Band overview
700 MHz frequency band



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1. Summary

The EU legal acts establishing obligations for the use of the 694-790 MHz frequency band (hereinafter referred to as: 700 MHz frequency band) provide a flexible framework for Member States to regulate use of the 700 MHz band. Within the regulatory framework, 2×30 MHz in the 700 MHz band shall be made available on a mandatory basis for mobile and fixed communication networks (MFCN[[1]](#footnote-1)) capable of providing wireless broadband communications services, while in other sub-bands, use options can be chosen at national level, subject to compliance with specified technical conditions. Such options include broadband radio applications for public protection and disaster relief (hereinafter referred to as: BB-PPDR[[2]](#footnote-2)), supplemental downlink (SDL[[3]](#footnote-3)) communications for increased downlink traffic, applications related to broadcasting and programme making as well as special events (hereinafter referred to as: PMSE[[4]](#footnote-4) applications) and machine-to-machine communications (hereinafter referred to as: M2M[[5]](#footnote-5)). The key decisions on the future of the 700 MHz frequency band are set out in the National Roadmap[[6]](#footnote-6) prepared in line with EU obligations.

The utilisation of the 700 MHz frequency band affects several interrelated radio spectrum management processes, and several sectors using frequency. One key issue is the deployment of broadband PPDR networks in the 700 MHz band, for which there are several options in terms of the frequency bands that can be chosen (e.g. the 400 MHz band can be used in addition to the 700 MHz band) and the type of implementation (dedicated government network operation, commercial service use or a hybrid solution combining the two).

From the 2x30 MHz band available for MFCN systems under the EU obligation, 2x25 MHz sub-band was distributed in the 2020 auction, while for the remaining 2x5 MHz sub-band planned category has been maintained until the spectrum needs of digital broadband PPDR systems in Hungary are clarified.

In this consultation, we will reassess the needs, taking into account the growing demand for spectrum in next generation networks, as well as the needs for PPDR systems. As a result of the public consultation, a decision can be taken on the future use of the undistributed sub-band, in particular on the method and opportunities of the distribution (e.g. launching a competitive procedure, meeting PPDR demands with a hybrid solution, etc.).

1. Introduction

Commission Implementing Decision (EU) 2016/687[[7]](#footnote-7) (hereinafter referred to as “Commission Implementing Decision”) on harmonised technical conditions for band utilisation with regard to the use of mobile broadband in the 694-790 MHz frequency band (hereinafter: 700 MHz frequency band) previously used for broadcasting was adopted in 2016. Then, in 2017, a decision of the Parliament and the Council[[8]](#footnote-8) on the task scheduling was published, setting out the obligations of the Member States regarding the re-use of the entire 470-790 MHz frequency band, and defining the expectations for the future of TV broadcasting.

The 700 MHz frequency band is also particularly important in terms of the introduction of 5G. Based on the 5G Action Plan of the European Commission[[9]](#footnote-9) and the 5G Strategic Roadmap set out in the RSPG’s opinion[[10]](#footnote-10), the 700 MHz band is considered as one of the primary bands in the introduction of 5G, together with the 3400-3800 MHz and the 24.25-27.5GHz bands (“pioneer bands”). So far, licences for the 700 MHz frequency band have been issued in 19 Member States of the European Union. Hungary was one of the first among them.

The physical properties of the 700 MHz frequency band allow for the cost-effective coverage of large areas, and therefore this frequency band is beneficial for the efficient implementation of nationwide coverage, in particular for rural, sparsely populated areas, and also provides favourable conditions for providing in-building coverage and long-distance machine-to-machine communications.

Pursuant to the Commission Implementing Decision, Mobile/Fixed Communications Network (MFCN) wireless broadband electronic communications services and other non-MFCN applications can also be introduced in the band. As a national option, part of the 700 MHz band may also be used for supplemental downlink (SDL), i.e. downlink-only (i.e. one-way) base station transmission as part of the provision of a terrestrial wireless broadband electronic communications service. SDL aims to increase downlink capacity of the service and thereby addresses the asymmetry of data traffic demand. National options for the 700 MHz band also include BB-PPDR, wireless audio PMSE applications and M2M**,** which can be operated on dedicated networks or on terrestrial systems capable of providing electronic communications services.

1. Regulation of 700 MHz band
	1. International regulation

The 5th generation mobile technology introduced in the ITU terminology with the term IMT-2020[[11]](#footnote-11) (more commonly known as 5G or NR) opens upnew perspectives in mobile telecommunications, therefore providing the necessary spectrum and establishing the relevant regulations have been considered a priority at international level by the relevant international professional organisations. According to the RSPG’s[[12]](#footnote-12) opinion on 5G spectrum issues[[13]](#footnote-13), the 700 MHz band is one of the so-called 5G pioneer bands. Making the 700 MHz frequency band available for mobile broadband applications and developing the current regulation required lengthy international preparations by the relevant international organisations and groups responsible for spectrum management (ITU[[14]](#footnote-14), CEPT[[15]](#footnote-15), European Commission, RSPG[[16]](#footnote-16), RSC[[17]](#footnote-17)). The key elements of international regulation are summarized below.

* + 1. ITU

Annex 1 to Decree No. 7/2015 (XI. 13.) NMHH on the national frequency allocation and the rules of using frequency bands (hereinafter: NFFF Decree) contains the international allocation in accordance with Radio Regulations (hereinafter: RR). According to the currently effective Radio Regulations, the 694-790 MHz band is allocated to the broadcasting and mobile (except aeronautical mobile) services on a primary basis.

The use for broadcasting purposes is regulated by the agreement and frequency plan (GE06[[18]](#footnote-18)) adopted at the Regional Radiocommunication Conference in Geneva in 2006 (RRC-06[[19]](#footnote-19)). In addition to the plan for the use of frequencies for broadcasting purposes, GE06 also includes the procedures necessary for the international coordination of services other than broadcasting.

