Fixed Service in Europe Current use and future trends post 2016

ANNEX 1: Band by band review of the FS usage

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1. Band by band review of the FS usage

This annex presents a deeper band by band analysis extracted from the replies to the questionnaire.

It should be noted that clauses related to frequencies lower than 50 GHz (clause A1.25 included) have been addressed by all questionnaires, while sections for higher frequencies are considered only in the last two surveys (2010- 2016).

In following tables, the amount of equipment refers to overall numbers declared.

Due to different number of countries answering all questionnaires (specifically answers for 1997 and 2001 revisions are not available in an electronic format), trends have been compute based on the overall number of links / band given in the previous version of ECC Report 173 (edition 2012) for 1997, 2001 and 2010, while trend for 2010-2016 is derived from answers of related questionnaires.

At the end, for more comprehensive visualisation of variation of number of links in field, the cumulative trend for all period has been applied to one hypothetical single link, assumed operating in 1997.

* + 1. Frequencies below 2 GHz

This frequency range is used by many applications, mostly related to the mobile world (GSM 900/1800, UMTS, HSPA, LTE, etc.). However the answers to the questionnaire indicate that also P-P applications exist in almost all countries, with limited level of harmonisation (about 10 different sub-ranges are indicated).

Two sub-bands (1350-1375 MHz paired with 1492-1517 MHz and 1375-1400 MHz paired with 1427-1452 MHz) are declared as open by about 15 administrations, although effective use is limited to about 7 of them.

Each of the other sub-bands is used by just one administration.

About 4000 P-P active links are reported, with significant increase of bidirectional links.

Few P-MP applications have been reported by some administrations. However, these latter bands, even if providing limited bandwidth, might be potentially suitable for NLOS backhauling applications (see section 4.1.4).

The number of active links reported is indicated in Table 4, while trend is reported in Figure 30.

Table 4: Number of active links declared in 2010 and 2016 in RF range below 2 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 4655 | 2291 | 154 |
| 2016 | 3998 | 908 | 44 |

Low capacity links are generally implemented, with a low percentage of medium capacity; licensing regime appears link to link in general, few administrations allow block assignment.

The only harmonised bands for FS below 2 GHz are: 1350-1375 MHz paired with 1492-1517 MHz and 1375-1400 MHz paired with 1427-1452 MHz which are using the Recommendation T/R 13-01 Annexes A and B, used in the majority of countries.

Several national plans are indicated in this frequency range.

Intention to decrease the use of these frequencies has been declared by several respondents, similarly to possible allocation to other services / applications; use of analogue system with limited BW is reported by one administration.

In most used sub-band (1375-1400 MHz paired with 1427-1452 MHz), intention to decrease is declared by Croatia, Sweden, Switzerland, while reallocation is anticipated by Finland, Croatia, Latvia, Norway, Portugal, Sweden, Switzerland, Slovenia.

Hop length: 95% percentile of “typical” length is in the range of about 30 to 40 km in different sub-ranges (10 to 20 km for those indicated as “minimum”) 60 km is the 50% percentile of “maximum” indication.



Figure 30: Trends for the P-P links in the band below 2000 MHz in CEPT (P-P links in 2010 =100%).

* + 1. 2.025-2.4 GHz band

This frequency range is available for many applications, mostly related to mobile service (IMT and so on; ENG/OB is indicated) and MSS. Four sub-ranges are indicated for FS among them 2025-2110 and 2200-2290 MHz is open by about 15 administrations, but used by only 4 with limited density. Some analogue links are still used in one country.

About 9200 P-P links have been indicated in operation in addition to about 4100 base stations.

Low capacity links are generally indicated, with a low percentage of medium capacity. Licensing regime is mostly link-by link based.

Use appears mostly for broadband infrastructure.

Great majority of applications (9100 FS links, all CS) are in one single country (Russia), in sub-range 2400-2483.5 MHz; related data for 2010 questionnaire were not present. For other countries addressed in previous questionnaire, the use is reduced (about 300 FS links, no BS).

CEPT Recommendation T/R 13-01 is the most frequently referred channel plan. Few countries indicated the existence of a national plan.

A trend for increased use is indicated by Russia (P-MP and P-P FWA networks (TDD)) and Croatia; decrease use is indicated by Greece; temporary use by Finland.

The use of this band for the fixed service seems to be stable or in reduction or in almost all countries. However, the 2 GHz band (CEPT Recommendation T/R 13-01 Annex C), providing ~ 80 MHz of paired bandwidths (presently up to 5 × 14 MHz paired channels), might be potentially suitable for NLOS backhauling applications (see section 4.1.4).

Hop length: 95% percentile of “typical” length is in the range of about 20 km in different sub-ranges (7 km for those indicated as “minimum”) 60 km is the 50% percentile of “maximum” indication.

* + 1. 3.4-4.2 GHz band

This frequency range is available for IMT (3.4-3.6 GHz as established by WRC-07) and P-MP applications (3.4-3.8 GHz), including WiMAX, as well as Fixed Service P-P traditional applications. The 3.4-3.8 GHz band is also addressed by the European Commission Decision 2008/411/EC where neutrality with regard to technology and service is required. 6 different sub-ranges, among which the 3400- 3600 and the 3600 to 4200 MHz are indicated by many administrations. Links in operation are indicated in great majority of open bands.

P-MP use is indicated by 18 administrations in 3400-3600 MHz frequency range, 10 administrations in 3800-4200 MHz frequency range. P-P use is referred by 8 administrations in 3400-3600 MHz frequency range, 8 administrations in 3800-4200 MHz frequency range.

The results of the questionnaire indicated more than 8500 base stations in operation, in addition to about 1800 P-P links. The number of base stations is underestimated, as block and link based licenses are foreseen in many countries.

It should also be taken into consideration that the portion 3.8-4.2 GHz (ERC/R EC 12-08 Annex B part 1), providing up to 6 × 29 MHz paired channels, might be potentially suitable for NLOS backhauling applications (see section 4.1.4). However, sharing with FSS should be carefully considered.

Number of active links reported is indicated in Table 5, while trend is reported in Figure 32Figure 31.

Table 5: Number of active links declared in 2010 and 2016 in RF range 3400-4200 MHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 5252 | 624 | 12664 |
| 2016 | 1790 | 285 | 8735 |

Band 3.4-3.6 GHz (also 3.6-3.8 GHz) is allocated to providers of electronic services in Slovak Republic, Fixed Wireless Access (FWA) is used or planned in Bosnia and Herzegovina and Czech Republic Broadband Wireless Access (BWA) in Lithuania, Portugal and Slovenia.

