Note (1): First come first served, or public bidding (beauty contest) procedures;
Note (2): preferential channels;
Note (3): only in 26 GHz and 28 GHz bands.

It may be seen from information provided in Table 1 that the block allocation is a preferred choice for assignment of frequencies for FWA and, more generally, for PMP networks. This is in particular due to the fact, that while the PP links are usually authorised on a link-by-link basis, subject to actual demand, the FWA (PMP) networks are authorised by a service (network operation) licence to an operator. Thus, it is very convenient to simply attach a specific frequency block to the licence without having to specify the frequency assignments on a per link basis. This becomes even more so, when network licences become attached to specific frequency blocks, e.g. when using auctioning of the spectrum. See section 5.1 for more detailed discussion regarding the block vs. individual assignment of frequencies.

The data in Table 1 also suggests that European countries often prefer FWA licensing mechanisms other than auctions. A few of those countries have also indicated that the “first come, first served” principle applies in normal circumstances, unless spectrum congestion is detected.

Another issue related to FWA, seen from the Table 1, is the fact, that contradictory to the common feeling in the field, there are only a few countries which mention explicit restrictions in their FWA licences to provide only subscriber access services. This means that more often FWA operators are free to provide both customer and infrastructure support services with their networks. Such freedom presumably means more flexible business opportunities for FWA network operators and subsequent relief of pressure for the PP infrastructure links on the one hand, but could lead to distortion of competition between FWA licensees on the other.

This brief summary of FS regulatory environment may be complemented by selected examples of the national FS regulatory practices and policies, which are described in detail in Annex 2 to this report.

3 ANALYSIS OF THE CURRENT AND FUTURE FS USE

This section provides a detailed analysis of the responses received from CEPT administrations to the questionnaire on current FS use and future trends, carried out by the ERO in summer/autumn 2001. It is believed that the number of responses received and the range of countries responding is sufficient to represent the overall European trends of FS developments.
However it should be born in mind that the actual usage figures and specific statistics derived, do cover only those 21 CEPT countries that responded to the questionnaire before 1 November 2001 (AUT, BEL, HRV, CZK, DNK, EST,

FIN, F, D, HNG, IRL, I, LVA, LTU, LUX, POR, SVK, SVN, SUI, TUR and G). General overview of all responses is presented in tabular form in Annex 1.

Whenever a comparison of FS usage figures is made between the situation in 1997 and in 2001, only those records are counted where usage figures were quoted both for 1997 and for 2001.

Whilst every possible effort has been made to alleviate errors in interpreting data and providing statistical analysis, some errors are unavoidable due to inherent differences in national definitions of FS applications, different accounting techniques, various licence exempt or otherwise unregistered FS uses, etc.

3.1 Development of different FS sectors between 1997-2001

Comparison of the data recorded in 1997 with that derived from the 2001 questionnaire allowed evaluation of the overall indices of FS developments between 1997-2001 through direct comparison of reported numbers of links.

The Figure 4 in section 1.2 showed the comparison of aggregate numbers of reported FS links in 1997 and 2001. The Figure 5 below shows the distribution of usage figures into specific sectors of FS applications.

It should be noted that the numbers for sector “General RRL” in Figure 5 show the usage numbers in the bands designated by administrations for “general purpose (digital, private) radio relay links”. Usually this assumes any links with individually assigned frequencies on a case-by-case basis and may include such links as ad-hoc infrastructure support and trunk, private (corporate) networks and individual links, broadcasting contribution links, etc. The sector “Other” covers any other specifically mentioned applications, which were less significant in their use volume, such us CATV distribution, MMDS, video SAP/SAB links, old analogue links, etc.

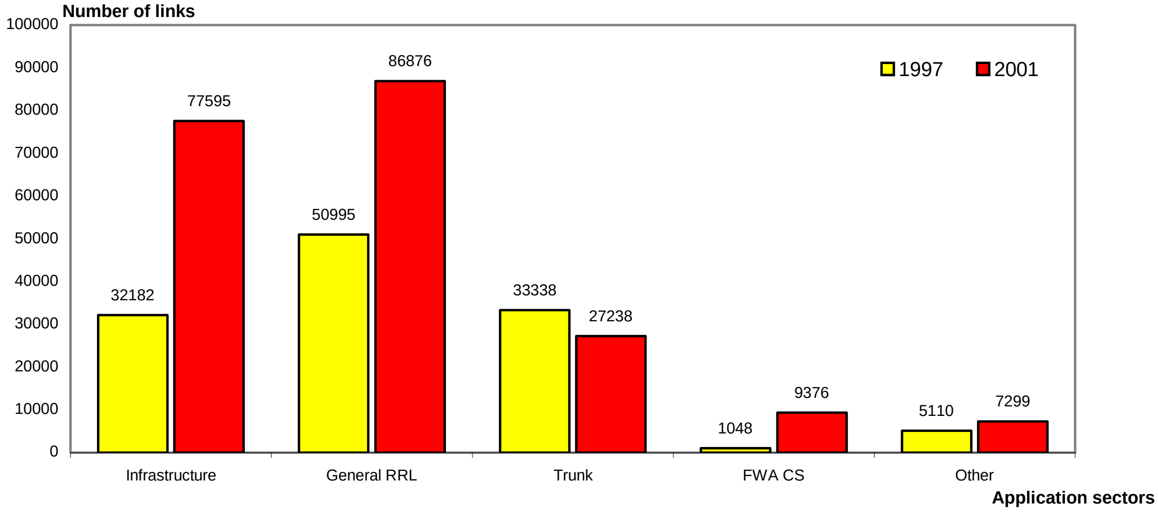


Figure 5: Number of FS links/assignments per different sectors

Therefore the FS application sectors used in Figure 5 correspond more to definitions/designations of the FS bands by administrations, rather than to precise use of particular links. This resulting potential overlap of definitions may mean that, for example, the actual number of trunk links had not actually decreased, but that such links are now sometimes categorised as infrastructure links or outsourced from the general RRL bands, etc.

But it is believed that resulting potential deviations should be insignificant with regard to the overall scope of the usage numbers and, anyway, have no impact at all on the resulting aggregate numbers, showing convincingly the overall growth in FS use in Europe over the last years.

Although the above described statistics of FS use seem to indicate clearly the overall development of FS in Europe, in individual countries the pace of such development may be different. One particular national example is given below in Figure 6, showing detailed statistics of total number of FS links in Finland between the years 1992-2001.

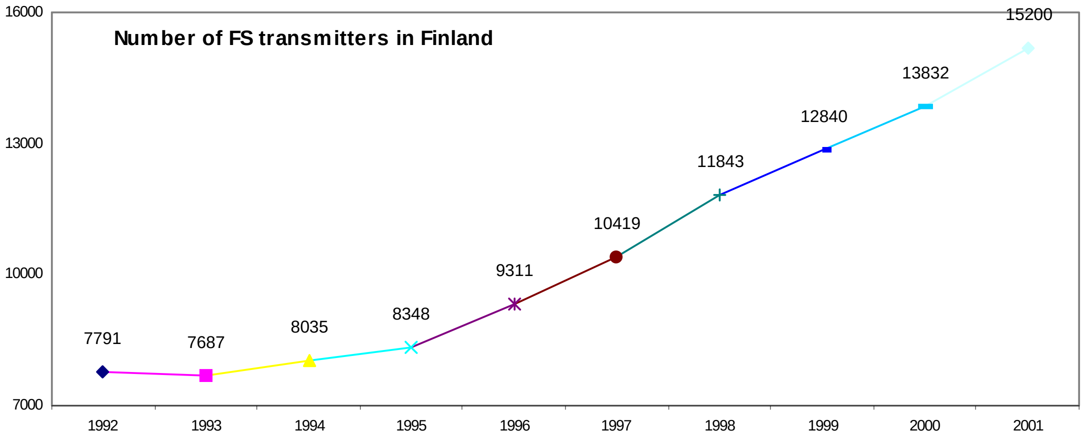


Figure 6: Dynamics of number of FS links in Finland between 1992-2001

Although differing in figures from the overall pan-European dynamics of FS developments, the above Finnish example also demonstrates a steady positive growth of number of FS transmitters at the annual rate of around 10% over the last few years.

3.2 Frequency bands with highest positive and negative growth

Whilst the previous section described the FS application sectors, which showed the most noticeable growth since 1997, analysis of usage records per individual band helps in identifying those frequency bands which showed the highest positive or negative growth in terms of absolute number of accommodated links.

Six of the bands, which have shown the highest positive growth, are shown below in Figure 7.

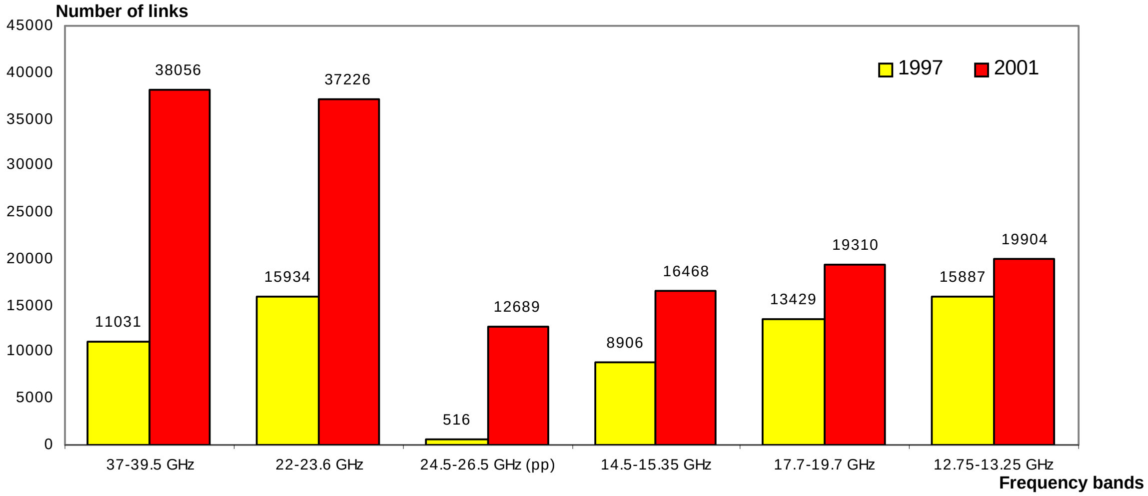


Figure 7: The frequency bands, which showed the highest positive FS growth between 1997-2001

With regard to the bands where number of FS links decreased, situation is less obvious than above described picture of positively growing bands. Those few bands, where negative growth was detected, showed a decrease of the total number of links by only one or two thousand links. As such a relatively small number may depend on the change of use (e.g. refarming of the band) in one or few bigger countries only, therefore it would be impossible to draw statistically reliable conclusions applicable on a wider European scale.

Still a couple of such most notable “negative” bands may be mentioned by way of example: 3.6-4.2 GHz (-1914 links between 1997-2001), 10.7-12.5 GHz (-1438 links) and the band 10.0-10.68 GHz (-1201 links). The rest of the bands with negative growth subtracted altogether a little bit more than 1000 links from the overall balance of FS development.

It may be seen from the above example that such negligible decrease may not be considered as a trend of negativity in the development of the band. Rather it shows relative stability, freezing or delay in developments of the band in question. Addressing those particular bands, it may be noted that the band 3.6-4.2 GHz had been stable because of the stabilising number of long-haul trunk links. Another band 10.7-12.5 GHz had been impacted by the difficulties of sharing with satellite services. Finally, the band 10.0-10.68 GHz, in countries where it is not used by military, have seen a significant delay in the take-off of FWA systems.

3.3 The progress of harmonisation in FS use

In this section an attempt is made to evaluate the scope of harmonisation in utilisation of the various frequency bands by FS across CEPT countries.

For this purpose, Table 2 below lists (in ascending order) some of the frequency bands, where the highest degree of harmonisation may be seen.

Harmonisation in this context means bands that show a dominant uniform use across CEPT countries and a high degree of relevant CEPT channel arrangements or frequency plans being implemented.

Frequency band	Typical FS applications	CEPT channel plan		Typical trends
		REC Nr.	Implemented	
3400-3600 MHz	FWA	14-03	71%	Expected growth of FWA
3600-4200 MHz	Trunk/infrastructure	12-08	67%	Stable/slow growth
5925-6425 MHz	RRL/trunk/infrastructure	14-01	76%	Slow growth/digitalisation
6425-7125 MHz	RRL/trunk/infrastructure	14-02	71%	Slow growth/digitalisation
10-10.68 GHz	FWA/video links	12-05	62%	Expected growth of FWA
10.7-11.7 GHz	Trunk/infrastructure	12-06	52%	No new links/decrease
12.75-13.25 GHz	RRL/infrastructure	12-02	76%	Increase/congestion
14.5-15.35 GHz	RRL/MS infrastructure	12-07	52%	High increase
17.7-19.7 GHz	Infrastructure	12-03	86%	Increase
22-23.6 GHz	Infrastructure/RRL	13-02 Annex A	95%	Increase/congestion
24.5-26.5 GHz	FWA + infrastructure	13-02 Annex B	86%	High increase
27.5-29.5 GHz	FWA/PMP links	13-02 Annex C	52%	Plans, DEC(00)09 applies
37-39.5 GHz	RRL/infrastructure	12-01	81%	High increase

Table 2: Current frequency bands with highest degree of harmonisation

The degree of implementation shown in Table 2 indicates how many administrations of those responding to questionnaire have claimed that they are using the relevant CEPT recommendations on channel plans in the frequency assignment process. The actual degree of technical harmonisation in most cases will be even higher, because administrations, not referencing the CEPT plan for a particular band, often make reference to ITU-R recommendations, which directly correspond to a CEPT plan.

From the analysis of data in Table 2 and overview of the use in other bands, it becomes obvious that the availability of CEPT channel arrangements becomes a powerful incentive for achieving wide spread European harmonisation of FS usage in a particular band.

In that respect, it might be also interesting to note how particular ERC/ECC Decisions and Recommendations in the FS field are implemented across CEPT countries. For this purpose Figs. 8 and 9 below show the number of CEPT administrations committing or planning to commit to certain ERC Decisions and Recommendations, which are most relevant for the planning of FS services. This data is based on the ERO implementation records, as valid for 1 December 2001.

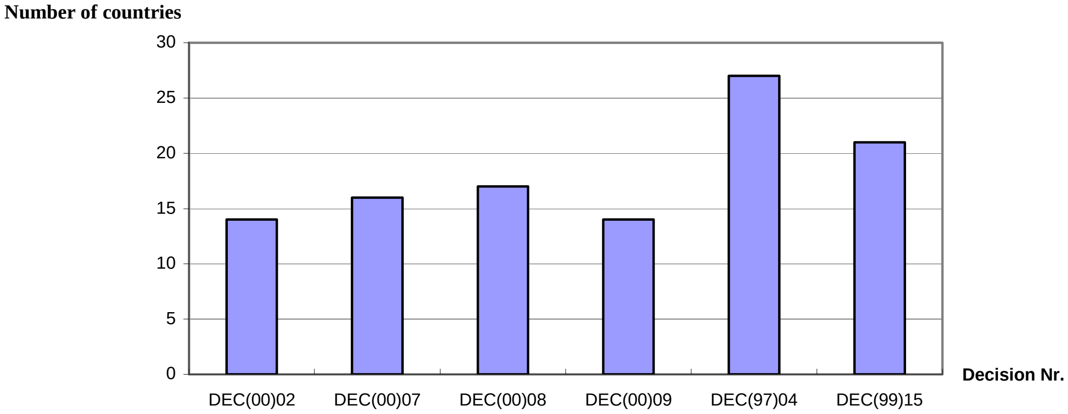


Figure 8: Implementation of some major ERC Decisions in the field of FS (December 2001 official data)

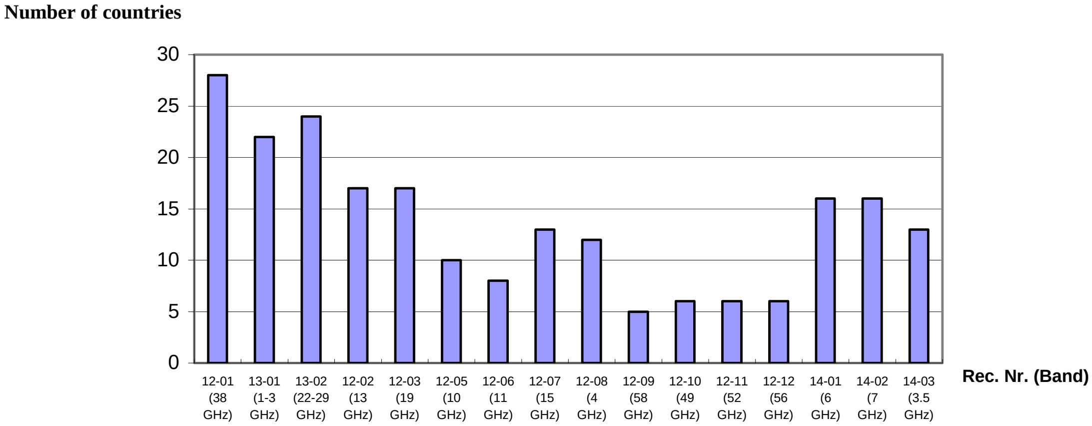


Figure 9: Implementation of ERC Recommendations, which prescribe FS channelling (December 2001 official data)

It may be noted from Figs. 8 and 9 that the level of declared implementation of ERC Decisions and Recommendations in the FS field is around 50% of CEPT membership, without considering the status of implementing ERC RECs 12-09…12. The latter recommendations are apparently lagging behind because of up to now limited industry interest in exploiting the bands above 40 GHz.
Limited implementation of some other recommendations, such as REC 12-05 and REC 12-06, reflects actual limitations in the use of the subject bands for FS in many European countries.

3.4 Band by band review of FS trends

This section analyses the major trends in current and future FS use in different frequency bands, allocated to Fixed Service. This section corresponds to the information given in Annex III of the original 1998 report.

<u>1350-2690 MHz</u>
The overall CEPT spectrum policy foresees optimisation of this band for the use by mobile and other radiocommunication services, which for line-of-sight and similar operational limitations may not be accommodated in the bands higher than about 3 GHz. However, many CEPT administrations stressed the need to continue FS use in parts of this band and the availability of suitable channel arrangements (ERC Recommendation T/R 13-01) to allow the long-term development of fixed services side-by-side with mobile and other services in this frequency range.

The requirement to ensure the long-term FS use in this band and to maintain T/R 13-01 unchanged was also confirmed in the results of DSI Phase III investigations (1999-2000) and supported in the relevant response of ERC (March 2001). However, it may be noted, that the variety of actual FS applications deployed in this frequency range is great and depend on actual national requirements.

Beside the civil FS use, this frequency range is also extensively used for tactical fixed links within NATO as well as in non-NATO countries. Within the NATO Joint Frequency Agreement (NJFA) particular frequency bands in the range 1350 - 2670 MHz are identified for the use of tactical radio relay systems. As a result of the WARC-92 decisions a transition of the tactical radio relay applications to harmonised sub-bands above 2000 MHz is envisaged.

This general trend of maintaining the various individual FS uses in the range is evidenced by the statistical analysis of the replies to the questionnaire, showing slight increase in number of reported FS links. Most administrations are using the T/R 13-01 and typically position civil and military/governmental FS assignments in the following sub-bands:

- 1350-1375 MHz paired with 1492-1517 MHz;
- 1375-1400 MHz paired with 1427-1452 MHz;
- 2025-2110 MHz paired with 2200-2290 MHz, bands 2025-2070/2200-2245 MHz were confirmed by the DSI Phase III as the harmonised solution for near/cross-border operation of Tactical Radio Relay Links (TRRL);
- 2520-2670 MHz (many countries indicated FS use until this band is demanded by IMT-2000/UMTS).

Most typical civil FS applications indicated in this frequency range are general purpose RRL, infrastructure support, FWA (WLL), and video SAP/SAB links. Future plans indicated by administrations for this range do vary, but more typically these are:

- removal of remaining FS from the sub-bands other than mentioned above;
- military/governmental use (e.g. TRRL);
- residual use for rural networks (including FWA/WLL);
- the future of the band 2520-2690 MHz is highly dependant on the developments of IMT-2000/UMTS, many administrations attach certain temporality conditions and freeze remaining FS use.