The use of the 694-790 MHz frequency band for mobile services (except aeronautical mobile service) in Region 1[[20]](#footnote-20) of the ITU was approved by WRC-15[[21]](#footnote-21), while maintaining the primary nature of broadcasting.

The conditions of use for mobile services are set out in footnotes 5.312A and 5.317A:

|  |  |
| --- | --- |
| ***5.312A*** | *In Region 1, the use of the frequency band 694-790 MHz by the mobile, except aeronautical mobile, service is subject to the provisions of Resolution* ***760 (WRC-15)****[[22]](#footnote-22). See also Resolution* ***224 (Rev.WRC-15)*** *[[23]](#footnote-23).**(WRC‑15)* |
| ***5.317A*** | *The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands 694-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT*[[24]](#footnote-24)*) – see Resolutions* ***224 (Rev.WRC-15)****,* ***760 (WRC-15)*** *and* ***749 (Rev.WRC-15)****[[25]](#footnote-25), where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-15)* |

As a result of the WRC-15 conference, the 700 MHz band was allocated to the mobile service (in addition to the broadcasting) on a primary basis in all three ITU Regions and became available for broadband mobile service applications (IMT). Harmonisation between regions (Europe, Asia and the Pacific) was an important aspect in developing frequency arrangement in order to ensure economies of scale and unimpeded global roaming.

The frequency bands identified for IMT and related channel arrangements are included in Recommendation ITU-R M. 1036-5[[26]](#footnote-26). The 700 MHz frequency band is also allocated to the aeronautical radionavigation service (hereinafter: ARNS[[27]](#footnote-27)) on a primary basis in some countries, according to footnote 5.312 of the Radio Regulations:

|  |  |
| --- | --- |
| ***5.312*** | *Additional allocation: in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the frequency band 645-862 MHz, in Bulgaria the frequency bands 646-686 MHz, 726-758 MHz, 766-814 MHz and 822-862 MHz, and in Poland the frequency band 860-862 MHz until 31 December 2017, are also allocated to the aeronautical radionavigation service on a primary basis. (WRC‑15)* |

The use of the 700 MHz band for IMT has raised a number of regulatory issues, including the specification of permitted emission levels of mobile user devices outside of the 700 MHz band (within the broadcasting band), issues of compatibility between mobile service and broadcasting, and the adoption of technical criteria for the shared use of the band by IMT and ARNS.

Regarding the protection of broadcasting, the WRC-15 concluded that there is no need for further regulatory requirements, and the GE06 agreement contains the necessary procedures for international coordination between IMT and broadcasting.

The ARNS systems in the countries listed in footnote 5.312 of the RR may significantly restrict the use of the 700 MHz frequency band for mobile services; therefore, bilateral coordination agreements had to be concluded between the countries concerned in order to allow the use of the 700 MHz frequency band for IMT in order to avoid problems arising from different radio spectrum use. Among the neighbouring countries, Ukraine operates ARNS equipment, so Hungary, like all the other countries concerned, had to conclude an agreement with Ukraine to ensure the protection of ARNS.

Pursuant to footnote RR 5.296, the 470−698 MHz band has also been allocated, on a secondary basis, to the land mobile service in several countries for applications ancillary to broadcasting and programme making.

In line with the mobile service allocation of the 694-790 MHz frequency band, the WRC-15 also amended footnote RR 5.296 on the secondary allocation of the 470-698 MHz band covering part of the 700 MHz band, which Hungary also joined at the conference:

|  |  |
| --- | --- |
| ***5.296*** | *Additional allocation: in Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, The Former Yugoslav Republic of Macedonia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Swaziland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe, the frequency band 470-694 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme-making.*− *Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-15)* |

Pursuant to RR Resolution 646[[28]](#footnote-28), it is possible to use certain parts of the 694-790 MHz frequency band in ITU Region 1 for public protection and disaster relief (PPDR[[29]](#footnote-29)) systems. The frequency bands identified for PPDR, band and channel arrangements and channel numbers are included in ITU-R Recommendation M.2015-2[[30]](#footnote-30). The possible arrangements are shown in Tables 3.1.1.a and 3.1.1.b.

|  |  |  |
| --- | --- | --- |
| Frequency arrangement | Paired arrangement | ECC Decisions containing technical conditions |
| Mobile station transmitter(MHz) | Duplex gap(MHz) | Base station transmitter(MHz) | Duplex spacing(MHz) |
| a) | 698-703 | 50 | 753-758 | 55 | Annex 1 of ECC/DEC/(16)02 |
| b) | 703-733 | 25 | 758-788 | 55 | ECC/DEC/(15)01 |
| c) | 733-736 | 52 | 788-791 | 55 | Annex 1 of ECC/DEC/(16)02 |

Table 3.1.1.a: Possible PPDR band arrangements

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 698-703 MHz | 703-708 | 708-713 | 713-718 | 718-723 | 723-728 | 728-733 | 733-736 MHz | 736-753 | 753-758 MHz | 758-763 | 763-768 | 768-773 | 773-778 | 778-783 | 783-788 | 788-791 MHz |
| PPDR a)uplink | PPDR b)uplink (MFCN) | PPDR c)uplink |  | PPDR a)downlink | PPDR b)downlink (MFCN) | PPDR c)downlink |
| 5 MHz | 30 MHz (6x 5 MHz blocks) | 3 MHz |  | 5 MHz | 30 MHz (6x 5 MHz blocks) | 3 MHz |

Table 3.1.1.b: Detailed PPDR channel arrangements

For ITU Region 1, a decision reflecting the position of the European Union was taken at the WRC-15 conference on the remaining 470-694 MHz frequency band for broadcasting. Accordingly, no changes to the Radio Regulations affecting this frequency band are expected before the WRC-23 conference, so the frequency band below 694 MHz will continue to be allocated primarily for broadcasting. WRC-15 decided to postpone the review of the use of the 470-694 MHz frequency band for IMT until the World Radiocommunication Conference in 2023 (WRC-23).