Mid/High capacity links are mostly implemented. Links are mostly used in network/broadcast infrastructure. Minor use is declared for mobile backhaul.

Link by link (17 administrations in various bands) and block licensing regimes (14 administrations) are used.

The great majority of countries refer to ERC/REC 14-03 and ERC/REC 12-08; Finland, Russia and Croatia adopt a national frequency plan.

In the full band, growth is foreseen in Slovak Republic, decrease in Germany and Hungary, stability or scarce use was indicated by Austria, Romania and Russia.

In 2016 questionnaire, in 3.4/3.8 GHz band, increase of use in next years are indicated by Bosnia and Herzegovina, Czech Republic, Serbia, Slovenia, Sweden, Hungary, Greece, Lithuania, Latvia, Slovak Republic and Ireland.

Concerning 3.6-4.2 GHz band, increase is expected in Russia (long-distance multi-hop links), Croatia, Hungary, Sweden, Bosnia and Herzegovina; decrease in France, Italy and Greece.

Some administrations indicate possibility to reallocate part of the band to other services (9 for the 3.4-3.6 GHz, 6 for the 3.6-4.2 GHz).

Hop length: 95% percentile of “typical” length is in the range of about 50 to 60 km in different sub-ranges (20 km for those indicated as “minimum”) 70 to 80 km is the 50% percentile of “maximum” indication.



Figure 31: Historical (normalised to 1 link in 1997) trends for P-P and P-MP links
in band 3400-4200 MHz in CEPT

* + 1. 4.4-5.4 GHz band

This band appears scarcely used for P-P and P-MP links.2 sub-bands are indicated, it is open by 7 administrations, but used just in Austria (P-P only) and Russia. Few links were reported, most of them in Russia for FWA (P-P and P-MP) in frequency band 5150-5350 MHz.

Number of active links reported is indicated in Table 6, while trend is reported in Figure 32.

Table 6: Number of active links declared in 2010 and 2016 in RF range 4400-5400 MHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 (4500-5000 MHz only) | 484 | - | - |
| 2016 | 1603 | 10 | 5419 |

Used mainly for medium/high capacity links mainly in fixed /broadcasting infrastructure for telecom operators, FS Military use is noted in some countries.

Licensing regime is link by link.

4400-5000 MHz range is used with a national plan in Austria, 5150-5350 MHz range is referred to ITU-R Rec. F.1099 and F.746.

Possible increase of use is reported by Russia in P-MP FWA networks (TDD) in small telecom operators' networks.

Hop length: 95% percentile of “typical” length is in the range of about 43 km (21 km for those indicated as “minimum”) 50 km is the 50% percentile of “maximum” indication.



Figure 32: Historical (normalised to 1 link in 2010) trends for P-P and P-MP links
in band 4400--5400 MHz in CEPT

* + 1. 5.65-5.95 GHz band

This frequency range is open for P-P and P-MP applications by 7 administrations, some allowing both uses. Three sub-ranges are indicated (5650-5850 MHz, 5725-5795 MHz, 5850-5925 MHz); among them the 5650-5850 MHz range accounts for highest number of links, while 5850-5925 MHz range is indicated by most administrations. Active links are indicated in Austria, Greece and Russia.

The band has meaningful use in Russia, while appears scarcely used elsewhere in Europe.

Number of active links reported is indicated in Table 7, while trend is reported in Figure 33.

Table 7: Number of active links declared in 2010 and 2016 in RF range 5650-5950 MHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 (5650-5850 MHz no info) | 1568 | 187 | 623 |
| 2016 | 3071 | - | 4977 |

Low, medium and high capacity applications are used in network infrastructure.

All licensing regimes are used; unlicensed use is noted by 3 administrations (Norway, Portugal and Switzerland).

National plans are declared by Austria and Russia.

Trends for increase of use are indicated by Russia (P-P FWA networks 5650-5850 MHz) and Greece (5625--5795 MHz).

Hop length: 95% percentile of “typical” length is in the range of about 40 km (4 km for those indicated as “minimum”) 54 km is the 50% percentile of “maximum” indication.

 

Figure 33: Historical (normalised to 1 link in 2010) trends for P-P and P-MP links in band
5.65-5.95 GHz in CEPT

* + 1. 5.9-7.1 GHz band-

This frequency range has been traditionally used in Europe for P-P links since quite a long time. P-MP use is also allowed. 5 sub-bands are used. Band is open in about 20 countries. After a negative trend towards the end of the 20th century, mainly due to the migration from analogue to digital links, and a stable situation till 2010, there was a significant increase. 4 different sub-ranges are indicated (5925-6425 MHz, 5925-7125 MHz, 6425-7110 MHz, 6425-7125 MHz), the second being open and used for P-P by about 20 administrations. P-P and P-MP FWA is also used in Russia (5925-6425 MHz) and some P-MP in Slovak Republic (5925-7125 MHz).

About 23000 P-P active links are indicated in total by administrations and 5300 base stations are used in Russia, together with P-P links. The use of unidirectional links has been significantly reduced, mainly in Germany.

Number of active links reported is indicated in Table 8, while trend is reported in Figure 34

Table 8: Number of active links declared in 2010 and 2016 in RF range 5900-7100 MHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 17663 | 4253 | 1942 |
| 2016 | 23027 | 80 | 5370 |

High capacity, long distance P-P links are implemented, mainly forming part of fixed, mobile and broadcasting infrastructure.

Used frequency plans are in accordance with ERC/REC 14-01 (5925 to 6425 MHz) and ERC/REC 14-02 (7425-7125 MHz). No national frequency plans are noted.

Licensing regime is mostly link by link; block assignment is foreseen in Estonia (5850-5925 MHz) and available, in addition to link by link, in Norway (5925-7125 MHz).

In the 6 GHz (5.9-7.1 GHz) band, trend to increase the use of the band is indicated by Slovak Republic, Finland, Croatia, Sweden, Greece, Russia, Netherlands, Italy, Latvia, Malta, Portugal, Switzerland. Stability or slight decrease was indicated by Romania and Germany. Intention to use narrow channels in the guard bands and centre gaps of the lower 6 GHz and upper 6 GHz bands was indicated by Portugal; congestion was indicated by Slovenia, Bulgaria, Croatia, Sweden, Germany, Finland, Netherlands, Mobitel; heavy use is noted in France. Possible future reallocation to other services/applications is noted by Portugal.