Designation of the extension bands for IMT-2000/UMTS at 2.5 GHz will cause the removal of current FS applications from this band. This could require administrations to find appropriate compensation spectrum for those displaced FS applications.

The average reported hop length of the links in this frequency range is 32 km.

3400-4200 MHz

The CEPT channel arrangements for PP systems in the range 3600/3800-4200 MHz (ERC/REC 12-08), as well as the frequency slot plans for PMP systems in sub-bands 3400–3600/3800 MHz (ERC/RECs 12-08 and 14-03), formed the basis for a harmonised FS use in this range.

With those ERC recommendations the usage of this range in European countries became much more harmonised and normally corresponds with the following pattern:

- the sub-band 3400-3600 MHz is designated for PMP FWA systems in a majority of CEPT countries and the frequency plan in ERC/REC 14-03 is widely adopted;
- the sub-band 3600-4200 MHz (or 3800-4200 MHz) is used for high capacity (34-155 Mb/s) trunk and infrastructure links, following the channel arrangements in ERC/REC 12-08. Some administrations consider the band 3.8-4.2 GHz as also suitable for low and medium capacity applications.;
- some countries consider or have already introduced PMP FWA systems also in the band 3600-3800 MHz, leaving only the sub-band 3800-4200 MHz for PP links, this arrangement is in accordance with provisions of annex B of ERC/REC 12-08.

Although the PP FS use seems being quite harmonised throughout CEPT, a closer look shows that various channel spacings are used in different countries. This leads to a subsequent variety of different technologies and applications.

ERC/REC 12-08, being based on ITU-R Recommendations F.635 and F.382, provides a variety of channel spacings and arrangements for low, medium and high capacity fixed links for 3600/3800-4200 MHz to cater for different requirements of individual countries.

Probably due to those recent FS re-arrangements in the band, which were necessary for the introduction of FWA, the number of links reported in the band 3600-4200 MHz has slightly decreased since 1997. However many administrations indicate expectations of increase in use of this band for trunk/infrastructure support links.

The extent of actual use and growth of FWA in the sub-band 3400-3600 MHz is more difficult to estimate, since countries only reported the number of issued licences or, in few cases, a number of central stations in FWA (see information in Annex 1 for details).

In the band 3600-4200 MHz more countries have selected channel arrangements with a channel bandwidth 29 MHz (few countries utilising 40 MHz channels), the average hop length of the recorded links is 39 km.

5850-7075/7125 MHz

The part of the range below 5925 MHz is used for fixed links only in few European countries and mostly for old analogue links. No further interest for developing FS in this part of the range is indicated.

The sub-bands 5925-6425 MHz and 6425-7125 MHz are used for FS quite extensively across Europe, mostly for medium and high-capacity (between 34-155 Mb/s) trunk and Public Mobile Networks infrastructure support links. This use follows the recommended channel spacing of 29.65 MHz in the sub-band 5925-6425 MHz (ERC/REC 14-01) and 40 MHz in the sub-band 6425-7125 MHz (ERC/REC 14-02). However, in the latter band the actual upper band limit varies among countries between 7075 MHz and 7125 MHz.

Another recently appearing trend shows not an increase in numbers of links, but increase in their transmission capacities beyond 155 Mb/s (up to 4 x STM-1 SDH streams). This should be mostly due to the fact, that the supra-regional backbone configuration does not have to change with the densification of served network. Therefore, most operators choose to use more efficient modulation technologies over existing links rather than building new ones. Many responders predicted further growth in use of this band.

A potential future use of the lower 6 GHz band by uplink transmissions from Earth Stations on board vessels (ESVs) will require protection measures for the FS application to be taken by the administrations.

The average current hop length of the PP links in this band is 37 km.

7125-8500 MHz

Use of the frequency range 7125-8500 MHz for FS in Europe still remains controversial and divergent, nothing has changed since the time the original report was published in 1998.

Although this range is used for PP links in every European country (at least of those responding the questionnaire), the actual sub-bands and frequency plans vary. The general trend appears to be in using this band for infrastructure support links, in particular for non-incumbent operators of Public Mobile Networks.

It should be also noted that in several countries military authorities use most of the band 7750-8500 MHz.

In most cases administrations are using the ITU-R Recommendations F.385 in the sub-bands between 7125-7750 MHz and F.386 in sub-bands within 7750-8500 MHz. In both cases channel widths vary between 3.5-28 MHz.

With regard to the future trends, 26% of the responses indicated expectations of further increase and introduction of new links, 11% indicated change to digital, while 27% indicated no change. Only 2% indicated removal of links and remaining 34% of records did not offer any opinion. It seems that this spread of opinions may be qualified as moderately positive and therefore further harmonisation effort through development of CEPT channel arrangements could be justified. Today this is the only remaining frequency band with major FS use in Europe, where there is no CEPT channel arrangement established.

The average hop length of the PP links in this band is 31 km.

10.0-10.68 GHz

Recent developments in this band were triggered by the identification of 10.15-10.3/10.5-10.65 GHz in ERC/REC 13-04 as one of the preferred bands for FWA introduction in Europe. Being supplemented by the development of the appropriate channel arrangement in ERC/REC 12-05, significant incentive is provided for harmonisation of use in this band, but unfortunately, this process is not yet completed.

The still remaining difficulties lie primarily in the use of other co-primary services in this band, notably the military radiolocation service. Another service, competing for access to this band is video SAP/SAB links (ENG/OB), such as cordless/portable cameras and temporary point-to-point video links, for which the band 10-10.68 GHz is designated as one of the tuning ranges. These video SAP/SAB links were quite successful in establishing better use of this band, because of their occasional and highly localised usage pattern, hence more favourable sharing conditions.

Arriving to this scene, FWA faced the difficulty of having to fit around existing and well established different services in this band. Therefore, although today already 7 of 21 responding countries have allowed FWA deployment in this band and 3 more indicated their plans to do so in the near future, the actually designated sub-bands for FWA (their width, duplex spacing and overall positioning within the band) vary significantly between those countries.

However, the first choice for FWA use still remains the sub-bands 10.15-10.3/10.5-10.65 GHz. If these sub-bands are available for FWA, then the unidirectional video SAP/SAB services may concentrate in the gap 10.3-10.5 GHz, avoiding possible incompatibility problems with dense FWA deployment.

It should be also noted that recent studies indicated sharing difficulties between FS and licence-exempt SRDs in the band 10.5 – 10.6 GHz when an EIRP of 25 mW is exceeded. Since the already established SRDs operating with a power in excess of 25 mW can not be shifted or removed from this band a common use of SRDs and FWA could cause difficulties. Thus uncoordinated SRD systems (traffic control, door openers, alarm systems, etc.) constrain the development of FS in many countries.

Furthermore, it should be noted that utilisation of the higher parts of the band require protection of EESS (passive) services, operating in 10.6-10.68 GHz.

As in other bands identified for FWA, the actual extent of FWA deployment is difficult to estimate because of lack of data on user terminals. Only a number of licensed networks or a number of central stations is reported in most cases (see information in Annex 1 for details). Extent of use by video links of this band is also impossible to evaluate precisely, because of their occasional operations, in particular by international visiting ENG/OB teams.

10.7-12.5 GHz

The band 10.7-11.7 GHz remains in major homogenous use throughout Europe for high capacity (140-155 Mb/s) PP links in infrastructure support/trunk networks. The channel arrangement adopted in most countries is set up by the ERC/REC 12-06, which eliminated inconsistencies with original channel plan in the ITU-R F. 387.

Further harmonisation measures in this band were taken by the CEPT through adoption of ERC/DEC(00)08, which stipulates that the new FS assignments in the sub-band 10.7-11.7 GHz should be limited to high capacity (more than 140 Mb/s) trunk links only. Administrations are also invited to take all other practicable steps to protect the uncoordinated FSS stations from the new installations of fixed links, since most FSS systems in the band 10.7-11.7 GHz provide Direct-to-Home (DTH) satellite TV to millions of satellite receivers throughout Europe.

The majority of administrations, who provided such information, indicated a decrease of interest for FS in the band 10.7-11.7 GHz. However, in some countries the number of assignments to FS increased since 1997 and is expected to increase further. Therefore no single trend for future developments in this band may be identified. Of countries responding to the questionnaire, 4 countries expressed opinion that no new links will be added and further 3 countries expressed their intentions to phase-out FS from this band completely, but also 2 countries indicated expected increase of FS use in the band 10.7-11.7 GHz.

The sub-band 11.7-12.5 GHz is still used in some countries for specific FS applications such as CATV distribution networks. However, apart from this remaining limited use, in most CEPT countries this band is not used and not planned for FS applications, in line with provisions of ERC/DEC(00)08.

12.75-13.25 GHz

This band is used homogeneously throughout Europe for multi-purpose low, medium and high capacity radio relay links. In most countries the channel arrangement follows ERC/REC 12-02, which allows the provision of channels for a variety of low-high capacity systems.

The band shows positive growth in the number of FS links. The channels assigned follow the pattern of 3.5/7/14/28 MHz lattice. The data throughput varies normally between 2-34 Mb/s, in some cases increasing to 155 Mb/s. The average hop length of the links is 19 km.

Most of the countries indicated that they expect further growth of FS use in this band, some mentioning possibility of congestion.

14.25-14.5 GHz

Current CEPT policy for this band (e.g. ERC/REC 13-03) discourages development of FS in those countries, where it was not up to now used for FS. This measure is seen as necessary to create most favourable conditions for development of VSAT and SNG services, by eliminating the need to co-ordinate with FS as much as possible. In accordance with this policy, there was no CEPT channel arrangement developed for FS in this band.

Current analysis confirms that the above policy reached its objectives. Today only 3 countries still use the band 14.25-14.5 GHz for FS and a limited number of transportable links is also in operation in one another country. No other country intends to introduce FS applications in this band, which is in line with ERC Recommendation 13-03.

In those countries using the band for FS, the total number of links had been almost stable over the past four years. The channel bandwidth range from 1.75 MHz to 28 MHz, the minimum hop length (based on data from one country only) is 6 km.

14.5-14.62/15.23-15.35 GHz

This is another band of major homogenous use in Europe for wide variety of low and medium capacity PP links, in particular focusing on local and regional infrastructure provisioning for new operators of Public Mobile Telephony networks.

Application of the CEPT channel arrangement in ERC/REC 12-07 respects the NATO harmonised band of 14.62-15.23 GHz by placing it in the duplex gap between go-return legs of the FS plan. However, in some countries, different military requirements resulted in national channel arrangements with different band limits.

Following high demand for infrastructure support in swiftly developing mobile networks, this band has seen almost two-fold increase in number of links since the 1997. The channel bandwidth ranges from 3.5 MHz to 28 MHz, with carried bit streams of 2-34 Mb/s, in few cases of up to 140/155 Mb/s. The average hop length in this band is 14 km.

17.3-17.7 GHz

Currently there does not appear to be many operational fixed links in the band throughout Europe. Only in 3 countries there are some links in operation.

All efforts within CEPT to promote FS use in this band through a primary allocation in the ECA table and the identification of this band as a possible candidate for MWS did not result in an increased use of this band or even more definite plans for future FS use.

17.7-19.7 GHz

With increasing tendency this band is extensively used throughout Europe for low, medium and high capacity fixed links in the regional networks in accordance with the harmonised channel arrangement in ERC/REC 12-03. The number of reported FS links in this band increased by about 50% since 1997.

Beside the vitally important FS use, this band is also envisaged for future FSS applications. ERC/DEC(00)07 sets forth the provisions for the co-existence of FS applications and FSS Earth Stations without individual site co-ordination.

For the fixed service this means the introduction of technical measures to improve co-existence, such as high performance antennas and Automatic Transmitter Power Control (ATPC). On the other hand, FSS Earth Stations without individual site co-ordination, receive no protection against potential interference from the FS.

The actual channel widths employed vary widely between 2-55 MHz, but channel width of 27.5/55 MHz is met more often, since the users tend to maximise the transmission capacities of their links. The average hop length for PP links in this band is 11 km.

21.2-22 GHz

Following a decision taken at WARC-92, the frequency range 22-29.5 GHz has been re-arranged and harmonised channel plans were introduced in CEPT through the CEPT Recommendation T/R 13-02 for the bands 22.0-22.6/23.0-23.6 GHz, 24.5-26.5 GHz and 27.5-29.5 GHz. Since then most FS in the 20-30 GHz range has concentrated in those harmonised bands.

Few remaining administrations that still use FS according to the old plan in the sub-band 21.2–22 GHz are considering the removal of the FS from this sub-band, taking into account the introduction of the broadcasting-satellite allocation in the year 2007. Apart from the FS use, the band or parts of it are used in several countries for ENG/OB.

22-23.6 GHz

With a fast growing number of assignments (number of links has more than doubled between 1997-2001), this band is heavily used throughout Europe for digital FS systems with low/medium and high capacity PP links. In many cases this is used for the provision of regional telecommunication infrastructure (e.g. for Public Mobile Telephony Networks), but also for multi-purpose RRL, such as private FS networks, etc.

In most countries the channel arrangement follows Annex A of CEPT Recommendation T/R 13-02, with actually used channel widths of 3.5/7/14/28 MHz. In few countries 56 MHz channels are also in use. The average recorded hop length in this frequency band is 7 km.

The gap 22.6–23 GHz as well as the sub-band 24.25–24.5 GHz is used in a few countries for video SAP/SAB links (ENG/OB).

24.5-26.5 GHz

The use of this band is fast increasing throughout CEPT for FS in accordance with the channel arrangements in Annex B of CEPT Recommendation T/R 13-02. This encompasses the FS applications for the provision of regional telecommunication infrastructure (e.g. for Public Mobile Telephony Networks) using digital point-to-point, but also point-to-multipoint fixed links. The capacity of the links ranges between low, medium and high.

On the other hand, this band is used for the provision of PMP FWA services, in accordance with its identification in ERC/REC 13-04 as one of the preferred bands for FWA introduction in Europe. Assignment of channels for FWA also follows arrangements given in T/R 13-02. Together with the band 3400–3600 MHz this band (or parts of it) constitutes the most widely used band for the provision of FWA within CEPT. While in 1998 there were only first intentions for the provision of spectrum for FWA in this band, most countries have now already assigned or at least plan to assign spectrum for FWA.

Unfortunately, as in other FWA bands, the actual extent of FWA deployment is difficult to estimate because of lack of data on user terminals. Only a number of licensed networks or a number of central stations is reported in most cases (see information in Annex 1 for details).

However, the growth of PP links in this band is documented more precisely, with the number of recorded links jumping from almost zero in 1997 to more than 10,000 in 2001. The replies also show expectation of further significant increase in FS use of this band.

The average length of reported (PP) links in this band is 6 km.

27.5-29.5 GHz

After the band was kept empty for a number of years, the recent adoption of ERC Decision ERC/DEC(00)09 has taken away the uncertainty regarding shared use of this band by FS and transmitting Earth Stations in Fixed Satellite Service. The FS usage plans in this band foresee provision of spectrum either for infrastructure support links (within the Public Mobile Telephony Networks) or FWA, or both, depending on the individual requirements in a particular country. The channel arrangements are likely to follow those in Annex C of CEPT Recommendation T/R 13-02.

31.0-31.3/31.5-31.8 GHz

These bands are currently used in one country for security video systems. Apart from further plans in one other country to use these bands, there is no other FS use or plans for such use in Europe.

However, it is acknowledged that with an appropriate channel arrangement, at least the band 31.0–31.3 GHz could be useful for future FS applications.

CEPT has therefore developed in ECC Recommendation (02)02 a channel arrangement for the part 31.0–31.3 GHz with channel spacing equal to those in the bands below and above in order to take benefit from the equipment family. This recommendation contains appropriate measures (guard band and transmitter output power) to protect the passive services in the neighbouring band.

The protection of the passive service, in particular EESS, is also the reason why the use of the band 31.5–31.8 GHz (which is allocated to the FS only through a footnote) is not promoted in this channel arrangement.

31.8-33.4 GHz

This band constitutes a new 1.6 GHz resource for the FS. The allocation to the FS was confirmed at WRC-2000 and identified as available for high-density applications in the fixed service through ITU-R RR footnote S5.547.

A harmonised CEPT channel arrangement was developed in ERC/REC 01-02 with channel spacings as in the FS bands below and above in order to benefit from the equipment and system developments in those bands. On a global level the ITU-R Rec. F.1520 provides similar channel arrangements, including block arrangements.

The band 31.8-33.4 GHz already plays an important role in the plans of many administrations, operators and manufacturers. With this new resource administrations can flexibly and quickly react to the market requirements, for example through the provision of additional spectrum for infrastructure links and/or FWA.

Some additional measures are foreseen for this band in order to ensure co-existence with the airborne stations in the radionavigation service (RNS). The ITU-R RR footnote S5.547A requests administrations to take practical measures to minimise the potential for interference between stations in the FS and the said RNS stations in the band 31.8-33.4 GHz, taking account of the operational needs of the RNS. These measures are described in a Draft New Recommendation (DNR) ITU-R F.[Doc. 9/86], which at the time of completing this report was in the consultation process in ITU-R.

For FS stations the measures recommended in the DNR would mean the use of ATPC, Forward Error Correction (FEC), robust access/modulation techniques, receiver blocking filter, robust synchronisation and high performance antennas. Furthermore, minor operational restrictions on the FS may be necessary, where practical or possible, such as maximum elevation angle.

Currently work is also on going in ETSI on development of relevant standard for FS equipment in the bands 31-31.3/31.8-33.4 GHz.

37.0-39.5 GHz

With growing tendency this band is extensively used throughout Europe for a variety of PP links, mostly forming part of regional telecommunication infrastructure (e.g. for Public Mobile Telephony Networks), but also for multi-purpose RRL. These links usually have low or medium capacity and follow the channel arrangement in CEPT Recommendation T/R 12-01.

The high density FS use in this band is also reflected in the ITU-R RR S5.547A, identifying the band as being available for high density applications in the FS.

This band has seen one of the fastest growths over the last years, as the number of reported links in this band has more than tripled between 1997-2001. In many of responses the expectation for further increase in use of this band was indicated. Furthermore, several countries allow unplanned, uncoordinated FS use within specifically designated sub-bands, subject to national arrangements.

The actual channel width of PP links in this band follows the pattern of 3.5/7/14/28 MHz, the average hop length of recorded links was calculated at 2.7 km.

Besides the vitally important FS use, this band is also envisaged for future FSS applications. However, the priority for FS in this band was provided through the ERC/DEC/(00)02. According to this decision, Earth Stations in FSS without individual site co-ordination shall not be granted protection against potential interference from the FS.

40.5-43.5 GHz

This band is available for high density applications in the fixed service in accordance with ITU-R RR S5.547A. CEPT has also designated this band for Multimedia Wireless Systems (MWS) through the ERC/DEC/(99)15.

In addition to that, CEPT has also recently developed the ERC Decision, which sets the priority for the FS over the FSS Earth Stations without individual site co-ordination, by stating that the latter shall not be granted protection against potential interference from the FS.

The plan for introduction of broadband access systems in this band has found broad acceptance within CEPT. Recent ERC/REC 01-04 providing the necessary guidelines for development of a country's individual frequency plan, is aimed to be technology independent to ensure least possible incursion in the market competition between different system solutions.

47.2-50.2 GHz

Apart from FS in one country (49.2–50.2 GHz) and few video SAP/SAB links in some countries, this range is not yet used by the fixed service. However, a number of countries have already indicated their plans to introduce FS, following the CEPT channel arrangement set forth in ERC/REC 12-10 (48.5-50.2 GHz).

Regarding the introduction of High Altitude Platform Stations (HAPS, which is also seen as an application in FS, see ITU-R RR S5.552A) in the designated sub-bands 47.2-47.5/47.9-48.2 GHz, no such plans were reported. The lack of take up and plans for HAPS can be attributed to the fact that the technology of HAPS stations has not yet matured enough for commercial realisation. Interest for this technology could increase when the HAPS technology becomes commercially feasible.

51.4-52.6 GHz

This band is available for high-density applications in the fixed service through ITU-R RR footnote S5.547 and is planned for FS use in many European countries in accordance with the channel arrangement in ERC/REC 12-11.

Together with the FS bands immediately below and above, this band could play an important role in the provision of infrastructure for future mobile networks.

55.78-59 GHz

Also available for high-density applications in the fixed service through ITU-R RR footnote S5.547, this frequency range is planned for FS use in many European countries. The range is split into two parts: 55.78–57 GHz and 57–59 GHz, for which harmonised CEPT channel arrangements are available through ERC/RECs 12-09 and 12-12.