* + 1. CEPT

Two reports have been developed within CEPT on the basis of the studies carried out in the context of the European Commission’s mandate[[31]](#footnote-31):

* CEPT Report 53[[32]](#footnote-32) (Report A): CEPT Report A to the European Commission in response to the mandate “To develop harmonised technical conditions for the 694-790 MHz frequency band in the EU for the provision of wireless broadband and other uses in support of EU spectrum policy objectives” (28 November 2014)
* CEPT Report 60[[33]](#footnote-33) – (Report B): CEPT Report B to the European Commission in response to the mandate “To develop harmonised technical conditions for the 694-790 MHz frequency band in the EU for the provision of wireless broadband and other uses in support of EU spectrum policy objectives” (1 March 2016)

These CEPT reports provide the basis for harmonised technical conditions for the use of the 700 MHz frequency band by wireless broadband electronic communications services and also study the technical conditions for the use of PMSE devices in the 700 MHz frequency band and below 694 MHz.

Additional CEPT documents on the use of the 700 MHz frequency band for MFCN have been adopted with the approval of ECC[[34]](#footnote-34):

* Decision ECC/DEC/15(01)[[35]](#footnote-35) contains the harmonised technical conditions for the use of the 700 MHz band for MFCN purposes, such as the recommended channel arrangement of the 700 MHz band and the maximum radiated power levels to ensure the coexistence of different radio services;
* ECC Report 199[[36]](#footnote-36) contains a study of the spectrum need for broadband PPDR (BB-PPDR) systems, taking into account the different user requirements. Accordingly, the minimum spectrum need for nationwide BB-PPDR networks (BB-PPDR WAN[[37]](#footnote-37)) is 2x10 MHz, which can be met in part or in full in the 700 MHz band, depending on national decisions;
* ECC Report 218[[38]](#footnote-38) contains the frequency band options that can be designated to BB-PPDR and the harmonised technical conditions for the 700 MHz and 400 MHz bands;
* ECC Report 239[[39]](#footnote-39) contains compatibility studies for broadband PPDR (BB-PPDR) in the 700 MHz band;
* Decision ECC/DEC/16(02)[[40]](#footnote-40) contains the harmonised technical conditions and frequency bands (in the 700 MHz and 450 MHz bands) for the use of BB-PPDR;
* ECC Report 242[[41]](#footnote-41) contains compatibility studies and technical conditions for band sharing for M2M applications in the 733-736 MHz/788-791 MHz band;
* ECC Report 266[[42]](#footnote-42) studies the feasibility of M2M applications based on narrowband and wideband cellular systems in the harmonised MFCN bands, including the 700 MHz band, under the technical regulatory conditions adopted for MFCN in these bands. In the 700 MHz band, LTE MTC and eMTC, as well as NB-IoT can be introduced within MFCN systems;
* ECC Report 221[[43]](#footnote-43) contains compatibility studies between PMSE and MFCN operating in adjacent bands;
* Recommendation ECC/REC/(15)01[[44]](#footnote-44) contains coordination requirements for MFCN systems operating in the 700 MHz band (and in the 1452-1492 MHz and 3400-3800 MHz bands);
* Recommendation ECC/REC/(16)03[[45]](#footnote-45) contains coordination requirements for PPDR systems.

The CEPT regulation adopted for the 700 MHz band provides for flexible harmonisation, allowing in the 694-790 MHz band, in addition to a harmonised MFCN FDD frequency arrangement, and adapted to national needs, some segments of the guard band and/or duplex gap for supplemental downlink MFCN use (MFCN SDL), as well as for PMSE, PPDR or M2M applications.

The harmonised frequency arrangement for MFCNand the harmonised technical conditions for MFCN use are contained in Decision ECC/DEC/15(01).

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 694-703 | 703-708 | 708-713 | 713-718 | 718-723 | 723-728 | 728-733 | 733-738 | 738-743 | 743-748 | 748-753 | 753-758 | 758-763 | 763-768 | 768-773 | 773-778 | 778-783 | 783-788 | 788-791 |
| Guard band  | Uplink | Duplex gap | Downlink | Guard band |
| Duplex gap | SDL |
| 9 MHz | 30 MHz (6 blocks of 5 MHz) | 5 MHz | 20 MHz (up to 4 blocks of 5 MHz) | 30 MHz (6 blocks of 5 MHz) | 3 MHz |

Figure 3.1.2.a: MFCN frequency arrangement (source: ECC/DEC/(15)01)

Considering that the 790-791 MHz frequency range in the frequency arrangement in Decision ECC/DEC/15(01) overlaps with the 790-862 MHz band (i.e. the 800 MHz band), the technical conditions for the 790-791 MHz frequency range should be applied to ensure that the provisions of the ECC Decision for the 800 MHz band are also met.

In accordance with the flexible harmonisation under Decision ECC/DEC/15(01), the 694-790 MHz band contains a harmonised MFCN channel arrangement comprising a paired 2x30 MHz FDD frequency arrangement and an optional unpaired arrangement of up to 4 frequency blocks of 5 MHz for SDL purposes. Conditions for harmonised MFCN use:

* the size of the frequency blocks shall be 5 MHz or multiples of 5 MHz, which, however, does not preclude the use of a smaller channel bandwidth within the 5 MHz block;
* In the FDD arrangement, the transmission band for end-user equipment is in the 703-733 MHz frequency range, and the transmission band for base stations is in the 758-788 MHz frequency range;
* SDL use includes the following frequency block: 738-743 MHz, 743-748 MHz, 748-753 MHz and 753-758 MHz; the number of contiguous blocks that may be used for SDL may be decided at national level, depending on national needs;
* In addition to MFCN (FDD and SDL), other non-MFCN options (such as PPDR, PMSE, M2M) may also be decided at national level within the context of flexible harmonisation.