Hop length: 95% percentile of “typical” length is 40 km for 5.9-6.4 GHz range, 65 km for the 6.4-7.1 GHz range (about12 km for those indicated as “minimum”); 70 km is the 50% percentile of “maximum” indication.

 

Figure 34: Historical trends (normalised to 1 link in 1997) for P-P and P-MP links
in band 5900-7100 MHz in CEPT

* + 1. 7.1-8.5 GHz band

This range is also an historical and widely used band for P-P applications. 11 sub-ranges are used, three of them are widely used.

7125-7750 MHz is open and used in 17 countries, 7750-7900 MHz is open in 9 countries and used by 6, 7900-8500 MHz is open in 13 countries and used by 9. Significant use is declared in Russia for 7250-7550 MHz sub-range; no P-MP is allowed.

Number of active links reported is indicated in Table 9, while trend is reported in Figure 35.

Table 9: Number of active links declared in 2010 and 2016 in RF range 7100-8500 MHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 36036 | 5166 | - |
| 2016 | 52670 | 181 | - |

The great majority of countries refer to high and medium capacity, link based license, mainly forming part of network infrastructure, mostly for mobile backhauling; broadcast infrastructure is also involved.

Military use has been also reported, (7.25-7.3 GHz, 7.975-8.025 GHz); further details on military usage of this band can be found in the ECC Report 163.

Frequency use in this band appears very complicated, due to the fact that use has started quite long time ago, with analogue systems, and many countries adopted national plans at that time, without coordination with other countries.

In later times, most of used channel rasters have been incorporated in ITU-R Recommendations, but no frequency harmonisation was possible, since equipment was already in operation. Nevertheless in 2011 the ECC/REC/(02)06 was revised with a view to harmonise the use of the band in Europe for countries planning to refarm it. A high percentage of answers (60%) refers to the adoption of this Recommendation, but the total range of different sub-bands is still significant (12).

National plans are indicated by Bulgaria end Finland in some portions of the band.

Licensing regime has been adopted by all administrations. Finland and Norway adopt, in addition, block license in 7.9-8-5 GHz frequency range.

Significant number of countries (including Bosnia and Herzegovina, Netherlands, Italy, Latvia, Malta, Norway, Portugal, Sweden, Switzerland, Slovak Republic, Bulgaria) plan to increase the usage of this range (10 to 25% increase), possible reduction is declared by Finland, Portugal and Greece in some sub-bands. The comparison analysis with previous reports seems to show an overall stable situation in the band.

Congestion is declared in some ranges by Finland (some parts Upper 6 GHz), Turkey, Slovenia, Croatia, Sweden, Germany and the Netherlands.

Hop length: 95% percentile of “typical” length is in range 30 to 50 km (about 18 km for those indicated as “minimum”); 90 km is the 50% percentile of “maximum” indication in the band.

Figure 35: Historical trends (normalised to 1 link in 1997) for P-P links
in band 7100-8500 MHz in 19 CEPT countries available for comparison

* + 1. 10-10.68 GHz band

Use of this RF band has been declared by about 20 Countries, with 4 different sub-ranges, three of them being used within just one country. Band is used for P-P and P-MP applications. Significant percentage of central stations is used in just Russia.

Number of active links reported is indicated in Table 10, while trend is reported in Figure 36.

Table 10: Number of active links declared in 2010 and 2016 in RF range 10-10.68 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 3803 | 2662 | 1760 |
| 2016 | 6195 | 287 | 890 |

All range of capacities is reported in this band.

Most applications are part of infrastructure for mobile and broadcasting networks.

Most licensing regimes are based on individually licensed links; block assignment is also referred in some sub-bands (Latvia, Norway, Sweden, Slovak Republic, Slovenia, UK and Turkey), license free use is indicated in Czech Republic (10.301-10.588 GHz).

Frequency allocation is practically based on CEPT Recommendation ERC/REC 12-05 (and annexes) while the ECC/DEC/(10)01 regulates the sharing condition between FS, MS and EESS; in addition, some national plans (Greece and Czech Republic) exist. National plan is used Czech Republic in the bands 10.301-10.42 GHz and 10.476-10.588 GHz, but according to operator’s announcements, the band is getting congested.

Need for growth has been indicated by few countries (Bosnia and Herzegovina, Latvia, Norway, Switzerland, Slovak Republic and Bulgaria); few others indicate trend to decrease (Greece and Latvia).

The band is not congested in average.

Hop length: 95% percentile of “typical” length is 27 km (6 km for those indicated as “minimum”); 30 km is the 50% percentile of “maximum” indication in the band.

 

Figure 36: Historical trends (normalised to 1 link in 1997 for P-P and P-MP links
in band 10 to 10.68 GHz in CEPT

* + 1. 10.7--12.5 GHz band

This radio frequency range was allocated many years ago to fixed service and used mostly by P-P. Four sub-ranges are used (10700-11700 MHz, 10755-11725 MHz, 11700-12500 MHz, 11725-12500 MHz). The most used is the 10700-11700 MHz, opened in about 20 countries and used by about 15. P-MP links are used in Bosnia and Herzegovina, Hungary (restricted MVDS use only in the 12.3-12.5 sub-band) and Slovenia.

Use of P-P is quite wide, about 16000 P-P links are in service in this range. In 10.7-12.5 GHz some P-MP base stations are reported, mainly in Hungary in the 12.3-12.5 GHz sub-band (about 150 base stations in total).

It has to be noted that due to satellite sharing problems, some countries have stopped the introduction of new links in this band (see ERC/DEC/(00)08).

Number of active links reported is indicated in Table 11, while trend is reported in Figure 37.

Table 11: Number of active links declared in 2010 and 2016 in RF range 10.7-12.5 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 7271 | 196 | 2025 |
| 2016 | 16770 | 58 | 252 |

The majority of applications consist of high capacity links, individually licensed, forming part of telecommunication (including mobile backhaul) and broadcasting infrastructure networks.

Link by link regime is widely adopted; block assignment is used in Norway, Bosnia and Herzegovina, and Slovenia in specific sub-bands.

Frequency usage refers to CEPT ERC/REC 12-06, as well as Recommendation ITU-R F.387, with few national plans (Latvia, Slovenia and Bulgaria).

Some countries (Greece, Italy, Latvia, Switzerland, Slovak Republic, Bulgaria and Malta) intend to increase the use in next years and in one country (France) congestion is indicated in 10.7-11.7 GHz band.