While the band 55.78–57 GHz is intended for traditionally licensed links, the band 57–59 GHz is in many countries planned or already available for license exempt use by uncoordinated links. Provisions for such use are already incorporated in the ERC/REC 12-09.

64-66 GHz

Currently there are no commercial fixed service systems in operation above 60 GHz. Although 64-66 GHz is one of the bands listed in ITU-R RR footnote S5.547 for high density FS applications, its use by FS systems still seems to be a longer term objective.

3.5 Trends in FS applications

This section analyses some of the most prominent applications in the Fixed Service, which showed some significant development trends on the pan-European scale over the last few years.

Long-haul trunk networks

Long-haul trunk networks are probably the oldest major application in the fixed service. Such trunk networks were originally used for transmission of long-distance telephony traffic between the regional switching centres within the national PSTN networks of incumbent telecom operators, also forming part of international connections. Usually such long-haul trunk networks were made of long chains of high-capacity links (often with several parallel channels, including hot standby reserve channels), with a typical hop length of some 40-50 km and more. Later such chains were often completed to form several nation-wide rings for more adaptable and reliable routing of traffic.

Similar long-haul PP FS networks were used in many countries for distribution of TV and radio broadcasting signals from central production facilities (studios) to the regional VHF/UHF transmitters. Later, when new operators emerged in the liberalised telecommunications environment, additional long-haul trunk networks were set up to provide connectivity between the initially established regional branches of their new networks, such as the Public Mobile Telephony Networks.

Because of the long distances covered and the high capacity channels required, trunk networks were mostly concentrated in frequency bands such as 4 GHz, lower 6 GHz and upper 6 GHz. Some later established trunk networks (in particular those of new mobile operators) or networks which required shorter paths used frequencies in higher bands, such as 7/8 GHz and 11 GHz.

However, after many years of well-established and stable use, the long-haul trunk networks have recently seen significant change in attitude towards them. First of all, higher capacity fibre networks have gradually replaced many traditional trunk routes.

On the other hand, newer trunk networks, as used by mobile operators, have changed their deployment pattern following the introduction of densely deployed widely distributed mobile networks. They now have to provide many more densely located fixed links in complex chain/ring/star configurations. Therefore these types of trunk networks have been classified as "infrastructure support" networks.

So today the traditional long-haul networks are used as a supplement to other types of network, notably fiber networks, where justified by the need to preserve certain redundancy of national networks or where lying of a fibre or cable network is not economically feasible. This means that although the existing long-haul trunk networks are likely to remain in use for many years to come, they are not likely to develop significantly.

Infrastructure support networks

Infrastructure support networks of FS are usually used to provide connectivity between switching centres (one or several) and various nodes at different layers of such telecommunications networks as Public Mobile Telephony Networks or FWA networks. Infrastructure support networks are distinguished from trunk network by presence of many layers and different connectivity configurations, which are ultimately formed by fixed links. Configurations of infrastructure support networks range from the chains connecting remote underlying network segments, nation-wide rings of backbone routing and combined ring/star networks for connecting many base stations (or other kind of bearer network terminal points) to regional switching or multiplexing centres. One simplified fragment of such infrastructure support network was given in Figure 1 of this report.

The GSM networks in Europe have grown significantly since they were introduced around 1993. Very soon after commercial introduction, there was at least one GSM network in every European country, but in many countries there were 2-3 and even more networks (this was particularly the case after the licensing of GSM-1800 networks in second half of last decade). All these networks grew significantly first achieving maximum coverage, and thereafter a steady increase in subscriber bases and carried traffic networks. Up to now the networks are continuously growing in terms of the number of serving base stations and their density.

All this growth of internal infrastructures of 2G networks was required to support the permanent growth of subscriber bases, and as this still continues today, the infrastructure networks are also likely to grow further. This growth will continue and with the arrival of 3G (IMT-2000/UMTS) public mobile networks, further demand for infrastructure support solutions can be expected. On the other hand, the site sharing, which is now being increasingly considered due to environmental and cost reasons, could have a limiting effect on the number of needed infrastructure support links.

Moreover, other high capacity applications for infrastructure support, such as cable and optical fibre may be viable alternative or complimentary solutions to wireless. The choice of utilising these alternative/complimentary applications as part of a network infrastructure depends on the penetration of the existing infrastructure, the expected network rollout time, and the ultimate cost of different solutions.

Still today it seems that wireless often provides a more practical and economic infrastructure alternative for quick roll out of networks such as mobile networks. The mobile networks already have to erect towers for their base stations at least every 20-30 km, so inter-connecting them with wireless FS only adds to the overall cost by the cost of the FS terminal equipment. On the other hand, laying down fibre or cable links demands much more additional work and costs. Therefore fibre and cable only become viable after the mobile network has grown significantly to the level, where wireless infrastructure links have reached their capacity limits. But this usually happens only on inter-regional (trunk) paths.

Current FS infrastructure support links generally provide data throughput from 2 Mb/s and up to NxSTM-1 (155-655 Mb/s). In principle, all frequency bands available for the FS could be and often are used for infrastructure support networks.

In the following table 3 the most commonly used bands (as seen at the end of 2001) are listed and their technical characteristics such as transmission capacities, channel spacings, modulation levels, available number of channels and typical hop length are shown.

Of course specific national situations and requirements sometimes result in the use of other bands (e.g. bands below 3.6 GHz), different channel arrangements with different band limits or different characteristics than those described below. For detailed information on national use of infrastructure support links please refer to the summary FS usage table in Annex 1.

Frequency band (band limits)	CEPT Channel plan	Transmission capacities	Channels		Typical hop length
			Width	Total in the plan	
4 GHz (3600–4200 MHz)	REC 12-08	STM-1, nxSTM-1	40 MHz	7	20 – 80 km
			29/30 MHz	6/9	
		STM-0	20 MHz	14	
		34 Mb/s, 2x34 Mb/s, STM-0	15 MHz	18	
Lower 6 GHz (5925-6425 MHz)	REC 14-01	STM-1, nxSTM-1	29.65 MHz	8	20 – 80 km
Upper 6 GHz (6425–7125 MHz)	REC 14-02	STM-1, nxSTM-1	40 MHz	8	20 – 80 km
		STM-0	20 MHz	16	
7/8 GHz (7125–8400 MHz)	Not available	STM-1, nxSTM-1	28 MHz	5/8	20 – 80 km
		34 Mb/s, 2x34 Mb/s, STM-0	14 MHz	10/16	
		8x2 Mb/s, 4x2 Mb/s	7 MHz	20/32	
11 GHz (10.7-11.7 GHz)	REC 12-06	STM-1, nxSTM-1	40 MHz	12	10 – 50 km
13 GHz (12.75-13.25 GHz)	REC 12-02	STM-1, nxSTM-1, 34 Mb/s	28 MHz	8	5 – 35 km
		8x2 Mb/s, 34 Mb/s, STM-0	14 MHz	16	
		8x2 Mb/s, 4x2 Mb/s	7 MHz	32	
		4x2 Mb/s, 2x2 Mb/s	3.5 MHz	64	
15 GHz (14.5-14.62/15.23-15.35 GHz)	REC 12-07	2xSTM-1	56 MHz	2	5 – 30 km
		STM-1, nxSTM-1, 34 Mb/s	28 MHz	4	
		8x2 Mb/s, 34 Mb/s, STM-0	14 MHz	8	
		8x2 Mb/s, 4x2 Mb/s	7 MHz	16	
		4x2 Mb/s, 2x2 Mb/s	3.5 MHz	32	
18 GHz (17.7-19.7 GHz)	REC 12-03	STM-1, nxSTM-1	55 MHz	17	4 – 25 km
		STM-1, 2x34 Mb/s, 34 Mb/s	27.5 MHz	35	
		8x2 Mb/s, 34 Mb/s, STM-0	13.75 MHz	70	
		8x2 Mb/s, 4x2 Mb/s	7 MHz	136	
		4x2 Mb/s, 2x2 Mb/s	3.5 MHz	272	
23 GHz (22.0–23.6 GHz)	T/R 13-02 Annex A	2xSTM-1, STM-1	56 MHz	10	3 – 20 km
		STM-1, STM-0, 34 Mb/s	28 MHz	20	
		8x2 Mb/s, 34 Mb/s, STM-0	14 MHz	41	
		8x2 Mb/s, 4x2 Mb/s	7 MHz	83	
		4x2 Mb/s, 2x2 Mb/s	3.5 MHz	168	
26 GHz (24.5–26.5 GHz)	T/R 13-02 Annex B	2xSTM-1, STM-1	56 MHz	16	2-15 km
		STM-1, STM-0, 34 Mb/s	28 MHz	32	
		8x2 Mb/s, 34 Mb/s, STM-0	14 MHz	64	
38 GHz (37.0–39.5 GHz)	T/R 12-01	2xSTM-1, STM-1	56 MHz	20	1-6 km
		STM-1, STM-0, 34 Mb/s	28 MHz	40	
		8x2 Mb/s, 34 Mb/s, STM-0	14 MHz	80	
		8x2 Mb/s, 4x2 Mb/s	7 MHz	160	
		4x2 Mb/s, 2x2 Mb/s	3.5 MHz	320	

Table 3: Commonly used bands for infrastructure support networks

It should be noted that in addition to the bands listed in Table 3, further bands will be required especially for the provision of a high density over short links.

This requirement also becomes obvious from the structure and foreseeable density of the UMTS/IMT-2000 transport network, which will require a large amount of spectrum, especially for short hops in the range of a few kilometres, but also up to some tens of kilometres.

The following Tables 4 and 5 show the bands for PMP and PP links, which in addition to the bands in Table 3 are available in CEPT for accommodating future infrastructure support FS networks. However the actual FS usage in the bands listed in Tables 4 and 5, including time scales and whether a band is used by PMP or PP FS systems will depend on the individual administrations requirements.

Frequency band	CEPT	Transmission capacities	Channels	Typical

(band limits)	**Channel plan**		**Width**	**Total in the plan**	**hop length**
28 GHz (parts of 27.5–29.5 GHz)	T/R 13-02 Annex C	16x2 Mb/s, 32x2 Mb/s	28 MHz	14+8	< 5 km
		8x2 Mb/s, 16x2 Mb/s	14 MHz	28+16	
		8x2 Mb/s, 4x2 Mb/s	7 MHz	56+32	
		4x2 Mb/s, 2x2 Mb/s	3.5 MHz	112-+64	
32 GHz (31.8–33.4 GHz)	REC 01-02	16x2 Mb/s, 32x2 Mb/s	28 MHz	27	< 5 km
		8x2 Mb/s, 16x2 Mb/s	14 MHz	54	
		8x2 Mb/s, 4x2 Mb/s	7 MHz	108	
		4x2 Mb/s, 2x2 Mb/s	3.5 MHz	216	

Table 4: Possible frequency bands for future PMP infrastructure support networks

Frequency band (band limits)	**CEPT Channel plan**	**Transmission capacities**	**Channels**		**Typical hop length**
			Width	**Total in the plan**	
28 GHz (parts of 27.5–29.5 GHz)	T/R 13-02 Annex C	2xSTM-1, STM-1	56 MHz	7+4	2-12 km
		STM-1, STM-0, 34 Mb/s	28 MHz	14+8	
		8x2 Mb/s, 34 Mb/s, STM-0	14 MHz	28+16	
		8x2 Mb/s, 4x2 Mb/s	7 MHz	56+32	
		4x2 Mb/s, 2x2 Mb/s	3.5 MHz	112+64	
32 GHz (31.8–33.4 GHz)	REC 01-02	2xSTM-1, STM-1	56 MHz	12	1-10 km
		STM-1, STM-0, 34 Mb/s	28 MHz	27	
		8x2 Mb/s, 34 Mb/s, STM-0	14 MHz	54	
		8x2 Mb/s, 4x2 Mb/s	7 MHz	108	
		4x2 Mb/s, 2x2 Mb/s	3.5 MHz	216	
50 GHz (48.5-50.2 GHz)	REC 12-10	34 Mb/s	28 MHz	28	<2 km
		8x2 Mb/s	14 MHz	56	
		4x2 Mb/s	7 MHz	112	
		2x2 Mb/s	3.5 MHz	224	
52 GHz (51.4-52.6 GHz)	REC 12-11	STM-1	56 MHz	9	<2 km
		34 Mb/s	28 MHz	18	
		8x2 Mb/s	14 MHz	36	
		4x2 Mb/s	7 MHz	72	
		2x2 Mb/s	3.5 MHz	144	
55 GHz (55.78-57.0 GHz)	REC 12-12	STM-1	56 MHz	9	<1 km
		34 Mb/s	28 MHz	18	
		8x2 Mb/s	14 MHz	36	
		4x2 Mb/s	7 MHz	72	
		2x2 Mb/s	3.5 MHz	144	
58 GHz (57-59 GHz)	REC 12-09	2x2 Mb/s, nx2 Mb/s	100 MHz	20	<1 km
		2x2 Mb/s, nx2 Mb/s	50 MHz	40	

Table 5: Possible frequency bands for future PP infrastructure support networks

Looking at the extensive range of bands listed in Tables 4 and 5, it may be noted that these bands have none or very few FS links in operation today. It may therefore be concluded, that the available resources should be sufficient for long-term development of FS and in particular development of new infrastructure support FS networks.

Fixed Wireless Access networks

Fixed Wireless Access (FWA) networks are designed to provide a direct connection between the Customer Premises Equipment (CPE, essentially user terminal) and an operator's core network (PSTN network, data communication network). FWA normally uses PMP radio technology to serve a large number of CPEs within the coverage area of a central station, as was illustrated on Fig. 3. Thus, FWA essentially applies the principle of a cellular network, already well established in mobile communication networks, into a fixed service scenario.

Therefore FWA aims at providing a viable alternative solution for the replacement of the usual copper local loop of PSTN. However besides providing essentially narrow-band services over copper access in PSTN, FWA is also aiming at providing access solutions capable of provisioning truly broadband (multimedia) services to end-customers. Therefore FWA networks capable of providing broadband services are also sometimes called Broadband Wireless Access (BWA).

Another terminology, originating from North America, often refers to FWA in terms of MMDS or LMDS. MMDS stands for Multipoint Multichannel Distribution Service – a service in the 2-3 GHz range, originally used for pure cable-like TV distribution, but later augmented with interactive multimedia capabilities. LMDS stands for Local Microwave Distribution Service – a broadband access solution in frequency bands generally above 20 GHz, but originally between 30-40 GHz.

The scope of FWA in the bands around 3.5 GHz and below is to provide basic narrow-band telecommunication services (telephony, Internet access at ISDN data rates) to customers, which could not be reached economically by other media or those served by non-incumbent operators, having no copper infrastructure in place. However in the higher bands (10 GHz, 26 GHz and above) the scope of FWA is to provide basic telephony, but also high bit rate data services (anything up to 2 Mb/s and above) for Internet access, video conferencing, interactive multimedia services (e.g. video on demand, etc.).

Although FWA is in principle well suited for serving any customers, ranging from residential to small businesses (SOHO/SME) and large corporations, however the analysis of current market situation shows, that FWA operators today less and less hope to make profitable business plans by serving residential customers. After residential access (including ISDN and broadband DSL services) prices were driven down by competition and non-incumbent operators got access to copper infrastructure through the local loop unbundling, implemented in many countries, it became extremely hard for FWA to compete in residential market because of still high CPE pricing.

So today FWA operators are placing emphasis on targeting selected SME customers, providing bearer services to ISPs and alike or, recently more and more actively, they are connecting base stations in the mobile networks, thus provisioning infrastructure support. In many European countries (see Table 1), FWA operators are free to choose the services they provide, in those countries where FWA licences are restricted to residential access only, special licences for PMP infrastructure support network were sought.

As mentioned in previous sections, it was impossible in this study to assess the exact development of FWA in terms of number of links (served users), because of their usually non-licensed operation. Nonetheless, even those few numbers reported by administrations (either number of links, frequency assignments or central stations) show overall increase from some 1,000 in 1997 to a little bit more than 10,000 in 2001. However, again it is impossible to make a clear conclusion from comparing these figures, because of the different essence of accountable items (link/central station/network/frequency assignment) reported by respondents.

Despite the lack of tangible statistics, the CEPT has kept positive expectations towards the future growth of FWA in general. To ensure long-term development of wireless access systems, the band 40.5-43.5 GHz was designated in CEPT for Multimedia Wireless Systems (MWS), a next generation of FWA with true multimedia capabilities (combined multi-channel video distribution services with broadband interactive access).

The frequency bands identified today in CEPT for FWA are summarised in Table 6 below.

Frequency band (band limits)	CEPT Channel plan	Channels		Typical hop length
		Width	**Total in the plan**	
3.4 GHz (3400-3600 MHz, also/or 3600-3800 MHz in some countries)	REC 14-03 REC 12-08	0.25 MHz slots	760	10-20 km
10 GHz (10.0-10.68 GHz)	REC 12-05	0.5 MHz slots	1360	<10 km
26 GHz (24.5-26.5 GHz)	T/R 13-02 Annex B	28 MHz	32	<5 km
		56 MHz	16	
28 GHz (parts of 27.5–29.5 GHz)	T/R 13-02 Annex C	28 MHz	14+8	<5 km
		14 MHz	28+16	
		7 MHz	56+32	
		3.5 MHz	112-+64	
40 GHz (40.5-43.5 GHz)	REC 01-04	1 MHz slots FDD/TDD	3000	1-3 km

Table 6: Frequency bands identified as preferential for PMP FWA networks

Again the actual usage of the bands listed in Table 6 also their implementation time scales depends on individual Administration requirements and not all bands could be available in all CEPT countries for FWA applications.

Other bands used for FWA in a few European countries are mostly those below 3 GHz (around 1.5 GHz and 2-2.7 GHz), however they are used on a very limited national basis only.

It may be concluded, that FWA today is still at a very early stage of development, therefore it would be too early to conclude on its ultimate viability and share of the FS market it might occupy. Some important steps were made by CEPT since 1997 on the technical side through identification of preferential FWA bands and setting up channel arrangements, also on the national regulatory side through licensing of FWA operators. Now it is up to the market to show the real demand for FWA service offerings.

4 TECHNOLOGY TRENDS

4.1 Evolution of modulation technology

Point-to-point links

Technological advances in the area of modulation technology had a profound effect on the increase of capacities of point-to-point links. Today modulation schemes of as high as 128-QAM are used widely for trunk/infrastructure networks and modulation as high as 16-QAM is increasingly used for access links. Potential higher susceptibility to interference is successfully overcome by applying careful planning of link budgets.

The flexibility in applying higher modulation orders to achieve higher throughput in a given channel bandwidth allows operators to solve capacity problems within the conditions of spectrum scarcity in a particular frequency band.

Point-to-multipoint (FWA) networks

Some time ago FWA developers tended to follow the trend of increasing link capacities through the application of higher order modulation schemes. However consideration of intra-system radio planning issues has resulted in 64 modulation states being thought as the highest practical solution for PMP networks. Instead of increasing that, manufacturers try to utilise lower modulation schemes in a more efficient manner, optimising performance of radio system for a given deployment scenario.

PMP networks are usually deployed in a dense manner. It is necessary to ensure the transmission of high data rates between the base and terminal stations, and, at the same time, minimise the possible intra-system interference between different cells/sectors of the network. As link budgets for PMP networks, by nature of their design, will differ for differing terminal stations, this leads to consideration of the appropriate modulation scheme to be employed in a scenario of different terminal stations.

Therefore manufacturers recently started the development of systems with adaptive modulation. They provide the possibility to combine in the same transmitted stream a set of different modulation/coding formats, like including several modulations (e.g. QPSK together with (16/32/64)-QAM) and using advanced coding schemes (e.g. a basic code and derived punctured codes).