The use of the CEPT block edge mask (BEM) allows several radio applications to use parts of the frequency band, for example PPDR and PMSE can coexist in the duplex gap, ensuring technology neutrality in the use of the frequency band. The use of appropriate BEMs also allows different services to use the concerned sub-bands depending on the needs in each country. The BEM ensures the least restrictive technical conditions necessary for the interference-free operation of various MFCN networks as well as the MFCN and other services (such as broadcasting below 694 MHz). Specific conditions are set for base stations, mobile terminals and PMSE devices. Their use facilitates coordination between countries in case they use parts of the band differently (e.g. PPDR and SDL). In the event that terrestrial broadcasting causes interference to the MFCN, a case-by-case assessment must be carried out using appropriate mitigation methods at national level.

ThePMSE can also use the guard band and the duplex gap under the technical conditions published in the decision.

The current spectrum use of PMSE devices and future needs are discussed in CEPT Report 204. Compatibility conditions for interference-free operation of PMSE and MFCN applications in adjacent bands are described in ECC Report 221.

The frequency bands that can be used for the implementation of broadband PPDR (BB-PPDR) are set out in Decision ECC/DEC/(16)02.

On the basis of the different band arrangement options, the following bands in the 700 MHz frequency band were identified for BB-PPDR by Decision ECC/DEC/(16)02:

* 698-703 MHz (uplink) / 753-758 MHz (downlink);
* 733-736 MHz (uplink) / 788-791 MHz (downlink);
* 703-733 MHz (uplink) / 758-788 MHz (downlink).

If the PPDR is designated within the 703-733 MHz (uplink) / 758-788 MHz (downlink) sub-band designated to MFCN, it must comply with the least restrictive technical conditions for MFCN as set out in Decision ECC/DEC/(15)01.

If the BB-PPDR is implemented in the dedicated 698-703 MHz (uplink) / 753-758 MHz (downlink) and/or 733-736 MHz (uplink) / 788-791 MHz (downlink) bands, the technical conditions are set out in Annex 1 to Decision ECC/DEC/(16)02.

M2M systems may be implemented in the 700 MHz frequency band within MFCN networks or, as a national option in accordance with the flexible harmonisation provided in Decision ECC/DEC/15(01), a 2x3 MHz dedicated bands for M2M may be designated in the 733-736 MHz/788-791 MHz sub-band (in the sub-band separating the duplex sub-bands and in the guard band).

The results of the compatibility studies for the 733-736 MHz/788-791 MHz sub-band to avoid interference between M2M (LTE-based or narrowband M2M) and other applications are presented in ECC Report 242.

The potential uses of the 700 MHz frequency band and the compatibility cases that may arise for M2M and MFCN/SDL, PMSE, PPDR applications operating in adjacent bands are summarised in Figure 3.1.2.b.



Figure 3.1.2.b: Potential uses of the 700 MHz frequency band (source: ECC Report 242)

* + 1. EU

Since the launch of the Digital Single Market strategy, the European Commission has prioritised the 700 MHz frequency band for its suitability for wireless broadband electronic communications services, particularly in rural areas.

The EU Radio Spectrum Policy Programme[[46]](#footnote-46) stresses that cooperation between Member States on security and emergency services should be guaranteed by harmonised technical solutions through BB-PPDR radio applications, and that Member States should aim to ensure the necessary amount of spectrum for PMSE in line with the EU’s objectives of improving internal market integration and access to culture. Another key objective is to make spectrum available for radio frequency identification (RFID) and other wireless communication technologies (including machine-to-machine communication - M2M) for the Internet of Things (IoT), and to work together to encourage the development of standards and harmonisation of spectrum use for IoT communications across Member States.

In light of the above objectives, the Commission Decision on the use of the 700 MHz frequency band for wireless broadband electronic services and the Parliament-Council Decision on the future of the UHF band were adopted:

* **(EU) 2016/687**[[47]](#footnote-47): Commission Implementing Decision (EU) 2016/687 of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union;
* **(EU) 2017/899**[[48]](#footnote-48)**:** Decision (EU) 2017/899 of the European Parliament and of the Council of 17 May 2017 on the use of the 470–790 MHz frequency band in the Union

**Commission Implementing Decision** **(EU) 2016/687** harmonises the technical conditions for the availability within the Union and the efficient use of the 694-790 MHz frequency band by terrestrial systems capable of providing wireless broadband electronic communications services. It also aims to promote flexible national use to meet specific national needs in line with the RSPP’s spectrum policy priorities.

According to the harmonised use, the 703-733 MHz and 758-788 MHz frequency bands shall be designated, on a non-exclusive basis, for terrestrial systems capable of providing wireless broadband electronic communications services (MFCN). PPDR may also be implemented in the frequency band designated for MFCN, in which case the technical conditions for wireless broadband electronic communications services shall also be applied. In addition to the dedicated 2x30 MHz MFCN sub-bands, additional optional applications are possible, depending on national needs, as follows:

* so-called Supplemental Downlink (SDL) links, limited to downlink only transmission (SDL) by the base station, to provide MFCN asymmetric traffic,
* BB-PPDR (698-703 MHz, 733-736 MHz, 753-758 MHz and 788-791 MHz): the end-user station transmission (uplink PPDR) is in one or both of the 698-703 MHz and 733-736 MHz frequency bands, and the base station transmission (downlink PPDR) is in one or both of the 753-758 MHz and 788-791 MHz frequency bands,
* PMSE: audio PMSE, indoor use,
* specifies national options for IoT/M2M (733-736 MHz/788–791 MHz, FDD mode) applications.