Bosnia and Herzegovina, Norway, Portugal declared trend to reduce usage, no use is reported in Germany; heavy use is declared by France, Greece. Possible reallocation to other services is foreseen by Bulgaria.

Hop length: 95% percentile of “typical” length is 40 km (10 km for those indicated as “minimum”); 40 km is the 50% percentile of “maximum” indication in the band.

 

Figure 37: Historical trends (normalised to 1 link in 1997) for P-P and P-MP links
in band 10.7 to 12.5 GHz in CEPT

* + 1. 12.75-13.25 GHz band

This RF range was allocated many years ago to fixed service, and is open and used widely for P-P by the great majority of countries in CEPT (open in 24 countries, used by 23).

Number of active links reported is indicated in Table 12, while trend is reported in Figure 38. The trend chart shows a continuous increase since 1997.

Table 12: Number of active links declared in 2010 and 2016 in RF range 12.75-13.25 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P(unidirectional) | P-MP Central Stations |
| 2010 | 51313 | 7951 | 7 |
| 2016 | 72200 | 41 | - |

The major utilization is for medium-high capacity links, individually licensed, most of them belonging to mobile backhaul, fixed, and broadcast infrastructure.

Link by link regime is widely adopted; block licence is also available in Norway.

The frequency usage has high a harmonisation level; all answers refer to CEPT ERC/REC 12-02.

Regarding the usage, about 10 countries indicate expectations to moderate increase in coming years (10-25% increase). Expectation to decrease is declared by Finland, congestion exists in Ireland, Slovenia, Hungary, Germany; Ireland, Croatia, Sweden, Russia, Greece, stable link amount was noted by Finland, Germany; increase by Hungary; Bosnia and Herzegovina; heavy use in Romania, Estonia, France; congested situations in big cities are reported by Hungary. .

Hop length: 95% percentile of “typical” length is 6 km (25 km for those indicated as “minimum”); 48 km is the 50% percentile of “maximum” indication in the band.

 

Figure 38: Historical (normalized to 1 link in 1997) and percentage trends for P-P links
in band 12.75 to 13.25 GHz in CEPT

* + 1. 14.25-15.35 GHz band

Three sub-bands have been indicated in this range, only for P-P links.

14.25-14.5 GHz sub-band is used for FS by a lower number of countries (Estonia, France, UK, Italy, Latvia, Portugal and Russia), with about 1400 active P-P links. In the UK and France the 14.25-14.5 GHz band is closed to new fixed links (around 150 existing links still in use in each country in 2016).

In this sub-band, no FS use or new deployment is indicated in Ireland, Hungary, Portugal, Malta, Latvia, Slovenia, Switzerland, Croatia, Estonia, Sweden, Russian Federation, Greece, Czech Republic, Austria as well as Bosnia and Herzegovina. Exclusive reservation for PPDR is indicated by Germany.

Sub-band 14.5-14.63 GHz, paired with 15.23-15.35 GHz, is widely (about 20 countries) and densely used all over Europe, with more than 57000 P-P active links in operation.

Number of active links reported is indicated in Table 13 and Table 14, while trend is reported in Figure 39. The trend chart shows a continuous increase since 1997 in range 14.5-15.35 GHz.

Table 13: Number of active links declared in 2010 and 2016 in RF range 14.25-14.5 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 1568 | 1044 | - |
| 2016 | 1424 | 1091 | - |

Table 14: Number of active links declared in 2010 and 2016 in RF range 14.5-15.35 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 46996 | 12239 | - |
| 2016 | 57228 | 362 | - |

* Major utilization is for low-medium capacity links, although a significant percentage assigned to high capacity use has been also indicated, mostly for mobile backhaul, fixed and broadcasting infrastructure. Military use is indicated by one country.
* Links appear mostly individually licensed; block licence is possible in Norway and Turkey. The great majority of links are part of fixed and mobile infrastructure (especially mobile backhaul).
* Frequency use refers to CEPT ERC/REC 12-07. Sweden and Greece refer to a national plan
* About 10 countries indicate expectation of growth in next years (10-20% increase), while congestion is declared by 6 administrations.

In the overall band, congestion was declared in Ireland, Germany; heavy use in Romania, Germany and Estonia. Trend to decrease is expected in Germany, Finland and France. Reallocation to other services is expected in Italy.

Hop length: 95% percentile of “typical” length is 20 km (5-10 km for those indicated as “minimum”); 30-40 km is the 50% percentile of “maximum” indication in all sub-bands.



Figure 39: Historical (normalised to 1 link in 1997) and percentage trends for P-P links
in band 14.25 to 15.35 GHz in CEPT

* + 1. 17-17.7 GHz band

Band is practically not used for FS P-P.

Former version of ERC Recommendation 70-03 made the frequency band 17.1-17.3 GHz available for wideband data transmissions systems. As there was a lack of the Harmonised Standards, in some CEPT countries, the applications of wideband data transmissions systems were limited to backhauling applications delivered by P-P links. In 2012 the ERC Recommendation was updated and the frequency band 17.1-17.3 GHz was removed. Nevertheless, based on existing applications within some CEPT countries, the CEPT Report 44 provides the possibility that individual countries may still use the band for licence-exempt applications. Due to the licence-exempt regime, the number of such a links is unknown.

* + 1. 17.7-19.7 GHz band

Heavily and widely used historical FS band, only for P-P (all 25 countries answering 2016 questionnaire indicated the band open and used). About 140000 active links have been indicated by all countries answering the 2016 questionnaire.

Number of active links reported is indicated in Table 15, while trend is reported in Figure 40. The trend chart shows a continuous increase since 1997.

Table 15: Number of active links declared in 2010 and 2016 in RF range 17.7-19.7 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 50833 | 71 | - |
| 2016 | 140320 | 544 | - |

The major utilization is for high capacity links, with a comparable usage of medium and a lower use for low capacity applications.

Majority is allocated to network infrastructure, with significant application for mobile backhaul (19 countries) and fixed infrastructure (16 countries). Use in broadband infrastructure is also indicated.

Most links are individually licensed, block assignment is also allowed in Norway.

Band usage is highly harmonised: the channel plan is based on the CEPT ERC/REC 12-03 (ITU-R F.595 is also indicated); no national arrangements are used.

Concerning the usage, significant increase is expected in next years (5-50% increase) in about 15 countries including Finland, Hungary, Italy, Croatia, Romania, Germany, Bosnia and Herzegovina and Slovak Republic.