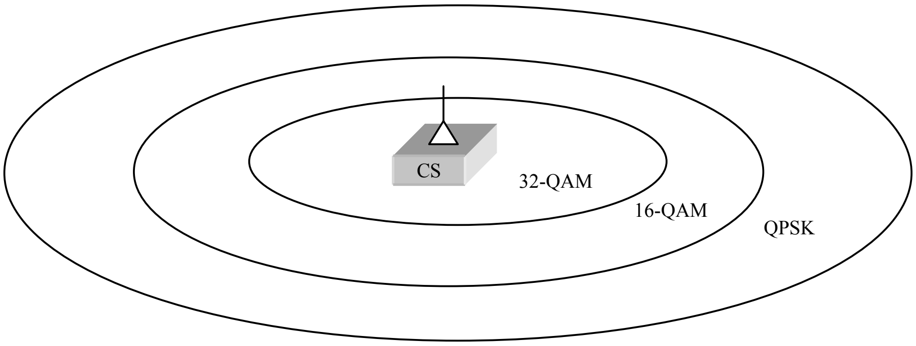


Figure 10: Example of using adaptive modulation in a PMP network, serving terminals with different link budgets

Such adaptive modulation allows achieving a most efficient utilisation of the available spectrum. For example, when different modulations are put in different time slots of the same TDMA stream, it allows the system to employ higher state modulations communicating with terminals in a close proximity to the base station. Then the time slots with more robust modulation could be used for communication with terminals located on the edge of coverage area, see example on Figure 10.

Techniques such as adaptive modulation are particularly well suited for point-to-multipoint scenarios of deployment of FWA and dense infrastructure support networks. Another important factor to note is that adaptive modulation techniques combined with adaptive duplexing (as is possible with TDD systems), provide flexibility to help solve problems related to evolution of network density and coverage.

4.2 Multipoint-to-multipoint networks

Multipoint-to-multipoint networks, also known as meshed networks, are intended to serve a large number of densely located fixed terminal stations. Meshed networks would therefore provide an alternative for point-to-multipoint networks, up to now usually employed for such purposes.

While PMP networks are employing the star configuration for their networking topology, meshed networks do not require central (base) stations for communications between terminal stations. Instead, each and every terminal station may act as a repeater and pass on the traffic to/from the next terminal station. Such networks would have only one or few drop nodes, which would provide interconnection of the meshed access network to the core transport network.

Normally all nodes of the meshed network are located on the customer’s premises and act as both customer access and network repeater. In such a way traffic is routed to the addressed customer via one or many repeaters. Nodes located at the edge of the network initially act as terminating points, however may be later converted into repeaters with the further growth of the network, see Figure 11.

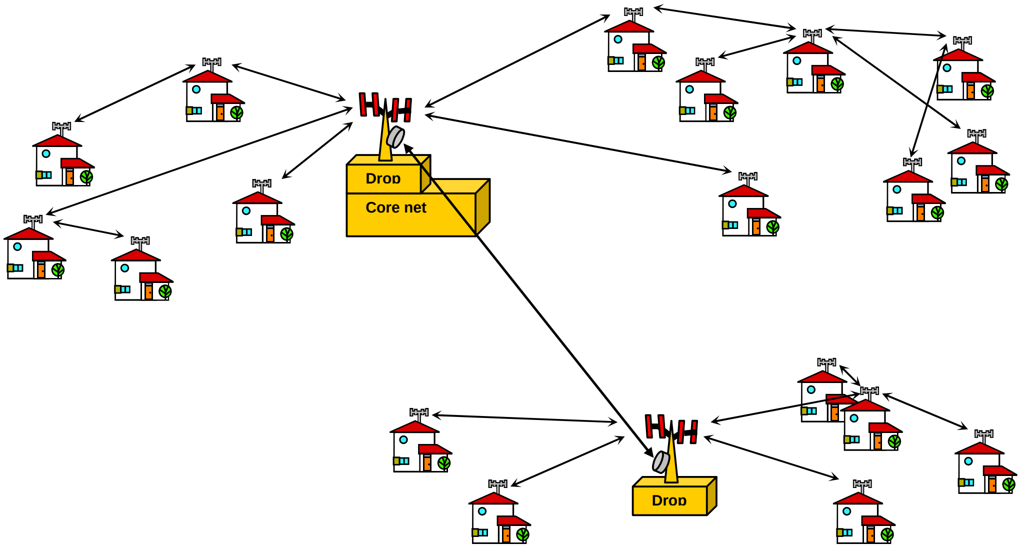


Figure 11: Example of topology in a mesh network (compare with PMP on Figure 3)

The primary advantage associated with mesh technology is a possibility for such networks to evolve seamlessly from the initial start-up with only a few nodes to a high-density deployment, by just adding additional nodes and re-configuring the network (routing arrangements). The possibility of flexible routing of the traffic could also mean improving the ability to achieve line-of-sight requirements for a new network node, as there will be higher chances to have an unobstructed path to at least one of many surrounding nodes.

Disadvantages, or rather engineering challenges, which have to be resolved before mesh technology becomes widely available, include the necessity to develop powerful and efficient tools to manage traffic flows and dynamic routing in such decentralised networks with a large (unlimited) number of nodes. Another challenge is that with the growth of the network, the proportion of the bit stream attributed to a particular node drops quickly, as the overall stream has to be shared with more and more subsequent nodes in the routing branch.

The important element of the mesh network, which influences different kinds of approaches in solving those challenges, is the kind of antennas used. It is possible to build mesh systems with either highly directional or wide beam (even omni-directional) antennas.

With omni-directional antennas there is no need to re-point antennas as the network grows and new nodes are added, but the interference created does not allow utilising the spectrum efficiently. With highly directional antennas it is necessary to point them precisely and then to have possibility to re-point them on a regular basis as the system grows and new nodes require a change in routing patterns. This might be done either by employing phased array steerable antennas, or by switching between different antennas or employing electro-mechanical mechanisms for steering directional antennas.

4.3 Antennas for FS

Antenna types

- **Directive dish antennas**

Point-to-point fixed service links use dish antennas to direct radiation between sites in order to achieve longer hop lengths and for reducing interference from and to other stations. Additionally, the microwave frequencies allow making highly efficient use of directive antennas, by reusing the same frequency channel several times at the same site into different directions. Reuse depends on many parameters, e.g. the antenna radiation pattern and the required interference attenuation.

Antenna radiation patterns are available from antenna manufacturers or they can be estimated from the ITU-R Recommendation F.699 or ITU-R F.1245 “Reference radiation patterns for sharing studies in the frequency range from 1 to about 70GHz”.

In addition, for integral and stand-alone point-to-point link antennas the following conformance specifications are referenced in EN 301 751: Radiation Pattern Envelope (RPE), antenna gain and cross-polar discrimination (XPD) for several classes of antennas depending on the potential of interference.

- **Sectorised and omni-directional antennas**

Point-to-multipoint fixed service systems normally use sectorised or omni-directional antennas at central stations and directive antennas at terminal stations.

For the omni-directional and sector antennas, their radiation patterns may be estimated from the ITU-R Recommendation F.1336. The conformance specifications for such integral and stand-alone antennas are referenced in the following ETSI standards: EN 301 525, EN 301 753, EN302 085 and EN 301215 for frequency bands between 3 and 60 GHz, see Annex 4 for details.

Antenna characteristics

In the trunk networks, important antennae characteristics are front-back ratio and decreased cross-polar radiation close to the main beam. In the access and infrastructure support networks, interference comes from larger off-axis angles, which requires high performance antennas with reduced sidelobes and improved cross-polar discrimination.
However, for economical reasons small gain antennas or low performance antennas are used in practice, especially for links with the short hop lengths. However, when it is necessary to improve frequency reuse or limit inter-service sharing difficulties through reduction of side-lobe interference, then use of such small gain or low performance antennas should be limited.

Frequency reuse

Point-to-point fixed service links in the access and infrastructure support networks are typically arranged in star configuration. For an efficient spectrum utilisation (thus high frequency reuse), more directive antennas should be placed at the central stations and the less directive lower gain antennas at the terminal stations.

A typical access network could operate at 23 GHz using 0.6 m dish antennas at the central station and 0.3 m dish antennas at the remote stations. For extended coverage 0.6 m dish antennas can also be used at remote stations. For example, it is assumed that a 40 dB attenuation is required between co-channel hops in star configuration. Based on the ITU-R Recommendation F.699, see figure 12, the minimum offset angles are 37 and 14 degrees for 0.3 m and 0.6 m dish antennas respectively. Based on ETSI EN 300 833, the required off-axis angles are 50 and 80 degrees for 0.3 m class 3 and 2 antennas, respectively.

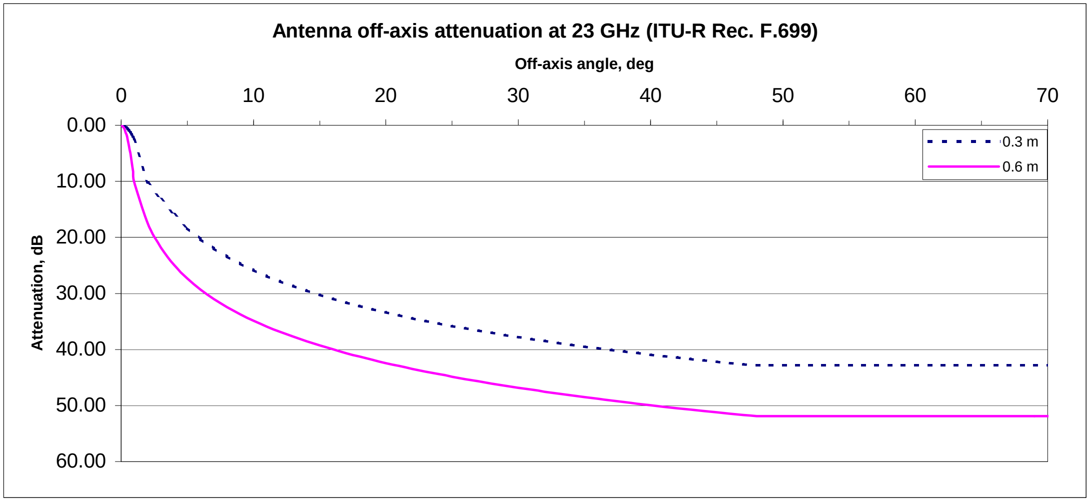


Figure 12 : Antenna radiation pattern at 23 GHz, based on ITU-R F.699-5

Then one can easily estimate that the maximum frequency reuse is 360/50=7 and 5 for 0.3 m class 3 and class 2 antennas, respectively. Frequency reuse can be further increased by using a larger 0.6 m antenna at the central station.

If another polarisation can be used, the minimum off-set angles are of the order of 5 degrees. This is mainly determined by main beam cross-polar attenuation, which is specified between 27 and 40 dB in EN 300 833.

Co-ordination
Directive antennas could reduce the potential of interference in shared frequency bands, e.g. with satellite services, for which typical cases of interference calculations are the co-ordination area around a satellite Earth station, interference from/to GSO satellites and interference from/to non-GSO satellites.

Typical radio-relay link parameters to be used in interference and sharing studies between the FS and other services are given in the ITU-R Recommendation F.758 and ITU-R RR Appendix S7, in which satellite Earth station parameters for co-ordination are also described.

The highest level of interference is produced through the main beam, particularly when the highest gain antenna is used in calculations. However, these high levels are associated with a low probability (in time for non-GSO satellites or in number of impacted links for GSO satellites). When small gain antennas are considered for short hop links or sectorised deployment, it decreases the maximum level of main beam interference, but increases the aggregate interference through sidelobes, which then becomes the limiting factor. This may cause problems in future if the use of small gain antennas is not properly considered in frequency assignments in the shared bands.

5 DISCUSSION AREAS

5.1 Assignment methods (block allocation vs. individual assignments)

From the responses to the questionnaire two different assignment methods are seen as predominant: the frequency assignment of each individual link and frequency block assignment. Table 1 in section 2.3 provides an overview on the assignment practices in various CEPT administrations.

The decision of an Administration for a particular assignment procedure for a particular band or an application can be influenced by a number of factors, which could have different backgrounds such as regulatory, administrative, technology/application or market driven.

First of all, an Administration is bound in its regulatory framework provided by their Telecommunications Act, which gives administrations certain possibilities, or flexibility limits in terms of the frequency assignment. On the other hand, this legal framework could also restrict to certain procedures, which may not always be beneficial under specific circumstances.

The choice for an assignment procedure is also very much influenced by administrative factors. The ability to handle the incoming amount of frequency assignment applications largely depends on the efficiency of the administrative handling, the assignment tool used and the manpower available in a particular Administration.

The decision for or against the individual assignment or block assignment also depends on the technology, employed by a particular application in question. For example, in the case of PMP systems, an individual assignment of each single link could produce an unnecessary administrative burden for the operator and the Administration. In this case, the individual frequency assignment for the base station or at least information on the base station location should be sufficient for the Administration to impose measures to ensure co-existence with neighbouring assignments of the same or different systems (operators).

Finally, market forces could also influence the decision for the assignment method. The time pressure for the introduction of new systems could impose the use of a speedy process for the frequency assignment in order not to hinder the rollout of networks, which are intended to enter the market quickly.

Considering the factors above, it may appear that block assignments for an operator seem to be the easiest and fastest assignment solution. This could be concluded in case of the rollout of PMP systems with a high number of links. However, this assignment method does restrict the number of operators for a given frequency band and precludes “mixed bathing” where the spectrum is available to all potential operators on a per site/link basis. Also when considering other applications, such as PP FS, a higher overall efficiency of spectrum utilisation may be achieved through an individual link-by-link assignment by the central frequency management office (Administration).

With all these potential influences and their consequences in mind, the consideration of Table 1 in section 2.2 shows that both methods are equally important for administrations to cope with the different situations in the various bands used for different purposes with different technologies.

Yet another assignment method, which could be used to cope with the different factors, is a general frequency assignment (also known as General or Blanket Licence). It is envisaged by many administrations and already practised in some countries in the band 57–59 GHz where the propagation conditions together with some basic technical restrictions should ensure the co-existence amongst many FS links without their prior co-ordination.

5.2 Convergence issues

The convergence of different telecommunications services, forming new innovative services or service packages, is currently becoming a very important issue on the agenda of spectrum managers, because it may potentially change the service definitions or give another dimension to the original definitions. Therefore the impact of this change of definitions and scope of services on the traditional service-defined allocations of spectrum is yet to be evaluated. Work on that subject has already started in the framework of ITU-R study groups.

Meanwhile it seems that for the traditional point-to-point FS, convergence is not likely to have a significant impact. As the PP FS usually provide the medium for carrying bearer services, this means that already for some time radio relay links are seen as providing transparent bit streams, which could ultimately carry any kind of information. So, the only actual change in the FS world with convergence was that instead of previously dedicated analogue systems (e.g. for distribution of TV signals, multi-channel trunk telephony networks) now users deploy universal digital links, capable of carrying any information with their allocated bit throughput.

But again, convergence may bring some new facets to provisioning of FWA applications, which, being essentially customer oriented and service tailored, may take different forms in terms of ultimate user interfaces and kinds of services provided. However even in FWA it is so far unlikely that the impact of convergence on spectrum management solutions will be as noticeable as for other radiocommunication services (e.g. broadcasting, mobile). The frequency bands and technological solutions used in FS are ultimately limiting the actual link configuration to the “point-to-point”, even for PMP and mesh networks, where the individual communication paths do still constitute a point-to-point line-of-sight connection. Therefore it is unlikely that any additional service offering on the subscriber side will change the principles behind the FS frequency allocation and use.

5.3 Refarming of frequency bands

Spectrum refarming is another new tool, since recently becoming more and more widely employed by national spectrum managers. Briefly defined, refarming is a set of administrative, economic and technical measures, aimed at achieving the recovery of a particular frequency band from its existing users for the purpose of re-assignment, either for new uses, or for the introduction of new spectrally efficient technologies.

Refarming became especially important within the last decade, in a wake of liberalisation of telecommunication services when large portions of spectrum, up to then freely used by incumbent PTTs and defence systems, had to be made available to new evolving telecommunication services and many competing non-incumbent operators.

For the FS sector in general, refarming meant both the need to vacate some of the occupied bands and obtaining new bands for development of new services. The most notable examples of FS surrendering a particular band, are the bands around 2 GHz, which were for long used for FS communications, but which had to be re-located to mobile services. On the other hand, FS gained wider access to higher bands, better suited for fixed links, in particular this concerns new bands for FWA and HDFSS.

But even internally within the FS sector refarming takes place very often, as an important tool for better re-arrangement of FS bands, used for different users or services. Examples of such “internal” refarming may be the conversion from PP to PMP use (e.g. in the band 3400-3600 MHz), the conversion from military to civil FS use, etc. Therefore FS spectrum management authorities should be well aware of advantages and mechanisms of spectrum refarming.

Some examples of FS spectrum refarming may be found in the description of national spectrum management practices in Annex 2 of this report. For additional detailed guidance on the subject, please refer to the separate ECC Report on Spectrum Refarming and Secondary Trading in the Converging World, which was under development at the time of completing this report.

5.4 Spectrum trading

Mechanisms for free trading of spectrum, in terms of transferring to a third party the right to use a particular frequency assignment is not a practice in European countries up to now. The current procedures foresee the issuing of authorisation to a particular legal or physical person, which is not transferable to other persons.

The possibility to allow trading of FWA (or PMP) licences may be further considered on the European FS market, taking into account that several FWA ventures where not able to turn their licences into actual operations, leaving large portions of spectrum unused. However, generally speaking, in such cases the right to use the frequencies is given back to the NRAs. In many cases, licence holders have little flexibility in managing their frequency usage within their overall business strategies.

The question of spectrum trading is discussed in more detail in a separate ECC report on Spectrum Refarming and Secondary Trading in the Converging World, which was under development at the time of completing this report.

6 OVERALL CONCLUSIONS OF THE REPORT

Based on the discussions presented in this report and results of the study on the current and future FS use in CEPT, the following overall conclusions may be offered:

1) Despite the recent financial turmoil in telecommunications stock markets, the core telecommunications sectors seem to be developing at steady pace. This is proved by the fact that the Fixed Services, being an essential part of basic telecom bearer services, have seen a 70% overall increase in the number of reported links in Europe between 1997-2001;

2) The most significant contributor to the growth of FS in the past years has been the provisioning of infrastructure support, in particular for GSM mobile networks. This growth of infrastructure support networks is likely to continue and may see an additional boost when 3G mobile networks (IMT-2000/UMTS) appear on the market;

3) The general overview of FS use and future trends shows the overall healthy state of the FS sector, with a steady growth in the number of links and an apparent progress of harmonisation in the selection of particular frequency bands and appropriate channel arrangements, in accordance with relevant CEPT policy decisions and recommendations;

4) It was not possible to evaluate fully the developments in the area of Fixed Wireless Access. Although records show a 10-fold increase in the number of FWA assignments since 1997, administrations often were not able to ascertain how many of those are actually on the air and how many user terminals are in operation. On the other hand, it may be concluded that CEPT initiatives with harmonisation of FWA allocations have been a success and today most of the European FWA operations are concentrated in common frequency bands;

5) Reviewing the conclusions and recommendations of the 1998 FS report, it may be concluded that its most important recommendations (creating competitive FS environment, harmonisation of FS use, development of strategies and technical rules by CEPT for access to new FS bands, etc.) have been successfully implemented by CEPT administrations, which have played a significant role in ensuring healthy growth of FS over the past few years and which have set the stage for further development of FS over many years to come;

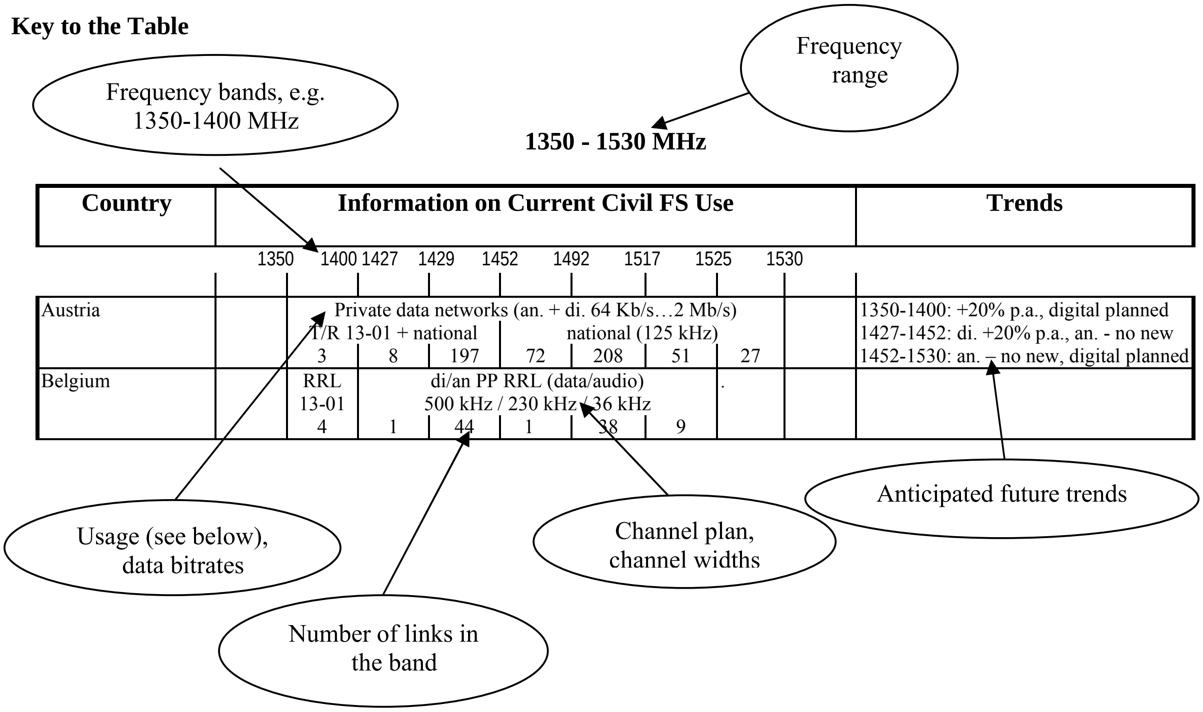
6) The only FS band, which was found lacking harmonisation incentives (in terms of clear CEPT policy and/or channel arrangements) is the band 7125-8500 MHz.