The block edge mask (BEM) parameters for base stations and mobile end-user stations are set out in the Annex to this Implementing Decision to ensure the coexistence of adjacent networks in the 700 MHz frequency band and to protect other services and applications using adjacent frequency bands.

Certain provisions of Implementing Decision 2016/687/EU relating to the **694-790 MHz** frequency band also apply to the frequency range 790-791 MHz, which overlaps with the 790-862 MHz (800 MHz) frequency band. Therefore, the harmonised conditions of the 790-791 MHz frequency range set out in this Decision must be applied so that the provisions of Decision 2010/267/EU concerning the 800 MHz frequency band are also complied with.

**Decision (EU) 2017/899** **of the European Parliament and of the Council** regulates the implementation deadlines and other obligations of the Member States and includes provisions for the use of the 700 MHz and the 470-694 MHz frequency bands.

* 1. National regulation

Pursuant to the NFFF Decree in effect, the 694-790 MHz frequency band is allocated to the broadcasting, mobile (except aeronautical mobile) and, differently from the RR, fixed services on a co-primary basis.

The NFFF Decree has been amended to implement the EU law. The legislative tasks required in the context of the Commission Implementing Decision and Decision (EU) 2017/899 of the European Parliament and of the Council were completed in two phases. The amendment to the NFFF Decree, which entered into force on 10 October 2017, indicated the possibility of introducing MFCN systems and broadband digital PPDR systems designed to meet non-civil frequency needs in the future in part of the frequency band with a planned category. With the amendment of the NFFF Decree effective from 30 March 2019, out of the 2x30 MHz band planned for MFCN systems, 2x25 MHz sub-band were categorized as designated and the legislative (technical, legal, band sales) conditions required for the competitive procedure of the 700 MHz frequency band were also incorporated. The remaining 2x5 MHz sub-band remained in the planned category until the spectrum needs of broadband PPDR systems in Hungary are clarified and the government decision on the implementation of the PPDR is made.

Accordingly, pursuant to the NFFF Decree in force, the 708-733/763-788 MHz sub-band within the 694-790 MHz frequency band is designated for terrestrial systems capable of providing wireless broadband electronic communications services on a primary basis, while the 703-708/758-763 frequency sub-band remains in planned status. The 698-703/753-758 MHz and 733-736/788-791 MHz sub-bands are planned for broadband digital PPDR systems.

The information on the acquisition of the right of radio spectrum use for the 708-733/763-788 MHz sub-band with the already designated status and the conditions of using the band is included in Annex 3 of the NFFF Decree.

| **Subject of condition** | **Requirement** |
| --- | --- |
| Purpose of use | providing electronic communications services |
| Method of frequency distribution | competitive procedure |
| Maximum amount of frequency range | a single radio spectrum right holder may have the right of and entitlement to radio spectrum use of up to two basic blocks within the territorial coverage of entitlement to radio spectrum use;radio spectrum right holders belonging to the same business group may together have the right of and entitlement to radio spectrum use of up to two basic blocks within the territorial coverage of entitlement to radio spectrum use; |
| if, after completion of the competitive procedure, any radio spectrum right holder or radio spectrum right holders belonging to the same business group exceed the maximum amount of frequency range, they shall reduce the amount of frequency range belonging to them to at least the maximum amount of frequency range within 1 year from the date the maximum is exceeded. |
| Minimum amount of frequency range  | a radio spectrum right holder shall have entitlement to radio spectrum use for at least one basic block |
| Duration of right of radio spectrum use | 15 years, which may be extended once by 5 years; the detailed rules and conditions of the extension shall be determined by the documentation of the competitive procedure and the decision or administrative contract closing the competitive procedure |
| Territorial coverage of entitlement to radio spectrum use | nationwide in case of obtainment of entitlement to radio spectrum use, as a result of a competitive procedure, in case of transfer, smaller geographical unit is also permitted  |
| Method of management | block management |
| Secondary trading | entitlement to and right of radio spectrum use may be transferred or leased in whole or in part; partial transfer in respect of frequencies may occur per basic blockwith regards to the lease of right of radio spectrum use, the documentation of the competitive procedure may define conditions in order to promote effective competition and to avoid distortions of competition |
| Band rearrangement | allowed |

Table 3.2.a: Conditions for obtaining right of radio spectrum use and conditions of using the band (708-733/763-788 MHz, source: NFFF Decree)

The spectrum management requirements are summarised in Table 3.2.b.

|  |  |
| --- | --- |
| **Subject of requirement** | **Requirement** |
| Uplink frequency band of an end-user station or a repeater station | 708-733 MHz |
| M[FCN](https://stir.nmhh.hu/publicview/?p=d&name=3melleklet#MFCN) station’s downlink frequency band | 763-788 MHz |
| Duplex spacing | 55 MHz |
| Mode of access | only [FDD](https://stir.nmhh.hu/publicview/?p=d&name=3melleklet#FDD) |

Table 3.2.b: Spectrum management requirements (source: NFFF Decree)

* 1. Actual use

As a result of the competitive procedure held in 2020, the Hungarian mobile service providers (Magyar Telekom Nyrt., Vodafone Magyarország Zrt., Telenor Magyarország Zrt.[[49]](#footnote-49)) acquired the right to use a total of 2x25 MHz frequency division duplex (FDD) spectrum from the 2x30 MHz spectrum available in the 700 MHz frequency band.