A moderate situation of congestion is already reported (Ireland, Slovenia, Hungary, Greece). Future possible reduction is foreseen in Sweden.

Hop length: 95% percentile of “typical” length is about 20 km (4 km for those indicated as “minimum”); 30 km is the 50% percentile of “maximum” indication in all sub-bands.

 

Figure 40: Historical (normalised to 1 link in 1997) and percentage trends for P-P links in band 17.7-19.7 GHz in CEPT

* + 1. 21.2-22 GHz band

This is a poorly used P-P band. 220 links are active in this range in UK, although 7 countries indicate the possibility to use it with link by link regime (some of them are legacy links). Most hop length indicated as “typical” is below 5 km (3 km for those indicated as “minimum”).

Links appear mostly low-medium capacity. Frequencies are used according to Recommendation ITU-R F.637 or local national plan.

No expectation to increase is reported, nor congestion.

* + 1. 21.2-23.6 GHz band

This is a heavily used historical P-P FS band, five sub-bands are used. About 30 uses of one or more sub-bands are indicated. Sub-bands 22000-22600 and 23000-23600 appear as the most widely adopted (open and used in 21 countries). No P-MP application is indicated.

In 2016, more than 130000 P-P active links were indicated in CEPT by all countries answering the questionnaire.

Number of active links reported is indicated in Table 16, while trend is reported in Figure 41. The trend chart shows a continuous increase since 1997.

Table 16: Number of active links declared in 2010 and 2016 in RF range 21.2– 23.6 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 98881 | 24321 | - |
| 2016 | 130969 | 562 | - |

High/medium capacity use is more frequently indicated, but significant use for low capacity links is noted. The majority of links are addressed to fixed and mobile infrastructure. A significant percentage of links (about 50%) is used for mobile backhaul. Use mostly in urban areas is indicated (Austria); possible sharing problems are noted in Switzerland.

Licensing regime is substantially link by link (24 Countries in the 6 indicated sub-ranges). Norway and Turkey indicate block based license in 22000-22600 MHz and 23000-23600 MHz.

Use of channel plan is well harmonised, about 20 administrations indicate use of CEPT T/R 13-02, national plan is indicated in Greece. This Recommendation was updated in 2010 to introduce additional channel arrangements in the centre gap.

In the 2016 questionnaire, trend for increase was declared by more than 10 countries, including Italy, Croatia, Germany, Bosnia and Herzegovina. Heavy use was indicated by Romania, Latvia; congestion or possible congestion was declared in Ireland, Slovenia, Hungary, Finland, France, Germany, Estonia; reduction is expected in Sweden. Trend to decrease is declared by Finland. Possible reallocation to other services is declared by Portugal.

Hop length: 95% percentile of “typical” length is about 10 km (4 km for those indicated as “minimum”), 20 km is the 50% percentile of “maximum” indication.



Figure 41: Historical (normalised to 1 link in 1997) and percentage trends for P-P links
in band 21.2-23.6 GHz in CEPT

* + 1. 24.2-24.5 GHz band

This band is declared open by 9 countries, but very poorly used.

P-P use possibility was indicated by few countries, with link by link regime. In general, licensing regime appears link by link; unlicensed use is declared in Norway.

Recommendation CEPT T/R 13-02 has been indicated by 3 countries as reference; national plan is indicated by Greece.

* + 1. 24.5-26.5 GHz band

The band is open in a large number of countries for P-P and P-MP use. Four different sub-ranges are indicated.

In 20 administrations the band is open and use is indicated by almost all. About 10 countries allow use of P-MP; in Austria, Bosnia and Herzegovina, Bulgaria, Greece, Hungary and Slovak Republic both P-P and P-MP are allowed.

More than 50000 P-P links and 4200 P-MP links are declared. Due to presence of block assignment, the declared number of links can be lower than the effective number of links in operation.

Number of active links declared is indicated in Table 17 while trend is reported in Figure 42. The trend chart shows a continuous increase since 1997.

Table 17: Number of active links declared in 2010 and 2016 in RF range 24.5-26.5 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 37158 | 19453 | 1646 |
| 2016 | 51728 | 17 | 4277 |

Medium and high capacity links are declared, minor use of low capacity is also noted; the majority of links is allocated to fixed and mobile infrastructure. Military use (25.25-25.492 GHz and 26.25-27.5 GHz) is declared by one administration.

Licenses are assigned by link (17 administrations) or by blocks (11 administrations) according to the use.

Four sub-bands are related to this frequency range, use appears well harmonised. Indicated P-P channel plan follows the CEPT T/R 13-02 in great majority of answers, no national plans are indicated. The P-MP channel plan reported is the ERC/REC/(00)05 (superseded by the ECC/REC/(11)01).

Significant use is reported by Ireland, Hungary (traffic shift from congested bands), Bosnia and Herzegovina (mobile infrastructure); possible congestion close to urban areas is indicated by Germany and Netherlands.

Possible trend to increase of use is indicated by Latvia, Bulgaria, Greece, Netherlands, Switzerland, Slovak Republic, Slovenia; reduction is indicated in Sweden.

Finland, Greece and Portugal indicate possible reallocation to other services.

Hop length: 95% percentile of “typical” length is about 10 km (3 km for those indicated as “minimum”), 11 km is the 50% percentile of “maximum” indication.

 

Figure 42: Historical (normalised to 1 link in 1997) trends for P-P and P-MP links
in band 24.5 to 26.5 GHz in CEPT

* + 1. 26.5-27.5 GHz band

This band is not used for P-P or P-MP applications. Indication of use for military use is given.

No expectation to increase the use in next years is envisaged, possible future reallocation to other services is indicated in Sweden.

* + 1. 27.5-29.5 GHz band

This band contains two ranges (overall range for most countries), 27828.5–28444.5/28948.5–29452.5 MHz for Latvia. Band is open in about 20 CEPT countries and used in about 10, with limited density of use; only in Austria and Germany, the number of active links is about 1000 to 2000.

P-P and P-MP applications are allowed; Austria, Bosnia and Herzegovina, Greece, Slovak Republic and Latvia allow both use.

Number of declared active links is indicated in Table 18, while trend is reported in Figure 43.

Table 18: Number of active links declared in 2010 and 2016 in RF range 27.5-29.5 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 2471 | 1424 | 183 |
| 2016 | 5869 | - | 363 |

Licensing regime is mostly link by link, but significant number of countries allow block assignment. It has to be noted that in many countries the block assignment does not require any link notification. Therefore the figures provided for this kind of band could be well underestimated.