ANNEX 1: TABULAR OVERVIEW OF RESPONSES TO THE FS QUESTIONNAIRE

This annex provides a tabular overview of the current use of FS spectrum in various CEPT countries.

It should be noted that only the civil FS applications are shown in the table.

Key to the Table



Country	Information on Current Civil FS Use	Trends
Austria	Private data networks (an. + di. 64 Kb/s…2 Mb/s) T/R 13-01 + national / national (125 kHz) 3 / 8 / 197 / 72 / 208 / 51 / 27	1350-1400: +20% p.a., digital planned 1427-1452: di. +20% p.a., an. - no new 1452-1530: an. – no new, digital planned
Belgium	RRL 13-01 / di/an PP RRL (data/audio) 500 kHz / 230 kHz / 36 kHz 4 / 1 / 44 / 1 / 38 / 9	

Terms used include:
an. = analogue
di = digital
vi = video
vo = voice
au = audio
pp = point-to-point
pmp = point-to-multipoint
CS – central station (PMP/FWA)
TS – terminal station (PMP/FWA)

For trends:
Dep. = depends
Rel. = re-location

Fixed Link Definition

For the purpose of this study a fixed service link is defined as a single hop transmission between points A and B. In case of Point-to-Multipoint systems, number of Central Stations (CS) and Terminal Stations (TS) is shown separately, when available.

1350-1530 MHz

Country	Information on Current Civil FS Use									Trends
		1350	1400 1427	1429	1452	1492	1517	1525	1530	
Austria		Private data networks (an. + di. 64 Kb/s…2 Mb/s) T/R 13-01 + national 3	8	197	national (125 kHz) 72	208	51	27		1350-1400: +20% p.a., digital planned 1427-1452: di. +20% p.a., an. - no new 1452-1530: an. – no new, digital planned
Belgium		RRL 13-01 4	di/an pp RRL (data/audio) 500 kHz / 230 kHz / 36 kHz 1	44	1	38	9			
Croatia		Da + vo pmp RRL (2-4 Mb/s) CEPT 13-01, 2/3.5 MHz channel 2	0	2	12	5	3			1452-1492: band to be freed for T-DAB
Czech Republic						an RRL 0.2 M 12				1492-1517: to be removed by end 2001
Denmark					Offshore an. RRL in North Sea MPT 1500B, 0.5 MHz 2					1450-1530: FS to be phased out
Estonia		RRL (civ+mil) planned T/R 13-01 (A+B)				FS civ+mil plan T/R 13-01 (A)				
Finland		pp+pmp, 2-4 Mb/s 13-01B, 0.5/3.5 MHz 312	4	308						No change
France		Private PP & PMP (2 Mb/s) T/R 13-01				SAP an.	No civil FS use			1375-1452: increase 1452-1492: to be freed for DAB 1492-1517: to be freed for defense
Germany	No civil FS use									-
Hungary		RRL	di PMP (2-4 Mb/s) national, 2/4 MHz 398	316	531	427	302	No civil FS		1375-1400/1427-1452: low capacity RRL in accordance with T/R 13-01
Ireland		pp Infra RRL (2 Mb/s) 13-01, <1 MHz 97								
Italy			Infrastructure links national plan (200 kHz) 20	124	118	213	7			
Latvia		di RRL 13-01	PMP WLL (up to 2Mb/s) T/R 13-01, 1 / 2 MHz 40 CS		-	40 CS	No FS			1350-1400 MHz: some use expected 1427-1517 MHz: rural use only, growth not expected
Lithuania					WLL 1 MHz 30 CS		pp au 13-01 1			1452-1492: no new assignments
Luxembourg		low capacity RRL 13-01				RRL 13-01				1350-1452/1492-1517: low capacity RRL foreseen
Norway		Infra 13-01 20	Infra, FWA and local networks (2-8 Mb/s) CEPT 13-01An.B + national (2-8 MHz) 120 + 20 infra in 1429-1452 MHz							Links rel. to concentrate only in 1350-1400&1427-1452&1492-1517, based on 13-01 plan, increase +10% p.a.
Portugal		pp RRL (up to 2-4 Mb/s) T/R 13-01 A&B, 25/250/300/500 kHz/1/2/3.5 MHz 339								
Slovak Republic			pp + pmp FWA F.379, 2 MHz 283							1427-1452: no change
Slovenia		WLL + RRL(2 Mb/s) T/R 13-01 (A-B), 2 MHz 15	1	7	-	229	Analogue RRL 500 kHz 79	12		Increase of use
Sweden		Analogue & digital FS T/R 13-01 5	28	161	196	24	No civil FS			1452-1492: Phase out for DAB (2003) 1350-1375/1492-1517: decrease 1375-1400/1427-1452: some increase
Switzerland		MS infra (50Kb...8 Mb/s) T/R 13-01, 50k…3.5 M 100	-	50	An. RL 26	MS infr up. pair 50	FM BC feeders 20			1350-1400: avg. +20 links/yr 1452-1492: no new assignments 1517-1525: avg. +10 links/yr
Turkey	No FS use					FS planned				
United Kingdom		pp RRL 13-01 238		pp RRL national 32	815	13-01 863	pp RRL national 181	26		1350-1375/1492-1517: increase of use 1429-1492 & 1517-1530: all links to be removed by 2007
		1350	1400 1427	1429	1452	1492	1517	1525	1530	

1668.4-2200 MHz

Country	Information on Current Civil FS Use	Trends
	1668 1670 1690 1700 1710 1880 2025 2110 2200	
Austria	no FS use	
Belgium	no FS use	
Croatia	An + di RRL F.283 13-01, 0.25/24.4 MHz 5 320 4	1880-2025/2110-2200: rel. to IMT-2000/UMTS from 2002
Czech Republic	an RRL 0.2 M 15 MMDS national 13	1700-1710: radio BC feeders increase to 50, use until 2008 2110-2300: UMTS/mil from 2002
Denmark	no FS use	-
Estonia	RRL planned (civ+mil) No FS RRL 13-01	1670-1675/1800-1805: reserved for TFTS, but relocation possible
Finland	Rural RRL, 16 Mb/s F.283, 14 MHz 106 F.283+1098A1, 14 MHz 204	1700-1790/1825-1900: used until requested for GSM-1800, decrease 1900-1982/2017-2100: rel. UMTS
France	Defense (including FS) ITU-R F.283-5 <100 RRL (8…34 M) F.283, 14 MHz 1000	Remaining military fixed (1710-2110) and FT links (2110-2310) to be removed by 1/1/2004
Germany	No civil FS use	
Hungary	No civil FS use RRL (2-34 Mbs) F.283, 14 MHz 52 27	2025-2110: low/medium capacity RRL planned (T/R 13-01)
Ireland	pp Infra + FWA 13-01, 3.5-14 MHz 61 pp	2025-2300: 2 FWA operators given 10 MHz each in June 2000
Italy	No civil FS use Trunk/infra/PMP 13-01+national, 3.5/27/29 MHz 1157 697 753 908	1880-2025/2110-2200: to be relocated for IMT-2000/UMTS
Latvia	di. RRL (8/16/34 Mb/s) F.283 & T/R 13-01, 7/14/28 MHz 7 17 9 21	1900-2025 & 2110-2200: to be re-located in 2002 2025-2110 & 2200-2290: no growth
Lithuania	RRL 13-01	2025-2110: no civil FS after 2008
Luxembourg	No civil FS use	
Norway	vi 13-01C	2025-2110: two channels for mobile video SAP/SAB links
Portugal	pp RRL F.283 & F.382, 14/29 MHz 7 8 2	1700-2300: no new assignments 2025-2110/2200-2290: PP RRL in accordance with T/R 13-01 planned
Slovak Republic	infra 33 MMDS 8 MHz 5 CS	1710-1880: bc feeders, no change 2100-2300: MMDS to be relocated giving place to UMTS and pp FS
Slovenia	no FS use	-
Sweden	No civil FS, except 2 links in 1710-1880/1880-2025 MHz	Decrease
Switzerland	no FS use Mil TV feeders (an.) 108	2110-2290: links to be removed 2200-2290: future Mil use
Turkey	RRL (16 Mb/s) F.283-5, 14 MHz	1880-2110: congestion 2110-2200: rel. for UMTS
United Kingdom	ppRRL nat 38 off shore national 1400 Trans horizon & pp + PMP 13-01for PMP 10 (th) 2 (th) 9 (th)	1670-1690: no new, rel. by 2007 1710-1900: no new offshore links 1900+: no new, th&pp t.b. removed
	1668 1670 1690 1700 1710 1880 2025 2110 2200	

2200-2690 MHz

2200 2300 2400 2450 2483.5 2500 2520 2655 2670 2690

Country	Information on Current Civil FS Use									Trends
Austria		Mobile ENG occ.	RLANs gen. licence		RRL for BC audio tx. between studios national (1.5 MHz / 14 MHz) 7	no FS	69	6	13	no change
Belgium	No FS use				pp RRL ITU-R F.283, 1.75/2/6/25 MHz 194					2483.5-2670: foreseen rel. to UMTS
Croatia	RRL see ←						di. RRL (8-34 Mb/s) 13-01, 4.5/14 MHz 18			
Czech Republic	MMDS see ←		RLANs 70-03 general licence							
Denmark		Offshore RRL (8 Mb/s) ITU-R Report 933 9					vi. SAP 13-01, 28 MHz			2300-2500: only between platforms in the North Sea 2520-2670: depend on UMTS devel.
Estonia	Plans for FS 13-01						13-01 (An. D)			2300-2483.5: FS shared civ/mil
Finland	RRL see ←	vi. SAP 20 MHz 25			Rural pp + pmp RRL, 2x2 Mb/s F.283, 2 MHz 843					2300-2400: transfer to digital, +10% 2480-2569/2603-2690:-50% in 5 yr, then transfer to 13-01 or UMTS
France	RRL see ←	Defense RRL National plan		No FS use			Defense (incl. RRL)			2110-2310: see previous 2310-2450: rel. to 4/7/15GHz bands 2520-2670: rel. for UMTS after 5 y.
Germany							FWA + pp di RRL 13-01, ≤14 MHz			2520-2670: limited to 2007
Hungary	RRL 13-01 planned		di FS 20MH 1				di RRL 13-01 (D) planned			
Ireland	see ←	an. rural access F.746A2, 2 MH considered				MMDS				
Italy	RRL see ←	Private RRL/ trunk/ infra (civ + mil sharing) National, 0.2/14/27 MHz 230		32	13	no FS	17			-
Latvia	RRL see ←	SAP 20 MHz 4					an. MMDS 8 MHz 1 CS			2300-2400: no change 2520-2690: plans for UMTS, no new MMDS systems
Lithuania			meshed RLAN 70-03 293				MMDS 8 MHz 5 CS			2400-2483.5: +10 % per year
Luxembourg	No civil FS use									2520-2670: may be foreseen for FS
Norway	vi SAP/SAB 13-01 -	National -					FWA/RRL/vi SAP 13-01D, 1.75/7/14 15+85/20/15			2200-2290: two channels for mobile 2300-2400: new plan from 4Q/2002 2520-2670: designated for UMTS
Portugal	RRL ←	Analogue video SAP links 14 MHz								2480-2690: vi. SAP to be removed
Slovak Republic	MMDS see ←						an. MMDS 8 MHz 5 CS			2520-2690: MVDS until 2008
Slovenia		Analogue ENG/OB 25 MHz Occasional use					An. CATV+RRL(16 M/s) T/R 13-01, 28/14 MHz 28 CATV + 60 RRL			2300-2500: change to digital 2520–2670: RRL dep. on UMTS 2520-2670: CATV rel. to 40 GHz
Sweden	No civil FS				PP FS	1	PP vi. SAP low capacity 242	178	13	2520-2670: depending on the need for UMTS extension bands in urban areas (2007)
Switzerland	Mil ←	no new assignments					ENG/OB			no new assignments to FS
Turkey	RRL 13-01	RRL 1.75/3.5 MHz					RRL F.283			2200-2450: congestion 2520-2655: rel. for UMTS
United Kingdom	RRL see ←	FWA (PMP) n/a n/a					Trans horizon 1			2310-2483.5: no further FWA plans 2520-2655: no new assignments

2200 2300 2400 2450 2483.5 2500 2520 2655 2670 2690

3400-5000 MHz

Country	Information on Current Civil FS Use							Trends
	3400 3580	3600	3800	4200 4400	4500	4800	4990 5000	
Austria	now radars	Trunk (155 Mb/s) F.635, 40 MHz 387		[SAP]	No civil FS use			3400-3600: FWA planned by 2002 3600-4200: no change 4400-4500: mobile vi. SAP planned
Belgium	FWA 14-03 2 licenses	Vi. infrastructure 187		No civil FS use				
Croatia	vi. SAP 14-03, 24.4 M 2	RRL 12-08, 7/24,4 MHz 136		No civil FS use				3400-3600: intro of FWA (pmp) from 2002
Czech Republic	pmp + pp F.382, 2/3.5 M 244 CS + 60 pp	MS infra (155 Mb/s) F.382, 29 MHz 136						-
Denmark	FWA 14-03, 3.5/7 MH -	Infra (140 Mb/s) 12-08, 40 MHz 80		No civil FS use				3600-4200: slow growth
Estonia	FWA REC 14-03 6 CS	RRL planned REC 12-08		FS planned	civ+mil	Mil	FS plan civ+mil	
Finland	FWA 14-03, blocks 7 networks	an + di vi infra F.635, 29/40 MHz 1034						3400 - 3600: rural FWA 3610-3850/3930-4170: transfer to di only (STM-0) in 40 MHz channels
France	FWA REC 14-03 2 networks	Video 1/30 M	Trunk 12-08	No civil FS use				3400-3600: dep. on FWA growth 3400-3800: video links rel. to 8GHz 4400-5000: links from 2G/3G bands
Germany	pmp FWA 14-03, 14 MHz 150 CS	pp RRL 12-08, 29 MHz 180		No civil FS use				FWA limited to 3410-3580 MHz 3600-4200: slow increase
Hungary	FWA 14-03, 3.5 MHz 14 CS	FWA 12-08 plans	Trunk 29 MH 327	No civil FS use				3410-3600: FWA licences auctioned 3600-3800: FWA licences to be auctioned
Ireland	FWA 25 MHz blocks	Infra 12-08, TBD						3400-3600: FWA operators given 25 MHz each in June 2000
Italy	No civil FS	Trunk/Infra 12-08, 30/40 M 459		No civil FS use				3600-4200: anticipated growth of infrastructure support links
Latvia	FWA (2 Mb/s) 14-03, 14 MHz 3 CS	FWA 12-08 2 CS	Trunk 12-08 plans	No civil FS use				3400-3800: FWA growth expected 3800-4200: high growth expected for STM-1 capacity links
Lithuania	TV infrastructure (analogue) OIRT, 40 MHz 31	30		No civil FS use				3400-4200: old links to be removed, new links will follow CEPT 14-03
Luxembourg	FWA CEPT 14-03 6	Trunk (34 Mb/s) 12-08, 28 MHz 3		Co-ordinated video SAP links occasional use				3400-4200: growth expected
Norway	FWA (2 Mb/s) 1.75 MHz 60 CS + 150 TS	di. + an. vi. Trunk F.382, 28 MHz 460						3400-3600: growth 25% p.a. 3600-4200: trunk to rel. in 2-5 yrs., band is a candidate for FWA
Portugal	FWA 14-03, 250 kHz -	12-08 22 CS	RRL 12-08 1	No civil FS use				
Slovak Republic	FWA CEPT 14-03 3	RRL (155 Mb/s) 12-08, 29 MHz 63		No civil FS use				no change
Slovenia	FWA + RRL CEPT 14-03 10 WLL + 9 pp	RRL (an./di) CEPT 12-08 82		No civil FS use				3400-3600: FWA increase 3400-3600: RRL decrease 3600-4200: change to digital
Sweden	PMP FWA 14-03 -	PP FS High-medium cap. 65		No civil FS use				3400-3600: major increase, regional FWA licences planned for 2003 3600-4200: increase
Switzerland	FWA CEPT14-03 -	FWA planned	Infra 12-08 30	No civil FS use				-
Turkey	FWA 14-03	RRL (16 Mb/s) F.635, 40 MHz						3600-5000: congestion
United Kingdom	PMP FWA 14-03	PMP FWA + Trunk (34-155 Mb/s) 358 (pp)						3400-3600: FWA 3600-4200 (trunk): increase of use 3600-4500 (FWA): one licence only
	3400	3600	3800	4200 4400	4500	4800	4990 5000	