Current entitlements to radio spectrum use are listed in Table 3.3.a and Figure 3.3.a

|  |  |  |  |
| --- | --- | --- | --- |
| **Right holder** | **Frequency band** | **Bandwidth** | **Entitlement expiry** |
|   | 708-718 / 763-773 MHz | 2x10 MHz | 2035 (+5 years) |
|   | 718-728 / 773-783 MHz | 2x10 MHz | 2035 (+5 years) |
|   | 728-733 / 783-788 MHz | 2x5 MHz | 2035 (+5 years) |

Table 3.3.a: Current use of the 700 MHz frequency band

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Figure 3.3.a: Current use of 700 MHz band

Decision (EU) 2017/899 of the European Parliament and of the Council provided that the use of this frequency band shall be allowed for MFCN systems by 2020. In Hungary, the licence of terrestrial digital television stations for broadcasting purposes was valid until 5 September 2020, and accordingly the broadcasting transmitters were switched off in the 700 MHz band. Terrestrial systems capable of providing electronic communications services have been operating in the 708-733/763-788 MHz band since 6 September 2020.

1. Future use

Decisions and studies on the use of the 700 MHz frequency band for mobile services have been completed at international level, decisions on the future use of the 2x5 MHz sub-band planned for MFCN in the current NFFF Decree in the 700 MHz frequency band and optional applications (BB-PPDR, M2M, PMSE, MFCN SDL) must be made and the necessary changes must be made to the domestic regulations accordingly.

The needs for the 700 MHz frequency band were assessed at a public consultation on the implementation of the national roadmap for the utilisation of the VHF III and UHF bands held on 23 November 2017. According to market participants and potential government users, the 700 MHz frequency band is of particular importance for the introduction of 5G.[[50]](#footnote-50) In the case of PPDR systems, 5G solutions are also considered for the implementation of BB PPDR, in addition to the provision of electronic communications services.

The arrangement, current use and options for future use of the 700 MHz frequency band are summarized in Figure 4.1 based on the current Hungarian regulations and the results of already conducted competitive procedure.



Figure 4.1: Designated and planned use of the 700 MHz frequency band under current regulation

1. Cross-border spectrum use and coordination

Currently, the 694-790 MHz frequency band is used for MFCN by Hungary and by most of the neighbouring countries. The switch-off of terrestrial television broadcasting has not been completed in two of the countries concerned (Ukraine and Bosnia and Herzegovina), but the introduction of MFCN is expected in the longer term in those countries as well. Among the neighbouring countries, there are also aeronautical radionavigation systems in Ukraine. On 14 December 2021, a decision was published in the Official Journal of the European Union, which formalised Ukraine’s commitment to release the 700 MHz frequency band for mobile use by the end of 2022.[[51]](#footnote-51)

In the case of spectrum use in border areas, spectrum use is permitted only for stations which meet the requirements laid down in the currently applicable international coordination documents.

International coordination requirements for the introduction of the 700 MHz MFCN and PPDR have been developed in the CEPT competent Working Groups. The coordination agreement[[52]](#footnote-52) based on Recommendation ECC/REC/(15)01[[53]](#footnote-53) was signed by Hungary with neighbouring Austria, Slovenia, Croatia, Romania and Slovakia. Negotiations with Serbia are currently in progress.

The coordination agreement is based on the limitations of the field strength level that can be used in the border area and the use of the preferential codes; accordingly, if the countries concerned comply with the values set out in the agreement, no specific coordination is required.

Hungary has already successfully concluded an agreement[[54]](#footnote-54) with Ukraine on the coordination procedure between MFCN and the aeronautical radionavigation service for the 700 MHz frequency band.

1. Other potential interference issues

One of the main objectives of the regulation of the radio spectrum is to ensure that different services or applications are protected from interference. When introducing new technologies, special attention must be paid to protect radio applications operating in the same band or in adjacent bands and to avoid interference caused by them, while at the same time preparations must be made to avoid interference in the case of wired technologies.

* 1. Terrestrial television broadcasting

In order to protect digital television broadcasting transmitters operating in the frequency range below 700 MHz, the out-of-band emission limits have been set to ensure the protection of television channel 48 while respecting the guard bands.

Commission Implementing Decision (EU) 2016/687 specifies power limits for end-user stations to avoid interference caused by (out-of-band) unwanted emissions below 694 MHz. The unwanted emission limit of –42 dBm/8 MHz is based on DVB-T2 digital terrestrial television broadcasting and wireless broadband systems with 10 MHz channel bandwidth, with 18 MHz separation between the centre frequencies of television broadcasting and wireless broadband systems (assuming 8 MHz TV channel, 9 MHz guard band and wireless broadband system with 10 MHz channel bandwidth). For wireless broadband systems with a channel bandwidth other than 10 MHz, mitigation techniques may need to be used (e.g. additional filtering for television, reduction of the in-block power of end-user stations or reduction of the transmission bandwidth of end-user stations). It must also be taken into account that the limit values for unwanted out-of-block emissions are established on the basis of fixed television reception, so that, even if portable indoor reception is provided, it may be necessary to use mitigation techniques.

In the case of co-existence of wireless broadband systems and broadcasting, blocking of DVB-T receivers by base stations of mobile networks (e.g. in the case of overdrive in antenna amplifiers) and interference of receivers of base stations by broadcasting transmitters may also occur, either due to the in-band power of the transmitter or due to unwanted emissions. In such cases, the base stations (land/central stations and repeater stations) must be designed and installed in such a way that the interference-free operation be ensured or, if necessary, appropriate mitigation techniques shall be used.

If harmful interference occurs or is likely to occur despite full compliance with the technical requirements, all involved service providers must take the necessary measures and cooperate to resolve any interference issues that may arise as soon as possible.

If the BB-PPDR application (698-703/753-758 MHz), which can be implemented in the guard band, is implemented, use of the mitigation techniques proposed in ECC Report 239 may be necessary to protect digital television operating below 694 MHz.