Use for high and medium capacity is mostly reported. Majority of links is allocated to mobile backhaul, other uses are for fixed and broadcast infrastructure.

Licenses are assigned by link (12 countries for the all declared cases) or blocks (Bosnia and Herzegovina, Czech Republic, Germany, UK, Greece, Norway, Portugal, Sweden), according to the use;

The band is well harmonised, the P-P channel plan follows the Recommendation T/R 13-02,the block assignment guidance for P-MP links is provided in the ECC/REC/(11)01, no national frequency plan is indicated.

Bulgaria, Germany, Finland, Greece, Netherlands, Croatia, Switzerland, Slovak Republic and Latvia indicate expectations to increase the use in next years (mostly below 10%, Few indicate higher expectation), no one indicate decrease, no congestion is reported. At the moment, Portugal has no use of FS possible future allocation to other services is indicated.

This band has been segmented between FS and uncoordinated FSS usage with the ERC/DEC/(05)01. The majority of CEPT administrations have implemented this Decision.

Hop length: 95% percentile of “typical” is about 10 km (3 km for those indicated as “minimum”), 11 km is the 50% percentile of “maximum” indication.

 

Figure 43: Historical (normalised to 1 link in 1997) trends for P-P and P-MP links
in band 27.5 to 29.5 GHz in CEPT

* + 1. 31-31.8 GHz band

Very limited use is indicated for this band, with very few indications (9 administrations out of 31). 450 P-P links are used in UK. Scarce equipment availability is indicated by Switzerland.

Licensing regime appears link by link.

The channel plan follows ECC/REC/(02)02, in addition to national plan adopted by UK.

No significant expectations to increase the use in next years are reported. Portugal indicates plan to reallocate the band to other services.

* + 1. 31.8-33.4 GHz band

This band is declared open in about 20 CEPT countries, and used in 11, few of them with relatively high density of use; in Germany about 10000 P-P active links are indicated in 2016.

P-P and P-MP applications are possible, but no P-MP is indicated; Portugal and Latvia allow both use.

The number of declared active links is indicated in Table 19, while trend is reported in Figure 44. The use of the band became effective after 2001.

Table 19: Number of active links declared in 2010 and 2016 in RF range 31.8-33.4 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | PmP Central Station |
| 2010 | 3177 | 1466 | - |
| 2016 | 16947 | - | - |

Use appears mostly for medium and high capacity and for mobile backhaul. Some uses for fixed and broadcast infrastructure are declared.

Licenses are assigned mostly by link (14 countries for all declared sub-ranges), although block assignment has been reported by UK and Norway.

The P-P channel plan follows the ERC/REC/(01)02, no national plan is indicated.

Germany, Finland, Greece, Netherlands, Portugal, Switzerland, Slovak Republic, Latvia expect an increase in the usage in coming years (10-20% and more). Sweden indicates trend for decrease of use. No congestion is reported. Portugal and Finland indicate possibility of allocating band to other services/applications.

Hop length: 95% percentile of “typical” length is about 3 km (1 km for those indicated as “minimum”), 6 km is the 50% percentile of “maximum” indication.



Figure 44: Historical (normalised to 1 link in 1997) trend for P-P links
in band 31.8 to 33.4 GHz in CEPT

* + 1. 36-37 GHz band

In the 2016 revision, no P-P active links are indicated by any of the CEPT countries answering the questionnaire. Band is not indicated open for FS. Military use is indicated by one country.

In previous revision (2010), the Russian Federation indicated 132 links in operation, P-P, with licensing regime for link and for blocks.

* + 1. 37-39.5 GHz band

This band is heavily used historically for P-P FS by most of the CEPT countries with high density. All administration responding to questionnaire declared this band opened and used. No P-MP use is allowed.

The number of declared active links is indicated in Table 20, while trend is reported in Figure 45. Trend shows continuous increase since 1997.

Table 20: Number of active links declared in 2010 and 2016 in RF range 37-39.5 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Stations |
| 2010 | 119923 | 42646 | - |
| 2016 | 132182 | 226 | - |

All capacities are reported, individually licensed (24 administrations); Norway and Turkey indicated that block licenses can be used in their administrations domains.

Great majority of links is used for mobile backhaul and fixed infrastructure, limited use for broadcasting infrastructure is declared. In Hungary 37.926-38.220/39.186-39.480 GHz sub-band designated for non-civil FS.

Band is widely harmonised; frequencies are utilized according to Recommendation T/R 12-01, ITU-R Recommendation F.749 is also mentioned; no national plan is indicated.

Concerning trends, increase in the use of the band is reported in coming years (10-50% increase) in 12 countries (one indicate decrease). Congestion is reported by Hungary, Slovenia, France, Austria. Possible sharing problems were declared by Switzerland; trend for future decrease is indicated by Sweden. Possible reallocation to other application is indicated in Finland.

In France, a new regulation was put in place in 2013 in order to offer more capacity to backhaul needs with higher bandwidth; Russia declares an increase of use, above all for mobile backhaul and in telecom operators' infrastructure and in industrial process communications.

The band is one of the potential candidate bands under study for 5G, for WRC-19 decision.

Hop length: 95% percentile of “typical” length is about 3 km (1 km for those indicated as “minimum”), 6 km is the 50% percentile of “maximum” indication.

 

Figure 45: Historical (normalised to 1 link in 1997) and percentage trends for P-P links
in band 37.5-39.5 GHz in CEPT

* + 1. 40.5-43.5 GHz band

In the 2016 revision, 18 countries declared the band to be open to P-P, while Latvia, Portugal and Russia are also open to use of P-MP.

The number of declared active links is indicated in Table 21, while trend is reported in Figure 46. This band has been opened to P-P applications in 2010.

Table 21: Number of active links declared in 2010 and 2016 in RF range 40.5-43.5 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P (unidirectional) | P-MP Central Station |
| 2010 | 73 |  | 3 |
| 2016 | 5459 | - | 16 |

Individually license (12 administrations) and block license (Norway and Turkey) are present; in Greece the allocation of the 41334-42000 MHz paired with 42834-43500 MHz is for P-P links, while potential future block assignment will address the rest of the band.

Majority of links are addressed to mobile backhauling and network infrastructure; in Russia, use addresses existing telecom operators' communications networks.