5755–7750 MHz

5755 5850 5925 6425 7075 7250 7300 7450 7550 7750

Country	Information on Current Civil FS Use	Trends
Austria	ENG pp 34Mb/s 12 Trunk (155 Mb/s) CEPT 14-01/02, 40 MHz 633 50 Private di. networks F.385, 7 MHz 501 392 Trunk F.385, 11 MHz 180 333	no change
Belgium	pp RRL 14-01 24 BC infra + pp vi. SAP 14-02 vi. CATV distribution 95	5925-6425: decrease
Croatia	pp RRL/MS trunk (2-155 Mb/s) 14-01 86 14-02, 40 MH 120 F.385, 7 MHz 168	-
Czech Republic	MS infra F.383 354 MS infra (155 M) F.384, 40 MHz 82 MS infra (8-16 Mb/s) F.385, 7/14 MHz 358	-
Denmark	Infra 14-01 0 Infra (140 Mb/s) 14-02, 40 MHz 50 Infra RRL F.385, 7 MHz 67	5925-6425: new digital links exp. 6425-7125: small increase 7125-7725: high increase
Estonia	FS planned RRL 14-01 planned RRL 14-02 planned RRL F.385 52 planned	-
Finland	Trunk, 140 Mb F.384, 40 MHz 478 Rural RRL, 34/140/155 Mb/s F.385 (mod.), 28 MHz 32 355	6460-6740/6800-7080: no change 7075-7750: increase +20% in 5 yrs., used as substitute for 1.9 GHz
France	Trunk (155 Mb/s) F.383/384, 29.65/40 MHz 700 SAP links No FS Trunk (civ+mil) F.385-6, 7/28 MHz 350	5925-7110: increase of use 7375-7750: transfer to military, for links displaced from 2G/3G bands
Germany	RRL (1…2 x STM-1) 14-01, 29.65 MHz 850 RRL (1…2xSTM-1) 14-02, 40 MHz 1170 RRL (34-155 Mb/s) F.385, 14 MHz 750 F.385, 28 MHz 1070	Increase in all bands
Hungary	Trunk (140/155 Mb/s) 14-01 14-02, 40 MHz 799 RRL (2-34 Mb) 1.75-14 MHz 44	7725-7900: BC infrastructure links
Ireland	Infra 14-01 175 Infra (>140 Mb/s) 14-02, 40 MHz 137 Infra (>8 Mb/s) F.358A1, 28 MH 47	
Italy	Infra nation. 65 Trunk (34…140/155 Mb) 14-02, 29.65/40 MHz 3430 Trunk (34…140/155 Mb/s) National, 28/40 MHz 748 1 669 365 692	7450-7550: infra for PLMN being implemented now (F.385 ch. plan)
Latvia	Trunk an., 28 MHz 19 14-01 planned 14-02, 40 MHz 58 Infra. support (16-34 Mb/s) F.385, 14/28 MHz 7 0 7 55 42	5670-6170: old an. RRL to go di. 5925-7125: heavy increase 7075-7750: slow increase
Lithuania	TV infrastructure (analogue) OIRT, 40 MHz 3 3 MS infra (34 Mb/s) F.385-6, 28 MHz 152 153 MS infra (16E1) F.385, 20 MHz 26	5925-7075: old links to be removed new links will follow CEPT 14-02 7075-7250/7300-7450: +5% p.a.
Luxembourg	Infra (34-140 Mb/s) 14-01/14-02, 29.65/40 M 16 Infra (16-34 Mb/s) 14-02/F.385, 14/28 MHz 2 0 2 10 12	Increase in all bands
Norway	Trunk F.383, 28 210 Trunk (incl. vi.) F.384, 40 MHz 650 Trunk, 140/155 Mb F.385mod., 28 M 200 RRL (8-34 Mb/s) F.385, 7/28 MHz 290	5925-6425: +5% p.a. 6430-7110&7114-7414: +10% p.a.
Portugal	pp RRL 14-01 6 pp RRL (140 M) 14-02, 40 MHz 28 pp RRL (8-16 Mb) F.385+nat, 7/14M 53 pp RRL (8 Mb/s) ITU 385, 7 MHz 35	-
Slovak Republic	pp RRL 29.65 M 69 pp (2x155 Mb/s) 40 MHz - pp RRL + vi. SAP 14 MHz 55 RRL + 5 vi. pp (4-16 Mb/s) F.385, 3.5/7 MHz -	-
Slovenia	RRL (140 Mb/s) CEPT 14-01, 14-02 92 RRL (analogue) ITU-R F. 385, 28 MHz 6 3 9 31 44	5925-7075: increase 7075-7750: change to digital
Sweden	Trunk (140/155 Mb/s) 14-01 503 14-02 465 No civil FS Trunk F.385 1761	5925-7175: some decrease 5925-6425: phase-out of analogue 7424.5-7725.5: some increase
Switzerland	TV infra 14-01 251 RRL (155 Mb/s) 14-02, 80 MHz 138 Infrastructure (8-34 Mb/s) ITU-R F.386 116 52 134 60	5925-6425: avg. +20 links/yr 6425-7125: avg. +20 links/yr 7125-7750: no new assignments
Turkey	RRL F.283, 40 MHz RRL F.285 RRL (16/32 Mb) F.385, 14/28 M	5925-7250: congestion 7450-7750: congestion
United Kingdom	Trunk (140/155 Mb/s) old plan 18 14-01 269 14-02, 40 MHz 445 Trunk (8-68 Mb/s) F.385, 7/14/28 MH 1259	5925-6425 & 6425-7125: increase 7425-7900: increase

5755 5850 5925 6425 7075 7250 7300 7450 7550 7750

7750–10000 MHz

Country	Information on Current Civil FS Use									Trends
	7750	7900	8025	8175	8215	8400	8500	9800	10000	
Austria		ENG/OB p-p nat., 18 MHz 12	15	Trunk (34 Mb/s) F.386, 24 MHz 19	14	73	43			no change
Belgium		pp RRL		pp RRL		pp RRL F.386 266				8200-8500: congestion status
Croatia		da + vo +vi pp RRL (4-34 Mb/s) F.386, 3.5-28 MHz 282								-
Czech Republic	No civil FS use									
Denmark	FS considered					Infra (34Mb/s) F.386, 14 MHz 6				8275-8500: high increase
Estonia		pp RRL F.386 Planned								8215-8500: civil-military sharing
Finland						an. + vi. RRL 14/28 MHz 146				8025-8490: planned as extension for 7 GHz band, but channel plan awaited from CEPT
France		SAP 28MHz		RRL (incl. sound/TV) F.386, 3.5/7/14/28/30 MHz 3000						8025-8500: increase of use by civil links, displaced from 2G/3G bands
Germany	No civil FS use									
Hungary	BC infra 1.75/28 MHz 21		pp RRL (2-34 Mb/s) national, 1.75/3.5/7/14 MHz 17	11	11	16	0			
Ireland		pp Infra F.386A1, 29.65 MHz 179				F.386, 7/14M 24				
Italy			Trunk 27 MH 2	No civil FS use			Trunk 27 MH 2			
Latvia		Infra F.385 29		Trunk (34 Mb/s) F.386, 28 MHz 8	0	6	15			7750-7900: slow increase 8025-8500: increase
Lithuania			TV infrastructure F.386-5, 40 MHz 8	7	6	9				
Luxembourg		Infra for MS, fixed and BC (34 Mb/s) ITU-R F.386, 14/28 MHz 0	0	0	2	10	5			7750-8500: increase
Norway		Transp. links nat., 30-50 M 25			vi pp 30 M 7	Trunk(incl di/an vi) F.386, 23-28 MH 60				8100-8200: no further growth 8200-8500: old an vi links to be removed, digital growth 10% p.a.
Portugal		pp RRL F.386, 29.65 MHz 0				11.662 MHz 25				-
Slovak Republic		pp RRL 115	No civil FS							-
Slovenia		RRL (analogue) ITU-R F.386 29.65 MHz 22	10	22	8	87	78			7750-8500: change to digital
Sweden		PP 2	Trunk 124	60	0	124	56	-	60	7750-8400: no change
Switzerland		military use								
Turkey		RRL (8/32 Mb/s) F.386-4, 7/29.65 MHz								7750-8500: congestion
United Kingdom		same as 7425-7750								7425–7900: increase
	7750	7900	8025	8175	8215	8400	8500	9800	10000	

10–13.25 GHz

Country	Information on Current Civil FS Use						Trends
	10.0	10.5	10.68 10.7	11.7	12.5	12.75	13.25
Austria	Video nat., 28 MHz 521	Trunk 52	Trunk, 155 Mb/s F.387, 40 MHz 150		an. vi. 8 MHz 100	Trunk (34 Mb/s) F. 497, 28M 190	10.0-10.68: small increase, FWA considered in parts of the band 12.5-12.75: no new assignments
Belgium	FWA 12-05 2 licences		pp RRL (140/155 Mb/s) 12-06, 40 MHz 78			Infra + pp vi SAP CEPT 12-02	10.7-12.5: decrease
Croatia	vi SAP 12-05 26		pp RRL(155Mb) F.387, 40 MHz 45			pp RRL (2-34 Mb/s) 12-02, 28 MHz 253	
Czech Republic	pp + vi SAP 28 MHz -		an/di RRL + MMDS 12-06, 8/14/27/40 MHz 14 + 10 MMDS			MS Infra (<155Mb) F.497, 3.5/7/28 MHz 268	10-10.68: pp under general licence 10.7-12.5: FS to be phased out by 2004 (RRL)/2009 (MMDS)
Denmark	Vi. SAP 12-05, 14/28 M		Trunk, 140 Mb/s F.387, 40 MHz 6			Trunk + infra (<155Mb) 12-02, 7/14/28 MHz 12	10-10.68: FWA planned in future 10.7-11.7: FS to be phased out 12.75-13.25: high increase
Estonia	pp CEPT 12-05 4	FWA+ pp planned	RRL F.387 planned			pp RRL (32 Mb/s) 12-02 145	-
Finland	FWA 12-05, blocks 4 licences					Infra, 8-155 Mb/s 12-02, 7/14/28 MHz 57	10-10.28: also vi. SAP links 12.75-13.25: opened recently, increase expected as infra for 2G/3G
France	No FS	T-RRL F.747 122	Trunk 12-06, 40 MHz 140	No FS		RRL 12-02, 3.5/7/14/28 MHz 4000	10.7-11.7: increase, mainly to be used by new operators 12.75-13.25: increase, congestion
Germany		vi. SAP 25-10 -	pp RRL 40 MHz 295			pp RRL (155 Mb/s) 12-02, 28 MHz 2000	10.4-10.68: vi-SAP links planned 10.7-11.7: no new links 12.75-13.25: increase
Hungary	BC infra + RRL 12-05, 1.75/28 M 3	74	Trunk (140/155 Mb/s) 12-06, 40 MHz 576			RRL (2-34 Mb/s) 12-02, 1.75-14 MHz 754	12.3-12.5: MVDS in Budapest area
Ireland	FWA planned		Infra (>140 Mb) 12-06An.E, 40M 273			pp RRL 12-02, 3.5-28 MHz 29	
Italy	Infra/RRL 12-05/nat, 20/28 1390	1368	Trunk/infra (34-155 Mb) 12-06/F.741, 40 MHz 2801			Trunk/infra (34-155 Mb) 12-02+nat, 20/28 MHz 6102	
Latvia	vi CEPT 12-05 exp	FWA+ pp 4CS/350pp	TV/radio distrib. 12-06, 40 MHz 63			MS infra/RRL (4-34 M) 12-02, 3.5/7/14/28 MHz 250	10.15-10.3/10.5-10.68: FWA incr. 10.7-11.5: no new links 12.75-13.25: increase
Lithuania	FWA 12-05 -		TV infrastructure OIRT, 40 MHz 2			MS infra (34 Mb/s) 12-02, 28 MHz 66	12.75-13.25: +(5-7)% p.a.
Luxembourg	Vi SAP links 12-05, 28 MHz 2	3				RRL (incl. vi. SAP) 12-02, 14/28 MHz 26	12.75-13.25: increase
Norway	vi SAP 8		Trunk (155M) F.387, 40 MHz 270			MS infra/RRL (8-34 M) F.497, 7/14/28 1670	10.7-10.9/11.2-11.45: +5% p.a. 12.75-13.25: +10% p.a.
Portugal		vi SAP 28 MH -	pp RRL (140 Mb/s) 12-06, 40 MHz 52			pp RRL (8-34 Mb/s) F.497, 7/28 MHz 214	10-10.45: vi. SAP considered
Slovak Republic	pp + vi. SAP - 141		pp (155Mb/s) + vi. SAP 12-06, 40 MHz -			pp RRL (up to 140 Mb/s) F.497, 3.5-28 MHz 78	10.15-10.3: pmp planned from 2002 10.3-10.5: pp vi. SAP links
Slovenia	RRL (an.) CEPT 12-05 70	98	RRL (140 Mb/s) CEPT 12-06, 40MHz 114			RRL (34 Mb/s) CEPT 12-02, 28 MHz 63	10.15-10.68: increase 10.7-12.5: no change 12.75-13.25: increase
Sweden	PP FS 12-05 44	45	Infra F.387 24	116		Infra CEPT 12-02 25	10-10.68: incr., regional FWA(2003) 10.5-10.6: concerns on sharing with unlic. SRDs; 12.75-13.25: decrease
Switzerland	Infra + vi. SAP 12-05, 3.5/14 M 54		Infra (155 Mb/s) 12-06, 40 MHz 137	Infra+ CATV 523		Infra(8/34 Mb/s)+CATV CEPT 12-02, 7-28 MHz 951	10.15-10.65: no increase, no new Infra in 10.7&13: avg. +50 links/yr 11.7-12.5: no increase
Turkey	RRL 200 kHz						10.0-10.68: congestion
United Kingdom	pmp FWA 12-05		Infra (140 Mb/s) F.387, 67 MHz 675			RRL, infra, vi. trunk 12-02, 1.75-28 MHz 4659	10-10.68: FWA 10.7-11.7: new links not anticipated 12.75-13.25: increase
	10.0	10.5	10.68 10.7	11.7	12.5	12.75	13.25

14.25–19.7 GHz

Country	Information on Current Civil FS Use									Trends
	14.25–14.5	14.5–14.8	14.8–15.35	15.35–17.3	17.3–17.7	17.7–18.1	18.1–18.8	18.8–19.3	19.3–19.7	
Austria		p-p (MS infra.) F.636, (12-07) ↓↑: 123 (720)				MS infra. CEPT 12-03, 55 MHz 20	Data (155 Mb/s) 50	85		14.5-15.35: private p-p – no change, MS infra – increase +20% yr. 17.7-19.7: increase +20% yr.
Belgium		MS infra 12-07, 3.5-28 M 540				pp RRL CEPT 12-03 698				14.5-15.35: congestion status
Croatia		pp RRL F.636, 28 MHz 269				pp RRL (34 Mb/s) 12-03, 27.5 MHz 12				
Czech Republic		MS infra 12-07, 7/14 MH 500				MS infra (8-155 Mb/s) F.595, 3.5-55 MHz 1121				14.5-15.35: until 2004 du=420 MHz from 2005 du=728 MHz
Denmark		Trunk + MS infra 12-07, 7/14/28M 74				Trunk + MS infra (<155 Mb/s) 12-03, 7/14/28 MHz 450				14.5-15.35: high increase 17.7-19.7: high increase
Estonia		pp RRL (8-32M) F.636 375	46			pp RRL (16-32 Mb/s) CEPT 12-03 20	168	planned		14.8-15.35: shared with military
Finland		MS infra, 8/16M F.636, 14 MHz 4612				Access + infra, 4-155 Mb/s F.595+, 5/7.5/15/27.5/55/110M 2296				14.5-15.35: further increase 17.7-19.7: further increase
France	RRL 10/14 M 800	Defense F.636 -	RRL 10M 350			RRL (16/34/140/155 Mb/s) CEPT 12-03, 13.75/27.5/55 MHz 1100				14.25–14.5: no change 14.5-15.25: for mil. links from 2/3G 17.7-19.7: increase (DEC(00)07)
Germany	temp. FS links	RRL (16-34 Mb) 12-07, 7/14 MH 3950				RRL (≤155 Mb/s) CEPT 12-03, 27.5/55 MHz 3250				14.25-14.5: emergency servcs only 14.5-15.35: heavy increase 17.7-19.7: increase
Hungary		RRL (2-16 Mb) F.636 (12-07) 1304				Infra RRL (34-155 Mb/s) 12-03 A, 27.5/55 MHz 88	197	253		14.5-15.35: T/R12-07 links planned 17.3-17.7: reserved for MVDS
Ireland		Infra (34 Mb/s) F.636, 3.5-14M 749				Infra 12-03 An.A, 27.5/55 MHz 177				
Italy	Infra nat. 978	Trunk/infra 12-07+national 1444	1411		RRL nat. 30	Trunk/infra (2-155 Mb/s) Most 12-03, 2/3.5/7/13.75/27.5/55 731	1065	709		17.7-18.1: more PLMN infra links foreseen using ch. plan in F.535-5
Latvia		RRL(8-34 Mb/s) F.636/12-07 76				Infra (34/155 Mb/s) 12-03, 27.5/55 MHz 11	45	54		14.5-15.35: increase 17.7-19.7: increase
Lithuania		MS infra (8 Mb) 12-07, 7/14 MH 12	12			MS infra (34 Mb/s) 12-03, 27.5 MHz 20		20		14.5-15.35: +(5-7)% p.a. 17.7-19.7: +5% p.a.
Luxembourg		RRL (34-155 M) 12-07, 28 MHz 12	12			Fixed and MS infra (155 Mb/s) 110 MHz 11	4	15		14.5-15.35: increase 17.7-18.1/18.4-18.6/18.8-19.7: no increase, DEC(00)07 applies
Norway		No civil FS links				MS infra/RRL (8-155 Mb/s) F.595, 8/27.5/55/110 MHz 490				17.7-19.7: +10…15% p.a.
Portugal		pp RRL 12-07/F.636 70				pp RRL (2-155 Mb/s) 12-03/F.595, 2/13.75/27.5/55/110 247				14.5-15.35: no more F.636 links 17.7-19.7: no more F.595 and 110 MHz CEPT12-03 links
Slovak Republic		pp (up to 140 M) F.636, 7-28 MH 368				pp RRL 12-03/F.595, 3.5/7/28 MHz 490				-
Slovenia		RRL (8 Mb/s) CEPT 12-07 98				RRL (34 Mb/s) CEPT 12-03, 27.5 MHz 191	49	138		14.5-15.35: increase 17.7-19.7: increase
Sweden	Infra F.746 1	Infra 12-07 2122	2125	1	an. vi. nat. plan 146	CATV distribution F.595+12-03; 13.75/27.5/./220M 24	104	162	55	14.5-15.35 & 17.3-19.7: increase 18.7-18.92: ph. out 220 MHz CATV 18.647-18.7/18-987-19.04: no civil
Switzerland		Infra (16 Mb/s) CEPT 12-07 277				Infrastructure (34/155 Mb/s) CEPT 12-03, 27.5/55 MHz 50				14.5-15.35: avg. +100 links/yr 17.7-19.7: avg. +100 links/yr
Turkey						RRL (32 Mb/s) 27.5 MHz				17.7-18.6: congestion
United Kingdom	vi infra F.746 914	Access + infra 12-07 229			Infra national 5	Access RRL (8/34/140/155 Mb/s) F.595+12-03, 7/27.5/55/110 MHz 7501				14.5-15.35: increase 17.7-19.7: increase

14.25 14.5 14.8 15.35 17.3 17.7 18.1 18.8 19.3 19.7

21.2-23.6 GHz

Country	Information on Current Civil FS Use									Trends
	21.2	21.4	22.0	22.21	22.55	22.6	23.0	23.55	23.6	
Austria	ENG/OB nat., 17 MHz 8	6	Mobile networks infrastructure T/R 13-02 Ann. A, 3.5 MHz 725	2575	future use		3300	future		21.2-22.0: no change 22.0-23.6: increase +20% yr.
Belgium	vi. SAP	BC infra/F.637	pp RRL (CEPT 13-02)			vi SAP	BC infra			22-22.6/23-23.6: increase for pp RRL using CEPT13-02
Croatia	vi. SAP planned		pp RRL / MS trunk (8-34 Mb/s) 13-02, 7-28 MHz 209			-	192			
Czech Republic			MS infra (8-36 Mb/s) F.637-3, 3.5-28 MHz 1380			vi SAP	1432			
Denmark	vi. SAP 28 MH	No FS	Trunk + MS infra (up to 155 Mb/s) 13-02A, 28 MHz 670			vi SAP	670			22-22.6/23-23.6: high increase
Estonia		FS plans	pp RRL (8-32 Mb/s) CEPT 13-02 A + F.637 97	106	planned					21.2-21.4: planned for temp. links
Finland			MS infra + access RRL (4-155 Mb/s) CEPT 13-02, 3.5/7/14/28 MHz 1414			-	1414			22-22.6/23-23.6: further increase, band proposed for 2G/3G infra on individual assignment basis
France	RRL (video) F.637, 28 MHz 160		RRL CEPT 13-02, 3.5/7/14/28 MHz 3300							21.2-21.4: Rel. to 24.25-24.5 GHz 21.4-22: planned for HDTV 22-23.6: likely congestion
Germany	vi. SAP links		RRL (8-34 Mb/s) CEPT 13-02, 3.5/7/14/28 MHz 12700			-	12700			22-22.6/23-23.6: heavy increase
Hungary	vi. SAP 12-03 2		RRL (2-34 Mb/s) CEPT 13-02 A, 1.75/3.5/4/14/28 MHz 792	820	0	vi. SAP	1610	0		-
Ireland			Infra pp links CEPT 13-02, 3.5/7/14/28/56 MHz 897			-	897			
Italy			Infra 13-02 205					Infra 13-02 170		22.21-22.5/22.6-23.55: civ + mil sharing foreseen
Latvia	vi. SAP 28 MH 3		Infrastructure and private RRL (8-155 Mb/s) 13-02, 7/14/28/56 MHz 164	129	7	-	294	7		21.2-21.4: some increase expected 22-22.6/23-23.6: increase
Lithuania	vi. SAP		MS infrastructure (8/34 Mb/s) 13-02, 7/28 MHz 270	302		vi. SAP	568	1		22-22.6/23-23.6: +10% p. a.
Luxembourg	vi. SAP 28 MH 2		MS and fixed infrastructure (2-34 Mb/s) 13-02, 7/14/28 MHz 171			Trunk	171			22-22.6/23-23.6: increase 22.6-23: trunk (3.5 MHz ch.) – 2 links, no new assignments
Norway			Infra/RRL/TV distribution (8-155 Mb/s + an vi) 13-02, 7/28/56 MHz 230			20 (vi)	230			22-22.6/23-23.6: +5…15% p.a. 22.6-23: analogue TV distr. links to be removed in 1-2 years
Portugal			pp RRL (+ transp. links) T/R 13-02 (F.637), 7/14/28/56 MHz 42			-	42			21.2-21.4: vi. SAP considered 22-22.6/23-23.6: no new transportable links
Slovak Republic			pp RRL 3.5/7/14/28 MHz 470							-
Slovenia			RRL (2 x 2Mb/s) + ENG/OB tuning range CEPT T/R 13-02, 3.5 MHz 254	25	0	-	285	0		Increased use
Sweden	vi. SAP + PP F.637 3	125	RRL CEPT T/R 13-02, 3.5/7/14/28/56/112 MHz 1054	84	14	-	1230	23		21.2-22: phasing out 22-23.6: increase
Switzerland	vi. SAP		Infrastructure (up to 34 Mb/s) CEPT T/R 13-02, 7/14/28 MHz 1120			vi. SAP	1120			22-22.6/23-23.6: avg. +400 lnk/yr 23.55-23.6: also ENG/OB
Turkey				RRL (4/8/16 Mb/s) 13-02, 3.5/7/14 MHz						22.21-23.55: congestion
United Kingdom	Customer access and infrastructure RRL F.637		CEPT 13-02 Ann. A, 3.5/7/14/28 MHz 9028							21.2-22: no new assignments 22-23.6: further developments
	21.2	21.4	22.0	22.21	22.55	22.6	23.0	23.55	23.6	