* 1. PMSE

Based on the National Roadmap, we do not plan to use the 700 MHz frequency band for PMSE, and based on the NFFF Decree, PMSE equipment were allowed to operate in this band until 5 September 2020. The protection of PMSE devices operating in the band below 694 MHz is planned at least until 2030 in accordance with Decision (EU) 2017/899 of the European Parliament and of the Council. Commission Implementing Decision (EU) 2016/687 also provides that in the 700 MHz frequency band, terrestrial wireless broadband electronic communications services and other national options introduced in the frequency band shall also ensure adequate protection of existing wireless audio PMSE applications below 694 MHz in accordance with their regulatory status. In order to ensure the compatibility of wireless audio PMSE equipment and mobile electronic communications networks using adjacent frequency bands, it may be necessary to use solutions to reduce interference, such as those described in Commission Implementing Decision 2014/641/EU[[55]](#footnote-55).

* 1. Cable television

Based on the experience in the 800 MHz frequency band and the use of the 700 MHz frequency band, LTE terminal equipment may cause interference in the operation of set top boxes (image quality deterioration and data transmission errors) and interference may be caused by LTE base stations installed in the vicinity.

The interference-free coexistence of cable television networks and broadband mobile systems operating in the 700 MHz frequency band requires full compliance with the technical specifications (e.g. the use of quality devices, cables, modems complying with standards, electromagnetic compatibility specifications, the establishment of ports, the use of appropriate receivers) and the careful planning of the networks. In order to minimise interference, all relevant service providers must take the necessary measures to inform customers properly (e.g. instructions for use, brochures) and cooperate to resolve any interference issues that may arise as soon as possible.

1. Radio spectrum fees

The method of calculation for regular radio spectrum fees is prescribed by Decree 1/2011 (III.31.) NMHH on frequency reservation and usage fees (hereinafter: Fees Decree). Pursuant to the NFFF Decree, the right holder acquiring entitlements to radio spectrum use shall pay a monthly band fee, in the case of radio spectrum for service purposes acquired as a result of a competitive procedure, as a result of the extension of the entitlement to radio spectrum use, or as a result of the renewal of the entitlement to radio spectrum use, and resold after acquisition, during the term of the entitlement to radio spectrum use, starting from the earliest date of the validity of the radio licence determined in Section 22(3) of Decree 4/2011 (X. 6.) NMHH on the Rules of Auctioning and Tendering to Acquire Entitlements to Frequency Usage.

The calculation method for the band fee payable is set out in Section 20 entitled “Fees payable for bands within the scope of block management” and in Annex 9 of the Decree. For the determination of the band fee, the unit fee shall be multiplied by the sum of bands sold and acquired, expressed in kHz, and the band multiplier. In the case of duplex band, both parts of the band must be taken into account when determining the volume of bands sold and acquired.

The factors determining the band fee for the 700 MHz frequency band are:

* for national band use, the band multiplier for the 694-790 MHz frequency band is 1,
* unit fee is 6500 HUF/kHz/month.

The sub-bands of the 700 MHz frequency band planned for non-civil purposes are not covered by the Fees Decree as described in Section 1 (3) thereof.

Pursuant to Section 20(4a) of the Fees Decree, company acquiring entitlement to radio spectrum use in the frequency bands 708-733/763-788 MHz in competitive procedures launched after 15 March 2019 in order to build next generation mobile radio telephone networks shall be entitled to a discount of 50% from the band fee determined according to paragraph (2) for 10 years from the date on which the decision closing the procedure becomes final or the date of the conclusion of the administrative contract, if it claim the band discount in a statement of commitment to fulfil the conditions and requirements for the band fee discount, as specified in the documentation of the competitive procedure.

If the 703-708 MHz/758-769 MHz sub-band currently in its planned status in the 700 MHz band is distributed for MFCN, extending the possibility of the discount on the band fee to this sub-band also, which requires an amendment to the Fees Decree, must be considered.