The channel plan follows the ERC/REC/(01)04. Expectation for growth is expressed by Germany, Greece, Italy, Latvia, Portugal, Switzerland, Slovak Republic. Possibility of allocation to other applications is given by Finland, Greece and Portugal.

Hop length: 95% percentile of “typical” length is about 3 km (1 km for those indicated as “minimum”), 4 km is the 50% percentile of “maximum” indication.



Figure 46: Historical trend for P-P and P-MP links in band 40.5-43.5 GHz in CEPT

* + 1. 48.5-50.2 GHz band

Quite limited use is indicated for this band, 30 P-P active links are indicated in UK above 49.2 GHz.

Planning is for a P-P use belonging to fixed and mobile network infrastructure, with licensing regime mostly on link by link.

The channel plan follows Recommendations ERC/REC 12-10 and ERC/REC 12-11.

No significant expectation to increase the use in next years is reported.

Possibility of future replanning for other services/applications is indicated by Finland and Portugal.

Low availability of equipment was noted.

The band is one of potential candidate bands under study for 5G.

* + 1. 50.4-51.4 GHz band

Very limited use is reported in FS for this band, with very few indications (8 administrations indicate the band as open for use, while in 22 administrations the band is currently not open). Link-by link regime is generally foreseen; 4 administrations consider band opening or licensing regime variation. Block assignment is reported in 2 cases.

One link only is reported in use in Denmark, 1.8 km length.

28 MHz channel BW is indicated, with 52 dBm e.i.r.p.. Possibility of future replanning for other services/applications is indicated by Finland.

Low availability of equipment was noted.

The band is one of potential candidate bands under study for 5G, for WRC-19 decision.

No significant expectations to increase the use in next years are reported.

* + 1. 51.4-52.6 GHz band

This band, available for P-P applications, is almost empty with the exception of the 299 links in Switzerland, with length about 800 m. It is currently open in 22 CEPT countries, while in 7 it is not open.

Links appear as block licensed, while majority of answering countries gave indication for link-based license; 3 administrations declared possibility to change to/add block licence.

e.i.r.p. limits of 85 and 60 dBm are reported by 6 countries.

Majority of answers relate to allocation for network infrastructure.

The channel plan follows the Recommendation T/R 12-11.

Latvia and Portugal report expectations to increase the use in coming years; Switzerland expects decrease of use.

Possibility of future replanning for other services/applications is indicated by Finland and Portugal.

Low availability of equipment was noted.

The band is one of potential candidate bands under study for 5G, for WRC-19 decision.

* + 1. 55.78-57 GHz band

No active links have been indicated. From the replies to the questionnaire it seems that the planned licensing regime will be mostly link based (21 countries gave reply), with few indicating possibility of block assignment, and the band should be used for fixed and mobile infrastructure. 2 administrations consider possibility to open or simplify usage.

The channel plan follows the Recommendation T/R 12-12.

Channel BW from 3.5 to 56 MHz are given in most answers, maximum e.i.r.p. of 85 dBm is mostly indicated.

Concerning the usage of the band, expectations to increase the use in coming years are reported by few countries. There were indications that no equipment with sufficient capacity was available in 2016.

Possibility of future replanning for other services/applications is indicated by Portugal.

* + 1. 57-64 GHz band

The channel plan for this band (57-59 GHz) follows ECC/REC/(09)01 which combines the whole 57-64 GHz range specifically for P-P application with Multi Gigabit Wireless Systems (MGWS) following ERC Recommendation 70-03 and EN 302 567.

27 administrations indicate that the band is open already, 2 administrations plan to open it, in Ireland the band is closed and there is no indication of possible change.

Around 400 links are in use in this band in 6 countries.

Almost all capacities have been reported, most being licensed on a link by link basis (18 answers), but some administrations foresee also block licence (4 answers) or light licence (3 Administrations). 11 administrations also indicate possibility of unlicensed use.

12 administrations show interest in changing regime, mostly to open the band or replacing link by link licensing regime with less stringent regimes, indication of possible transition from unlicensed to light licence regime was given by one Administration.

In 11 Administrations the band, or part of it, is unlicensed.

Great majority of links is allocated to fixed and mobile infrastructure.

Concerning the usage, new equipment following the new Recommendation is becoming available and one link is already reported in Norway. Others should follow.

Possible use for P-MP is reported by 3 administrations, while in 19 these systems are not allowed.

Channel BW obtained by aggregation of “n” consecutive 50 MHz channels, up to 2500 MHz wide, are reported.

Most frequent e.i.r.p. reported is 55 dBm (7 answers), in Germany higher values (65-70 dBm) are allowed.

Few indications of link lengths are available, all referring to links typically in range from few hundred meters to 1 km.

It shall be noticed that band 59 to 61 GHz can be used for NATO/military applications also, as well as for SRD (ISM possible in 61-61.5 GHz).

* + 1. 64-66 GHz band

Band is declared as open in 27 Countries, but no active links are reported in this band.

5 Countries indicated unlicensed regime, while 3 Countries declared light licence.

A general trend for a link by link authorisation regime can be referred (14 answers).

Foreseen application for high capacity P-P links is reported.

The frequency band is used according to the ECC/REC/(05)02.

SRD use has also been indicated, with potential openings and lack of equipment.

* + 1. 71-76 GHz / 81-86 GHz band

In some countries (5 administrations) part of the band (71-74/81-84 GHz) is reserved for military use (NATO).

The use of these joined bands is recent.

The number of declared active links is indicated in Table 22, while trend is reported in Figure 47. This band has been was opened to P-P applications between 2005 and 2010 and the trend shows continuous increase.

Table 22: Number of active links declared in 2010 and 2016 in RF range 71 to 86 GHz

|  |  |  |  |
| --- | --- | --- | --- |
| Year | P-P total | P-P(unidirectional) | P-MP Central Stations |
| 2010 | 96 | - | - |
| 2016 | 8440 | - | - |

22 answers indicate this joined bands as open, while in 6 administrations they appear as closed.

Most administrations indicate maximum e.i.r.p. of 85 dBm.

Channel BW from 250 to 4500 MHz have been frequently indicated, 4 administrations indicated possibility of sub-channelling.

Maximum throughput of 2Gbit/s have been indicated

Most answers relate to link by link licensing regime (17 Countries), with the exception of 4 Administrations, indicating both link by link and block based approach.

3 administrations refer to unlicensed regime, light-license regime are indicated by 2 Administration.