24.25-29.5 GHz

Country	Information on Current Civil FS Use				Trends
	24.25	24.5 24.75 25.25 25.5 26.0	26.5	27.5 28.5	29.5
Austria		FWA + MS infra (8 Mb/s) T/R13-02, 28(FWA)/14(pp) MHz FWA 1130 720 FWA 1850		FWA+ MS infra Exp. from 2002	24.5-26.5: FWA – freq. assigned for 2 networks, but no use yet 24.5-26.5: p-p infra – incr. +40% yr.
Belgium		FWA + pp RRL 13-02 Ann. B, 3.75/7.5/14/28 MHz 4 FWA licences / 400 pp RRL		FWA + pp RRL 13-02 Annex C planned	27.5–29.5: planned
Croatia	vi. SAP plans	FWA + pp RRL 13-02 planned		FWA + RRL planned	
Czech Republic		FWA + MS infra (8-32 Mb/s) F.1401 (FWA) + F.748 (RRL) 45 FWA CS + 1824 pp		FWA + Infra planned	27.5-29.5: in acc. with DEC(00)09, blocks for UMTS infra assigned end of 2001
Denmark	vi. SAP 28 MH	FWA (34 Mb) + pp (155 Mb) 13-02B, 3.5/7/14/28 MHz 4 FWA licences + 600 pp		FWA (34 Mb/s) 13-02C, 3.5-28 MH temp. licences	24.5-26.5: high increase 27.5-29.5: in acc. with DEC(00)09
Estonia		FWA 13-02 B 1 CS 1 CS		FWA + pp RRL 13-02 C planned	-
Finland		FWA 13-02, 56/112 MHz 6 licences		FWA?	24.5-26.5: assignments frozen, low interest to start operations 27.5-29.5: FWA not demanded at all
France	vi. SAP	FWA (8 ch.) / PP(4) / Defense(4) T/R 13-02, 14/28/56 MHz		FS/FSS T/R 13-02	24.25-24.5: future SAP band 24.5-26.5: increase of use 27.5-29.5: in acc. with DEC(00)09
Germany		pp + pmp infra + pmp FWA (≤34 Mb/s) CEPT 13-02, 3.5/7/14/28 MHz 5550 pp / 850 FWA CS		Infra (pp/pmp) 13-02, blocks -	24.5-26.5: heavy increase 27.5-29.5: blocks for UMTS infra. assigned mid 2001
Hungary	vi. SAP	pmp infra + pmp FWA 13-02 B 1			24.5-26.5: to be auctioned
Ireland		RRL + FWA 13-02 An. B, 3.5/7/14/28/56 MHz 1 pp		FWA 13-02 An. C planned	24.5-26.5: national FWA licences issued July 2000 (56 MHz each)
Italy		PMP planned ERC REC(00)05		PMP planned DEC(00)09	PMP licences to be auctioned
Latvia		FWA(2 Mb/s) + infra(155 Mb/s) 13-02, 28(FWA blocks)/56(infra) MHz 6 (infra) + 2 CS (FWA)		FWA 13-02, 28 M blocks -	24.5-26.5 GHz: heavy increase 27.5-29.5 GHz: heavy increase
Lithuania	vi. SAP	FWA planned T/R 13-02		FWA planned T/R 13-02	
Luxembourg		FWA + Trunk (34 Mb/s) 13-02, 28 MHz 8 CS 7 pp		RRL DEC(00)09 -	24.5-26.5 GHz: increase expected 27.5-29.5 GHz: increase expected
Norway		FWA + RRL (8-155 Mb/s) 13-02 B, 7/28/56 MHz 140CS/300TS + 120 pp		FWA planned	24.5-26.5 (FWA/RRL): +25% p.a. 27.5-29.5: in acc. with DEC(00)09 to be licensed in 2002/2003
Portugal		FWA 13-02 B, 56 MHz 42 CS		FWA 13-02 C, 175 MHz 3 CS	-
Slovak Republic		pp + pmp 13-02, 28 MHz (pmp) / 3.5-56 MHz (pp) 5 pmp CS + 14 pp		pp/pmp planned -	27.5-29.5:
Slovenia		FWA under consideration		FWA tested	Not clear yet
Sweden		FWA + Infrastructure 13-02, 3.5/7/14/28/56 MHz 4 855 640 41 1458		FWA CEPT 13-02 -	24.5-26.5 GHz: major incr., 1 FWA lic. issued 2001; 27.5-29.5: major increase, 3 FWA lic. issued 2001
Switzerland	ENG	FWA Infra FWA Infra T/R 13-02, 14/28 MHz 10 sectors ↓ ↓ 10 sect ↑ ↑		FWA CEPT 13-02	25.2-25.5/26.2-26.5: infra for FWA - expected avg. +50 links/yr 27.5-29.5: in acc. with DEC(00)09
Turkey		FWA CEPT 13-02			
United Kingdom		Customer access and infra. RRL 13-02 Ann. B, 3.5/7/14/28/56 MHz 1502		FWA(pp/pmp/mesh) 13-02, 3.5-28 M regional blocks	24.5–26.5: further assignments 27.5–29.5: FWA in exclusive FS parts, as per ERC/DEC(00)09
	24.25	24.5 24.75 25.25 25.5 26.0	26.5	27.5 28.5	29.5

31-43.5 GHz

Country	Information on Current Civil FS Use						Trends
	31.0	31.3 31.8	33.4 36	37.0 37.5	39.5 40.0	40.5 42.5	43.5
Austria		TBD		MS. infra CEPT 12-01, 3M5 1750 2650			31.8-33.4: FS use TBD in 2002 37.0-39.5: increase +40% p.a. 40.5-43.5: Use by MWS planned
Belgium		FS planned		pp RRL CEPT 12-01 410			31.8-33.4: FS planned
Croatia	FS planned	HDFS		pp RRL planned		MWS planned	
Czech Republic		FS		MS infra 12-01, 3.5-28 MH 3620		MWS planned	
Denmark	FS planned	FS planned		Trunk/MS infra 12-01, 3.5-28 MH 770		MWS planned Under tests	37-39.5: high increase
Estonia	FS planned	HDFS planned		pp RRL CEPT 12-01 82		MWS planned	37-37.5: shared with military
Finland				MS infra, 8-155M 12-01, 7-56 MHz 68		MWS?	37.0-39.5: increase 40.5-42.5: no demand to open band
France	RRL 28MHz 7	FS (01)02		RRL, vi. SAP CEPT 12-01 4000		MWS planned DEC(99)15	31-31.3: old links to be removed 37–39.5 GHz: increase, vi. SAP to be relocated to 24.25-24.5 GHz
Germany		FS planned		RRL (8 Mb/s) 12-01, 7 MHz 12050		MWS planned	37.5-39.5: heavy increase
Hungary	pp planned	pmp HDFS planned		pp (2-34 Mb/s) 12-01, 3.5-56 MH 410 2928		MWS planned	**31.5-31.8**: pp links planned
Ireland				pp Infra 12-01, 3.5-28 M 986		MWS planned	
Italy				MS infra 12-01 535		MWS planned	40.5-42.5: currently experimental use by manufacturers 42.5-43.5: MWS use under study
Latvia	vi RRL planned -	HDFS (01)02		RRL (acc+infra) 12-01, 3.5-56 MH 5 12		MWS planned	31-31.3: planned for security video
Lithuania	MS infra REC(01)02 -			MS infra,4/34 Mb 12-01, 3.5/28 MH 148		MWS planned	37.0-39.5: +(10-15)% p.a.
Luxembourg	pp/pmp planned -	RRL (01)02		Trunk RRL 3.5 M 12-01 2 0		Studies required	31-31.3/31.8-33.4: increase exp. 37-37.5: uncoordinated trunk links-increase expected
Norway	-	FWA (01)02 planned		RRL (8-155 Mb/s) 12-01, 7-56 MHz 200		MWS 0	31.8-33.4: licensing in 2002/2003 40.5-43.5: three operators, to start operations around 2003
Portugal				pp RRL (4-155M) 12-01 A, 7-56 M 82		MWS planned	-
Slovak Republic	pp/pmp planned -			pp RRL 3.5-28 MH 431		MVDS 14.5 MHz 1	40.5-42.5: MVDS/MWS planned
Slovenia				FS planned		MWS planned	Increase
Sweden	-	FWA+ infra F.1520		Infra 12-01, 3.5-56&140 65 731		MWS CEPT 01-04 - -	31.8-33.4: planned FS use 37-39.5: major increase 40.5-43.5: no FS plans
Switzerland	TDD	Infra 28/56M -	Mil T/R	MS infra 12-01, 7/14/28 MHz 1613		MWS	31-31.3: TDD systems 31.8-33.4: MS infra, avg. +50 lnk/yr 37-39.5: avg. +600/yr
Turkey	RRL					MVDS planned	
United Kingdom	vi RRL 28M 260	FS (01)02 -		RRL (acc + infra) 12-01, 3.5-56 MH 6557		MWS planned REC(01)04 likely block lic-ng	31-**31.8**: continue deployment 31.8-33.4: planned FS use 37-39.5: continue deployment
	31.0	31.3 31.8	33.4 36	37.0 37.5	39.5 40.0	40.5 42.5	43.5

47.2-66 GHz

Country	Information on Current Civil FS Use									Trends
	47.2	48.5	50.2 50.4	51.4	52.6	55.78	57.0	58.2	59.0	66.0
Austria	no FS use					MS infra (2 Mb/s) CEPT 12-09, 100 MHz 20				55.78-59.0: increase +70% yr.
Belgium	no FS use									-
Croatia	FS + vi. SAP planned		no FS use							
Czech Republic						RRL (8 Mb/s) 12-09, 50/100 MHz 2 under tests				
Denmark	vi. SAP	FS 12-10 plans		FS 12-11		FS 12-09, 12-12 10				High increase expected in all bands in the future 57.1-58.9: licence exempt use
Estonia	vi. SAP		FS planned	HDFS planned		HDFS planned				64-66: planned for HDFS
Finland							TDD 12-09 10			57.2-58.2: just opened, increase for uncoordinated short haul links
France	CEPT 12-10		Mil/FSS	12-11		CEPT 12-12				50.4-51.4: 500 MHz for defense
Germany	FS planned			FS planned		FS plans	un-coord. FS			57-59: parts opened by general lic. for uncoordinated FS link
Hungary		FS 12-10 plans		FS 12-11/12 plans		HDFS 12-11/12 2	pp TDD 12-09, 50/100M			64-66: HDFS planned
Ireland						RRL 12-12, 14/28/56/100 MHz 2				
Italy	no FS use									-
Latvia	CEPT 12-10			12-11		CEPT 12-09, 12-12				-
Lithuania	CEPT 12-10			12-11		CEPT 12-12				-
Luxembourg	CEPT 12-10			12-11		CEPT 12-09, 12-12			FS	-
Norway		FS 12-10 plans				FS 12-09 0				57.2-58.2: the band opened through general licence
Portugal	No FS use						CEPT 12-09			-
Slovak Republic	no FS use									-
Slovenia	no FS use									-
Sweden			PP FS 5	FS plan 12-11 -		FS plan 12-12 -	FS plans 12-09, 50/100M -			47.2-50.2: no FS plans 51.4-52.6 & 55.78-57: FS planned 57-59: FS planned
Switzerland	ENG/OB CEPT 12-10			MS infr 12-11		Fixed 22-03	Mob. networks CEPT 12-09			51.4-52.6: avg. +40 links/yr 57-59: avg. +40 links/yr
Turkey				FS						
United Kingdom		RRL propr. 576		FS 12-11		FS 12-12	di RRL + an. vi 12-09, 50/100 M 465			48.5-50.2: t.b. consid. after WRC-03 51.4-52.6 & 55.78-57: FS planned 57-59: increase
	47.2	48.5	50.2 50.4	51.4	52.6	55.78	57.0	58.2	59.0	66.0

ANNEX 2: NATIONAL EXAMPLES OF REGULATING FS

A.2.1. France

In France, the overall frequency management responsibility (in particular international policies and frequency co-ordination) fall into the hands of Agence Nationale des Fréquences (ANFR). However the authorisations for telecommunication activities, including authorisations for civil use of the radio spectrum, are issued by the Autorité de Régulation des Télécommunications (ART), the independent regulator set up in January 1997.

The ART is therefore responsible for co-ordination and assignment of frequencies for public and private network operators and then for issuing appropriate licences for operators. ART manages, amongst others, the following FS frequency bands: 3.5, 4, 6, 7 8, 11, 13, 18, 23, 26, 28, 32, 38 GHz.

Regularly, ART updates the strategy for the use of the different frequency bands allocated to the FS. These guidelines are defined in relation and with the co-operation of all the different actors involved (ART web site: www.art-telecom.fr).

The fixed link assignment system that has been developed by the ART is efficient in meeting the demands of customers. The ART has developed an exchange format to handle electronic licence application, which has reduced significantly the treatment time for fixed link assignments, which is now less than 2 months. In some bands, certain “preferential channels” are assigned to specific operators, where they can deploy their PP FS links in a more flexible way.

Generally speaking, the use of fixed links is closely linked to the evolution of the international regulation (such as the frequency bands allocations in the ITU RR, the adoption of relevant ERC Recommendations or Decisions). Such modifications may sometimes lead to the necessity of band refarming, recently becoming a familiar process for the French telecommunication users.

The regulation has also to take into account the recent arrivals of the new players in the FS field. New operators are being authorised by the ART according to two classes of networks given by the French Law: the class L33-1 applies for networks open to public and the class L33-2 applies for private networks. The range of telecom operators include: the incumbent operator (obligations of public service), operators of public mobile networks, operators of private mobile networks (PMR, PAMR, etc.), operators of FWA networks, the incumbent broadcasting operator, FM broadcasting operators and about 250 users of private FS networks. These telecom operators come in addition to the governmental users, who obtain frequency spectrum through the offices of Prime Minister and do not need authorisation from the ART.

The FS frequency bands, as designated in the French National Frequency Allocation Table, may be thus used by both the civil companies authorised by the ART and by governmental bodies.

Co-ordination with other services and organisations

International co-ordination processes are dealt with by the ANFR, especially when satellite services are involved.

At the national level, the co-ordination is also dealt with by the ANFR through a consultation process between all the concerned user groups so as to respect the interests of the existing users while ensuring, to the greatest extent, an access to the spectrum required for the new ones.

Spectrum pricing

At the moment in France only civil telecom operators have to pay fees for using the spectrum. An administrative incentive pricing system applies to the FS, this meaning that the fees depend on the bandwidth and the actual frequency band used by the operator. The bigger is the bandwidth, the higher are the fees; the higher is the frequency band, the lower are the fees. The fees depend also on the number of fixed links and the geographic coverage of the operator’s network.

Spectrum refarming

In France, a procedure for spectrum refarming is based on statutory texts and had been used in practice already for several years. This procedure is based on a sound economic approach and makes it possible to meet the demands of operators in the sector. Furthermore, it does not call into question the procedures for attribution and assignment of frequencies that are laid down at international level by the ITU and the CEPT and at national level by the regulatory authorities.

The spectrum refarming procedure establishes evaluation of the cost of the refarming and the management of a fund needed to finance this refarming.

The user who is to leave a frequency band usually receives compensation. This often takes the form of a financial contribution and assignment of frequencies in alternative frequency band, except when a wire-based technology may be used as a substitute. This compensation process is discussed by all concerned parties within a specific advisory commission, set up by the ANFR to deal with the financial aspects of spectrum refarming: the Refarming Commission. Moreover, in France, the State plays the role of intermediary by initially financing from the state budget the relocation of old services, with subsequent reimbursement of these funds from the new users of refarmed spectrum once they have obtained their demanded frequencies. An intermediary role played by the State makes it possible to increase significantly the speed of refarming process, by making the spectrum freed exactly in time when it is needed for new users.

The ANFR has also set up a commission to study the cases where the international obligations accepted and adopted by the French Administration lead to the necessity of changing, usually in a shorter term than the usual life-time of the equipment, the use of a part of the spectrum.

Normally the cost of refarming depends on the necessary speed of the replacement of old equipment and the cost of new, replacing equipment. This cost is ultimately beared by the new users of the spectrum to the extent possible.

Recently, the identification of frequency bands for the IMT-2000/UMTS has led to the necessity of removing a great number of fixed links, belonging to France Telecom and Ministry of Defense, from the bands, designated to future operators of the 3rd generation of the Public Mobile Networks. The estimated cost of this refarming project is 38 million EUR.

A.2.2. Hungary

General FS trends
As a general rule the RRL in Hungary widely use digital technologies.

The high-capacity microwave backbone networks operating at lower frequencies (in the 4 GHz, L6 GHz, U6 GHz, 11 GHz bands) are losing ground to optical cable transmission. High-capacity networks operating at 18 GHz are mostly used by the mobile carriers to link in a chain the base stations (with SDH/ATM technology) and connect them to the switching center. Further growth is anticipated in the latter area.

Point-to-point access networks continue significant growth in terms of the number of connections, further growth is anticipated mostly in the 23 GHz and 38 GHz bands.

Point-to-multipoint systems were allocated licences through auction in the 3.5 GHz band, meeting the current demand. However it is expected that an extension of allocated band will be required later. The possible options are the 3.7 GHz, the 26 GHz and the 32 GHz bands.

The MVDS system for TV program distribution now covers Budapest and operates in the 12 GHz band to meet an essential demand for residential sector. The 17.3-17.7 GHz band will be available for such services in the future, but the high price of the equipment suitable for this band seems to be a problem.

Sufficient frequency bandwidths
Sufficient frequency bandwidths are available in Hungary to serve the user demand of the fixed service. This bandwidth sufficiency is helped by the fact that Hungary has also joined the S5.546 footnote inserted in the ITU RR during the WRC'97. On the basis of this, Hungary will open an additional PP FS band in 31.0-31.3/31.5-31.8 GHz.

Avoidance of shared use by several radio services
The relative richness of the Hungarian spectrum for the fixed service makes it possible to develop such spectrum policy that reduces the chance of conflicts due to interference with the fixed satellite service.

In several frequency bands the fixed service enjoys priority over the satellite services. In other bands the satellite services have priority, but this does not go to the detriment of the fixed service in view of the relative richness of the spectrum.

Fixed service preferences

The following describes several cases where FS are given specific priority over other services:

- VSAT deployment is not allowed in the C satellite band. This measure provides protection for the 4 GHz, L6 GHz and U6 GHz high-capacity RRL networks;
- No satellite earth stations are allowed in the 14.5-14.9 GHz band in order to protect the RRL networks at 15 GHz;
- The earth stations of the 18.8-19.3 GHz NGSO systems (e.g. Teledesic) can not get protection from the fixed service. It can be ensured in this way that a later HDFSS application can not limit the operation of the RRL networks at 18 GHz.

Open data access

The radio engineering and deployment parameters of the RRL frequency assignments connections are openly available public information in Hungary, so they can not constitute a business confidentiality. The Communications Authority provides data for the affected parties for the design of radio connections. These data also cover the interference environment, which must be taken into consideration in the design phase.

Operator planning, authority control

In Hungary, the radio networks are designed by the applicants, or the applicants hire third party designers for the job. Only professionals with authority licence may perform design work. The designer carries extensive responsibility in the respect of the interference calculations. After planning, the authority granting the licence is entitled to check the plans.

Methods of frequency allocation

The frequencies for cellular PMP FS systems are considered to be a limited resource. Such frequencies are therefore to be allocated through an auction. In the 3.5 GHz band five national coverage frequency blocks have been auctioned. In the 26 GHz band, assignment of regional block is expected also through an auction.
From the point of view of frequency use, the frequencies for PP FS systems can not be regarded as limited resource, therefore applications for PP FS are treated on a first-come-first-served basis.

Frequency fees

In Hungary, frequency fees are charged on the use of the frequencies. The fee consists of two components:

- one-time frequency occupancy fee;
- monthly frequency usage fee.

The amount of the fees payable for different radio applications (also in the case of FS) is determined by legal rules. The frequency fee has a general regulatory and a highly useful measuring/evaluating function.

A.2.3. UK

Within the UK the responsibility for management of the civil use of the radio spectrum lies with the Radiocommunications Agency (RA). Recognising the already large density of high capacity point to point links in the UK and bearing in mind the substantial increase expected to meet future demands, it is essential for the UK to follow the highly structured strategy towards management of FS spectrum that it does. This is continually brought about by ongoing consultations with UK industry, which aid to national, European and global regulatory planning and development.

The availability of suitable technology and resources allow overall efficient central management of spectrum by the RA for the terrestrial fixed service with respect to link assignment and licensing. In the UK the RA centrally manages fixed service bands such as 1.4, 4, lower 6, 7, 13, 14, 22, 25, 38, 50, 58 GHz.

The RA annually updates the strategy for the future use of radio spectrum in the UK. This comprehensive document provides an outline of the RA’s plans and objectives for all services including the fixed service.

The fixed link assignment system that has been developed by the RA is efficient in meeting the demands of customers. The tool is updated with the relevant frequency assignment criteria agreed with UK industry prior to opening FS bands for civil use. The assignments in all FS bands for point to point use that are administered by the RA are fully incorporated into the assignment system and all assignments are made on a link by link basis.

Applications are at present made through a licensing application form sent via surface mail. Under the e-licensing initiative, the assignment system is currently being updated to handle electronic license applications, which will further improve the turnaround time for licences.

Minimum Link Length Policy

The choice of frequency band for fixed point to point links depends principally on the path length and the traffic capacity. In order to encourage operators to utilise higher frequency bands, the RA operate a minimum link length policy for the point to point links that allows selection of the appropriate frequency band for a given link. These link length limits are based on distances below which the operator should use the next highest band available.

Details of the Assignment Process

In the license application, the customer provides details of the preferred sites as well as technical characteristics of the required link e.g. equipment, polarisation, availability.

Prior to assigning the link, the application is validated by the system, which checks whether:

- sites are identifiable or known
- antennas used are approved for the band
- equipment is approved for the band and for the purpose that it's being used for
- link lengths are appropriate.

In most cases with the exception of 58 GHz, channels are assigned in the highest frequency band compatible in order to meet the radio planning requirements. If the application is valid, further technical validations are carried out including:

- correct antenna elevations and azimuths
- whether the required availability is greater than 99.99%.

After this validation process, the assignment routine identifies the terrain type around and in between link ends e.g. rural, urban, water, wood etc and the Fresnel Zone clearance, fade margin and the required EIRPs are calculated.

The assignment process next identifies all links in the same band within the co-ordination zone. The assignment engineer from all the channels available then selects a channel/range of channels. Individual channels are then checked in turn. The received signal level from and to every other users within the co-ordination zone is calculated and assessed for interference potential by referencing the wanted to unwanted ratios. The first available interference free channel is then assigned.

This system can be manually overridden for special cases.

Provisional Licence Schedule

When possible attempts will be made to assign preferred channels. The RA will initially assign provisional frequencies for each link, following co-ordination with existing fixed (point to point) terrestrial links and other services.

Notification of provisional frequencies does not give authority to operate the fixed (point to point) terrestrial link but is provided to assist the applicant with early equipment procurement and configuration

Co-ordination with other services and organisations

The choice of frequency band depends primarily upon the nature of the service and whether or not the spectrum is shared with other services. Shared spectrum requires different services to be co-ordinated to internationally agreed levels of interference.

The National Frequency Approval Panel (NFAP) agrees the day-to-day detailed frequency assignments and ensures that these are made in accordance with the UK peacetime frequency allocation table and in the interests of the UK users.

Co-ordination with the Fixed Satellite Service

All fixed links within a calculated co-ordination zone of an earth station (ES) are co-ordinated with that ES according to ITU RR Appendix S7. This methodology determines the number of victim fixed links within the calculated co-ordination area. ITU-R Recommendation SF.1006 is then used to determine the interference threshold to evaluate the interference from the ES to the fixed link and vice versa. All detailed co-ordination is performed using the ITU-R Recommendation P.452

Site Clearance

Licensees have to ensure that antennas and masts meet current planning requirements. Where antennas and masts constitute a hazard, particularly to aircraft, then the licensee has to obtain approval from the Civil Aviation Authority (CAA).

Site clearance permits a range of compatibility issues to be assessed such as blocking, intermodulation, obstructions etc. Fixed (point to point) terrestrial links are only exempt from site clearance under the following conditions:

- the Effective Isotropic Radiated Power is less than 45 dBW;
- the antenna height above ground level is less than 30 metres; or
- if mounted to an existing site cleared structure, then the new installation's height should not be increased by more than 5 metres.

Licence Issues

The licence is only formally issued when all clearances have been received with confirmations from all interested parties. For new customers, the first year's licence fee has to be paid. The RA for point to point fixed service links aims, with the exception of the 58 GHz uncoordinated band, to process and dispatch 90% of all applications within 40 working days and the remainder within 60 working days. This includes the full process from receipt of valid applications to the issue of the licence, inclusive of turnaround times needed for NFAP and site clearance. For 58 GHz all applications shall be processed within 5 working days.

Spectrum Pricing

The UK is currently in the 5th year of implementing spectrum pricing. The Wireless Telegraphy Act of 1998 (WTA'98) provided the RA with a spectrum management tool to enable a fairer more rational basis for pricing spectrum that takes into account the value of the resource that is used and provides incentives for spectrum efficiency. This is generally referred to as 'spectrum pricing'. There are two variants, administrative pricing, where fees are determined by regulation, and auctions where fees are set directly by the market. The approach of spectrum pricing in the UK is also in line with the EU licensing directive in that the mechanism should be used to achieve spectrum management objectives and not to maximise licence revenue. UK industry has been consulted in each phase of the development of the policy and is generally supportive of the principle.

The form of spectrum pricing that has been administered for point-to-point FS links in the UK is 'administrative incentive pricing' in which the fees are set by regulation on the basis of spectrum management criteria e.g. level of demand/congestion and bandwidth used. Administrative pricing of fixed point-to-point bands allows efficiency of spectrum usage by consideration of congestion in available bands, the use of spectrally efficient equipment, etc. A licence fee algorithm using spectrum management criteria has been developed for spectrum efficient equipment as well as mature technology. The licence fee for a fixed (point-to-point) terrestrial link will reflect whether or not the bands are congested and whether or not the link site(s) are located in predetermined geographically congested areas. Fees in subsequent years will increase where congestion occurs and decrease in non-congested bands.

The UK follows the principle that licence fees set by the regulator will be based solely on spectrum management principles, with auctions being applied selectively where appropriate. For the Fixed Service, the RA has used the second mechanism that is permitted under the WTA'98 by auctioning spectrum for Broadband FWA at 28 GHz. This mechanism allows licence fees to be set directly by the market.

ANNEX 3: LIST OF RELEVANT ECC DECISIONS, RECOMMENDATIONS AND REPORTS

ECC (former ERC) Decisions

Doc	Short document title
ERC/DEC(00)02	37.5-40.5 GHz for Fixed and Fixed Satellite Service
ERC/DEC(00)07	Shared use of 17.7-19.7 GHz for the Fixed and Fixed Satellite Service
ERC/DEC(00)08	Use of 10.7-12.5 GHz by the Fixed and Broadcasting-satellite/Fixed-satellite Service
ERC/DEC(00)09	Use of 27.5-29.5 GHz by the Fixed and Fixed Satellite Service
ERC/DEC(97)04	Transitional arrangements for Fixed and Mobile-Satellite Service in 1980-2010 MHz and 2170-2200 MHz
ERC/DEC(98)08	Type approval regulations for EN 300 197 V1.2.1 (Digital signals and analogue video in 37-39.5 GHz)
ERC/DEC(98)09	Type approval regulations for EN 300 198 V1.2.1 (Digital signals and analogue video in 21.2-23.6 GHz)
ERC/DEC(99)08	Type approval regulations for (ETS) 300 633 (Digital Radio Relay in 2.1-2.6 GHz)
ERC/DEC(99)09	Type approval regulations for (ETS) 300 431 (Digital PP FS in 24.25-29.50 GHz)
ERC/DEC(99)10	Type approval regulations for (ETS) 300 636 (TDMA PP digital systems in 1-3 GHz)
ERC/DEC(99)11	Type approval regulations for (ETS) 300 630 (Low capacity PP links at 1.4 GHz)
ERC/DEC(99)12	Type approval regulations for (ETS) 300 786 (Digital radio relay systems in 13 GHz, 15 GHz and 18 GHz with 14 MHz channel spacing
ERC/DEC(99)13	Type approval regulations for (ETS) 300 639 (Digital radio relay systems in 13 GHz, 15 GHz and 18 GHz with 28 MHz and 14 MHz channel spacing
ERC/DEC(99)15	Designation of frequency band 40.5-43.5 GHz for introduction of the Multimedia Wireless Systems (MWS)

ECC (former ERC) Recommendations

Doc	Short document title
T/R 12-01	Channel arrangements for analogue and digital terrestrial fixed systems in 37-39.5 GHz
T/R 13-01	Channel arrangements for fixed services in the range 1-3 GHz
T/R 13-02	Channel arrangements for fixed services in the range 22.0-29.5 GHz
T/R 22-03	Terrestrial fixed and mobile systems in 54.25-66 GHz
T/R 04-03	Digital radio-relay systems in the 17.7 to 19.7 GHz band
ERC/REC 00-05	Fixed wireless access in 24.5-26.5 GHz
ERC/REC 01-02	Channel arrangement for digital fixed service in 31.8-33.4 GHz
ERC/REC 12-02	Channel arrangements for 12.75-13.25 GHz
ERC/REC 12-03	Channel arrangements for 17.7-19.7 GHz
ERC/REC 12-05	Channel arrangements for 10.0-10.68 GHz
ERC/REC 12-06	Channel arrangements for 10.7-11.7 GHz
ERC/REC 12-07	Channel arrangements for 15.23-15.35 GHz
ERC/REC 12-08	Channel arrangements for 3600-4200 GHz
ERC/REC 12-09	Channel arrangements for 57.0-59.0 GHz

ERC/REC 12-10	Channel arrangements for 48.5-50.2 GHz
ERC/REC 12-11	Channel arrangements for 51.4-52.6 GHz
ERC/REC 12-12	Channel arrangements for 55.78-57.0 GHz
ERC/REC 14-01	Channel arrangement for 5925-6425 MHz
ERC/REC 14-02	Channel arrangement for 6425-7125 MHz
ERC/REC 14-03	Channel arrangement for 3400-3600 MHz
ERC/REC 01-03	Fixed Wireless Access (FWA)
ECC/REC 01-04	Guidelines for accommodation of MWS in the frequency band 40.5-43.5 GHz
ECC/REC 01-05	Parameters of digital point-to-point links

ECC (former ERC) Reports

Doc	**Short document title**
ERC Report 008	Compatibility between RLANs and the Fixed Service
ERC Report 010	Compatibility between DECT and radio relay systems in the 2 GHz band
ERC Report 016	Sharing terrestrial fixed service and space research/EES (S - E) at 38 GHz
ERC Report 017	Sharing between earth exploration satellite services (passive) and terrestrial fixed links at around 58 GHz
ERC Report 019	Sharing Earth Exploration satellite services (passive) and Fixed Services in the band 54.25 - 57.2 GHz
ERC Report 029	Compatibility mobile satellite service in the 1610-1626.5 MHz band and fixed service under RR730
ERC Report 033	The use of frequencies above 20 GHz by fixed services and ENG/OB
ERC Report 036	Sharing Fixed Service and Radio Astronomy
ERC Report 039	Sharing between fixed links and SNG in the 14.25 - 14.5 GHz band
ERC Report 040	Fixed service system parameters for frequency sharing
ERC Report 045	Sharing Fixed and Earth Exploration Satellite (passive) Services in 50.2 - 66 GHz
ERC Report 046	Sharing fixed service and Earth exploration-satellite service in 55.22 - 55.78 GHz
ERC Report 047	Compatibility fixed service and motion sensors at 10.5 GHz
ERC Report 055	Unwanted emission interference from mobile earth stations into fixed service receivers in the 2 GHz band
ERC Report 064	Sharing between UMTS and existing fixed services
ERC Report 065	Adjacent band compatibility between UMTS and other 2 GHz services
ERC Report 099	Coexistence of two FWA cells in the 24.5 - 26.5 GHz and 27.5 - 29.5 GHz bands

ANNEX 4: LIST OF RELEVANT ETSI STANDARDS

Standards for Point-to-Point FS systems

Generic harmonised standard for Point-to-Point digital fixed radio systems and antennas covering the essential requirements under article 3.2 of the 1999/5/EC Directive - **EN 301 751**

System specific standards

Freq. band	Subject	Standard	Channelling, MHz
1.4 GHz	Low capacity point to point digital radio relay systems in the 1,4 GHz band	EN 300 630	0.025 to 3.5
2.1-2.6 GHz	Low and medium capacity point-to-point digital radio relay systems operating in the 2,1 to 2,6 GHz frequency band	EN 300 633	0.5 to 14
3-11 GHz	PDH low and medium capacity and STM-0 digital radio relay systems operating in the frequency bands in the range 3 GHz to 11 GHz	EN 301 216	1.75 to 30
4-11 GHz	High capacity DRRS carrying 2 x STM-1 in frequency bands with 40 MHz channel spacing using co-channel dual-polarised (CCDP) operation	EN 301 461	40
4-11 GHz	High capacity DRRS carrying STM-4 in two 40 MHz channels or 2 x STM-1 in 40 MHz channel with alternate channel arrangement	EN 301 669	40
4-11 GHz	High capacity DRRS transmitting STM-4 or 4 x STM-1 in a 40 MHz radio frequency channel using Co-Channel Dual Polarised (CCDP) operation	EN 301 277	40
4-15 GHz	High capacity digital radio-relay systems carrying 1 x STM-1 signals and operating in frequency bands with about 30 MHz channel spacing and alternated arrangements	EN 300 234	28 to 30
4-15 GHz	High capacity DRRS carrying 2 x STM-1 in frequency bands with about 30 MHz channel spacing using co-channel dual-polarised (CCDP) operation	EN 301 127	28 to 30
13, 15, 18 GHz	Sub STM-1 digital radio relay systems (DRRS) operating in the 13 GHz, 15 GHz and 18 GHz frequency band with about 28 MHz co-polar and 14 MHz cross-polar channel spacing	EN 300 639	14 and 28
13, 15, 18 GHz	Sub STM-1 digital radio relay systems in the 13, 15 and 18 GHz bands with about 14 MHz co-polar channel spacing	EN 300 786	14
13, 15, 18 GHz	PDH low and medium capacity digital radio relay systems operating in the frequency bands 13, 15 and 18 GHz	EN 301 128	1.75 to 28
18 GHz	Parameters for radio systems for the transmission of STM-1 digital signals operating at 18 GHz in either 55 or 27,5 MHz channel spacing	EN 300 430	27.5 and 55
23 GHz	Parameters for radio relay systems for the transmission of digital signals and analogue video signals operating at 23 GHz	EN 300 198	3.5 to 56
26 GHz and 28 GHz	Digital fixed point-to-point radio link equipment operating in the frequency range 24,5 to 29,5 GHz	EN 300 431	3.5 to 56
38 GHz	Parameters for radio relay systems for the transmission of digital signals and analogue video signals operating at 38 GHz	EN 300 197	3.5 to 56
55 GHz	Parameters for radio-relay systems for the transmission of digital signals and analogue video signals operating around 55 GHz	EN 300 407	14 to 140
58 GHz	Parameters for radio-relay systems for the transmission of digital signals and analogue video signals operating at around 58 GHz, which do not require frequency planning	EN 300 408	50 and 100

Antenna specific standards

Freq. band	Subject	Standard
Any	Point-to-Point antennas: Definitions, general requirements and test procedures	EN 301 126-3-1
1-3 GHz	Antennas for point-to-point radio links in band 1 to 3 GHz	EN 300 631
Above 3 GHz	Antennas used in point-to-point radio relay systems operating in frequency bands from 3 to 60 GHz'	EN 300 833

Standards for Point-to-Multipoint FS systems

Generic harmonised standard for Point-to-Multipoint digital fixed radio systems and antennas covering the essential requirements under Article 3.2 of the Directive 1999/5/EC - **EN 301 753**

System specific standards

Freq. band	Subject	Standard	Channelling, MHz
Below 1 GHz	Point-to-multipoint digital radio systems below 1 GHz - Common parameters on national basis	EN 301 460-x	national issue
1-3 GHz	Point-to-multipoint DRRS in the frequency bands in the range 1 to 3 GHz (TDMA)	EN 300 636	1.75 to 4
1-3 GHz	Point-to-multipoint DRRS in frequency bands in the range 1 GHz to 3 GHz (DS-CDMA)	EN 301 055	3.5 to 14
1-3 GHz	Point-to-multipoint DRRS in frequency bands within the range 1 GHz to 3 GHz (FH-CDMA);	EN 301 179	1 to 14
1-3 GHz	Point-to-multipoint digital radio systems in frequency bands in the range 1 GHz to 3 GHz (FDMA)	EN 301 373	0.5 to 14
3-11 GHz	Point-to-multipoint radio systems in the Frequency Division Duplex (FDD) bands in the range 3 GHz to11GHz (TDMA)	EN 301 021	<1.75 to 30
3-11 GHz	Point-to-multipoint DRRS in frequency bands in the range 3 GHz to11GHz (FDMA);	EN 301 080	1 to 30
3-11 GHz	Point-to-multipoint DRRS in frequency bands in the range 3 GHz to 11GHz (DS-CDMA)	EN 301 124	5 to 20
3-11 GHz	Point-to-multipoint digital radio systems in frequency bands in the range 3 GHz to 11 GHz (FH-CDMA)	EN 301 253	1 to 14
3-11 GHz	Point-to-multipoint DRRS in the frequency bands in the range 3 to 11 GHz (DS-CD/TDMA);	EN 301 744	24
24.5-29.5 GHz	Point-to-multipoint radio systems in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 1: Basic parameters	EN 301 213-1	3.5 to 112
24.5-29.5 GHz	Point-to-multipoint radio systems in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 2: FDMA Methods	EN 301 213-2	3.5 to 112
24.5-29.5 GHz	Point-to-multipoint radio systems in frequency bands in the range 24,25 GHz to 29,5 GHz using different access methods; Part 3: TDMA Methods	EN 301 213-3	3.5 to 112

Antenna specific standards

Freq. band	Subject	Standard
Any	Point-to-Multipoint antennas - Definitions, general requirements and test procedures	EN 301 126-3-2
1-3 GHz	Antennas for Point-to-Multipoint fixed radio systems in the 1 GHz to 3 GHz band	EN 301 525
3-11 GHz	Antennas for point-to-multipoint fixed radio systems in the 3 GHz to 11 GHz band	EN 302 085
11-60 GHz	Antennas for point-to-multipoint fixed radio systems in the 11 GHz to 60 GHz band Part 1: General aspects	EN 301 215-1
11-60 GHz	Antennas for point-to-multipoint fixed radio systems in the 11 GHz to 60 GHz band; Part 2: 24 GHz to 30 GHz	EN 301 215-2