Most applications are foreseen for P-P links used for mobile backhaul and fixed infrastructure, and some test links are going on (e.g. Germany).

4 Administrations showed possibility of changing existing licensing regime, towards light licensing /blocks.

Expectation to increase of band use in next future was indicated by Bulgaria, France, Greece, Netherlands, Croatia, Italy, Portugal, Sweden, Switzerland, Slovenia Latvia and Romania, fast growing use was indicated by one administration.

The referred Recommendation for this band is ECC/REC/(05)07.

Portugal reported use also for SRD.

Hop length: 95% percentile of “typical” is about 2.6 km (1 km for those indicated as “minimum”), 3.5 km is the 50% percentile of “maximum” indication.

 

Figure 47: Comparative (normalised to 1 link in 2010) and percentage trends for the P-P links
in the band 71-76/81-86 GHz in CEPT

* + 1. 92-95 GHz band

Only 1 link in Czech Republic is indicated.

Band is currently open in 9 Administrations, among which seven refer of link by link licensing regime, while the Russian Federation indicated preference for unlicensed use; two administrations are considering to open it as unlicensed.

Most applications are foreseen for high capacity P-P links used in support of the fixed and mobile infrastructure.

ECC Recommendation (14)01 is given as reference by most answers.

National frequency plan has been indicated by Ireland.

* + 1. Fees

In general, licence fee depends on channel bandwidth (28 answers) and RF band (25 answers). In several cases, the number of Tx is considered in calculation fees (21 answers), while 11 administrations include also geometric considerations (area). 22 administrations intend to use incentives to promote use of higher frequencies, while 5 are not interested at the moment.

Concerning licence duration, most used time slot is 5 years (8 administrations); time base of 10 years is indicated by 4 administrations, 15 years by two countries, 6 and 8 years by one admin respectively; 3 administrations adopt 1 year. In general, all licences can be confirmed after time slot has ended.

Indication of links to websites where info related to fees determination procedures has been given by most administrations. Not for all of them a translation in English is available.

List of answers is given in Table 23.

Table 23: Fees related website list

|  |  |  |  |
| --- | --- | --- | --- |
| Country | Webpage | Functional link | English |
| ALB | <http://akep.al/informacion/pagesa/llojet-e-pagesave>; <http://akep.al/informacion/pagesa/aktet-e-pagesave> ; | Y | N |
| AUT | <http://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10012777>  | Y | N |
| BIH | <http://spektar.rak.ba/en/Kalkulator.aspx>  | Y | Y |
| BUL | <http://crc.bg/files/_bg/TaxTarif_.pdf>  | Y | N |
| SUI | <http://www.admin.ch/opc/fr/classified-compilation/20072116/index.html#a8>  | Y | N |
| HRV | <http://www.hakom.hr/default.aspx?id=273>)  | Y | Y |
| CYP | <http://www.mcw.gov.cy/mcw/DEC/DEC.nsf/All/D55CAB220E004339C22579C1004DD8B6?Opendocument>  | Y | Y |
| CZE | <http://www.ctu.cz/ctu-online/poplatky-vybirane-ctu/poplatky-za-vyuzivani-radiovych-kmitoctu.html> | Y | N |
| DNK | <https://ens.dk/sites/ens.dk/files/Tele/afgifter_2018.pdf>  | Y | N |
| EST | <https://www.riigiteataja.ee/en/eli/511022015002/consolide>  | Y | Y |
| FIN | No info |  |  |
| F | <http://www.arcep.fr/index.php?id=11976> <http://www.arcep.fr/fileadmin/reprise/dossiers/taxes/simulateur-cout-fh-nov2014.xlsm>  | Y | N |
| D | [www.bundesnetzagentur.de](http://www.bundesnetzagentur.de)  | Y | N |
| GRC | <https://www.eett.gr/opencms/export/sites/default/EETT_EN/Electronic_Communications/Radio_Communications/Rigths_Of_Use/FixedService/FeesFixedService.pdf>  | N |  |
| HUN |  <http://njt.hu/cgi_bin/njt_doc.cgi?docid=136918.319221> | Y | N |
| IRL | <http://www.comreg.ie/radio_spectrum/search.541.874.10014.0.rslicensing.html>  | N |  |
| I | <http://www.parlamento.it/parlam/leggi/deleghe/03259dl4.htm> | N |  |
| LVA | <http://likumi.lv/ta/id/267460>  | Y | N |
| LTU | <http://www.rrt.lt/rrt/lt/verslui/istekliai/radijo-dazniai/rrl.html> | Y | N |
| Malta | <http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=9065&l=1>  | Y | Y |
| MNE | <http://www.ekip.me/download/koriscenjeRF/Pravilnik_o_metodologiji_i_nacinu_obracuna_visine_godisnje_naknade_za_koriscenje_radio-frekvencija%2016-2014.pdf> <http://www.ekip.me/download/Odluka%20o%20vr.%20boda%20za%20RF%20za%202015.%20godinu.pdf>  | Y | N |
| HOL | <http://www.agentschaptelecom.nl/onderwerpen/zakelijk-gebruik/straalverbindingen/tarieven-straalverbindingen>  | Y | N |
| NOR | <http://eng.nkom.no/technical/frequency-management/fees-and-regulations/frequency-charges>  | Y | N |
| POR |  <http://www.anacom.pt/render.jsp?contentId=1180549#.VN3n6Sy4Jek>  | Y | N |
| ROU | <http://www.ancom.org.ro/uploads/forms_files/decizia_2012_551_versiune_consolidata_4_iulie_20141405000552.pdf>  | Y | N |
| RUS | <http://rkn.gov.ru/communication/p552/>  | Y | N |
| SRB | Rulebook on radio-frequency usage fees | N |  |
| SVK  | <http://www.teleoff.gov.sk/data/files/26551.pdf>  | Y | N |
| SVN | <http://www.pisrs.si/Pis.web/pregledPredpisa?id=AKT_827><http://www.pisrs.si/Pis.web/pregledPredpisa?id=AKT_1010> | Y | N |
| E | No info | N |  |
| S | <http://www.pts.se/upload/Foreskrifter/PTSFS%202014_4-avgifter.pdf> ; <http://www.pts.se/upload/Ovrigt/Radio/Radiotillstand/sammanfattning-av-arsavg-2015.pdf>  | Y | N |
| TUR | Examples have been given in response to the questionnaire | N |  |
| G | <http://www.legislation.gov.uk/uksi/2011/1128/contents/made>  | Y | Y |