1. MFCN: Mobile/Fixed Communications Networks - In the context of convergence of fixed and mobile wireless communications services, the CEPT regulation introduced the umbrella term MFCN (Mobile/Fixed Communications Networks).This includes IMT (International Mobile Telecommunication) systems as used by the ITU. [↑](#footnote-ref-1)
2. BB-PPDR: Broadband Public Protection and Disaster Relief [↑](#footnote-ref-2)
3. SDL: Supplemental Downlink [↑](#footnote-ref-3)
4. PMSE: Programme Making and Special Events [↑](#footnote-ref-4)
5. M2M: Machine to Machine [↑](#footnote-ref-5)
6. the National Roadmap for the use of the VHF III band (174-230 MHz) and the UHF band (470-790 MHz), published by the NMHH on its website on 8 September 2017: <http://nmhh.hu/dokumentum/189921/uhf_nemzeti_utemterv.pdf> [↑](#footnote-ref-6)
7. (EU) 2016/687: Commission Implementing Decision (EU) 2016/687 of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union [↑](#footnote-ref-7)
8. (EU) 2017/899: Decision (EU) 2017/899 of the European Parliament and of the Council of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union [↑](#footnote-ref-8)
9. Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions - 5G for Europe: An Action Plan (COM(2016) 588 [↑](#footnote-ref-9)
10. RADIO SPECTRUM POLICY GROUP STRATEGIC ROADMAP TOWARDS 5G FOR EUROPE Opinion on spectrum related aspects for next-generation wireless systems (5G), 9November 2016 [↑](#footnote-ref-10)
11. International Mobile Telecommunications 2020 [↑](#footnote-ref-11)
12. RSPG: Radio Spectrum Policy Group (The Radio Spectrum Policy Group (RSPG), established by Commission Decision 2002/622/EC of 26 July 2002 establishing a Radio Spectrum Policy Group, is an advisory group dealing with European strategic issues of the radio spectrum). [↑](#footnote-ref-12)
13. RADIO SPECTRUM POLICY GROUP STRATEGIC ROADMAP TOWARDS 5G FOR EUROPE Opinion on spectrum related aspects for next-generation wireless systems (5G), 9 November 2016 [↑](#footnote-ref-13)
14. ITU: International Telecommunication Union [↑](#footnote-ref-14)
15. CEPT: Conférence européenne des Administrations des postes et des télécommunications - European Conference of Postal and Telecommunications Administrations [↑](#footnote-ref-15)
16. RSPG: Radio Spectrum Policy Group [↑](#footnote-ref-16)
17. RSC: Radio Spectrum Committee [↑](#footnote-ref-17)
18. GE06 - Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470‑862 MHz (RRC‑06), Geneva, 2006 [↑](#footnote-ref-18)
19. Regional Radiocommunication Conference (RRC‑06), Geneva, 2006 [↑](#footnote-ref-19)
20. Europe, Africa and certain parts of Asia [↑](#footnote-ref-20)
21. World Radiocommunication Conference 2015 [↑](#footnote-ref-21)
22. RESOLUTION 760 (WRC-15) Provisions relating to the use of the frequency band 694-790 MHz in Region 1 by the mobile, except aeronautical mobile, service and by other services [↑](#footnote-ref-22)
23. RESOLUTION 224 (REV.WRC-15); Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz [↑](#footnote-ref-23)
24. IMT: International Mobile Telecommunications [↑](#footnote-ref-24)
25. RESOLUTION 749 (REV.WRC-15) Use of the frequency band 790-862 MHz in countries of Region 1 and the Islamic Republic of Iran by mobile applications and by other services [↑](#footnote-ref-25)
26. Recommendation ITU-R M.1036-5 (10/2015) Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR) [↑](#footnote-ref-26)
27. ARNS: Aeronautical Radionavigation Service [↑](#footnote-ref-27)
28. RESOLUTION 646 (REV. WRC-19) Public protection and disaster relief [↑](#footnote-ref-28)
29. Public Protection and Disaster Relief [↑](#footnote-ref-29)
30. M.2015 : Frequency arrangements for public protection and disaster relief radiocommunication systems in accordance with Resolution 646 (Rev.WRC-15) - https://www.itu.int/rec/R-REC-M.2015-2-201801-I/en [↑](#footnote-ref-30)
31. Mandate to CEPT to develop harmonised technical conditions for the 694-790 MHz ('700 MHz') frequency band in the EU for the provision of wireless broadband and other uses in support of EU spectrum policy objectives [↑](#footnote-ref-31)
32. CEPT Report 53 - Report A from CEPT to the European Commission in response to the Mandate “To develop harmonised technical conditions for the 694-790 MHz ('700 MHz') frequency band in the EU for the provision of wireless broadband and other uses in support of EU spectrum policy objectives” (Report approved on 28 November 2014 by the ECC) [↑](#footnote-ref-32)
33. CEPT Report 53 - Report B from CEPT to the European Commission in response to the Mandate “To develop harmonised technical conditions for the 694-790 MHz ('700 MHz') frequency band in the EU for the provision of wireless broadband and other uses in support of EU spectrum policy objectives” (Report approved on 28 November 2014 by the ECC) [↑](#footnote-ref-33)
34. ECC: Electronic Communications Committee [↑](#footnote-ref-34)
35. ECC Decision (15)01 Harmonised technical conditions for mobile/fixed communications networks (MFCN) in the band 694-790 MHz including a paired frequency arrangement (Frequency Division Duplex 2x30 MHz) and an optional unpaired frequency arrangement (Supplemental Downlink) (06 March 2015) [↑](#footnote-ref-35)
36. ECC Report 199: User requirements and spectrum needs for future European broadband PPDR systems (Wide Area Networks) (May 2013) [↑](#footnote-ref-36)
37. BB-PPDR WAN: Broadband Public Protection and Disaster Relief Wide Area Network [↑](#footnote-ref-37)
38. ECC Report 218: Harmonised conditions and spectrum bands for the implementation of future European Broadband Public Protection and Disaster Relief (BB-PPDR) systems (Approved October 2015) [↑](#footnote-ref-38)
39. ECC Report 239 Compatibility and sharing studies for BB PPDR systems operating in the 700 MHz range (Approved 30 September 2015) [↑](#footnote-ref-39)
40. ECC Decision (16)02: Harmonised technical conditions and frequency bands for the implementation of Broadband Public Protection and Disaster Relief (BB-PPDR) systems (Approved 17 June 2016) [↑](#footnote-ref-40)
41. ECC Report 242: Compatibility and sharing studies for M2M applications in the 733-736 MHz/788-791 MHz band (Approved 04 March 2016) [↑](#footnote-ref-41)
42. Draft ECC Report 266: The suitability of the current ECC regulatory framework for the future usage of Wideband and Narrowband M2M in the frequency bands 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300MHz, 2600 MHz, 3400-3600 MHz and 3600-3800 MHz [↑](#footnote-ref-42)
43. ECC Report 221: Adjacent band compatibility between MFCN and PMSE audio applications in the 700 MHz frequency band (Approved September 2014) [↑](#footnote-ref-43)
44. ECC Recommendation (15)01 Cross-border coordination for mobile / fixed communications networks (MFCN) in the frequency bands: 694-790 MHz, 1452-1492 MHz, 3400-3600 MHz and 3600-3800 MHz (Approved 13 February 2015, latest amendment on 14 February 2020) [↑](#footnote-ref-44)
45. ECC Recommendation (16)03 Cross-border coordination for Broadband Public Protection and Disaster Relief (BB-PPDR) systems in the frequency band 698 to 791 MHz Approved 17 October 2016 [↑](#footnote-ref-45)
46. Decision No 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy programme [↑](#footnote-ref-46)
47. Commission Implementing Decision (EU) 2016/687 of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union [↑](#footnote-ref-47)
48. Decision (EU) 2017/899 of the European Parliament and of the Council of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union [↑](#footnote-ref-48)
49. Yettel as of 1 March 2022. [↑](#footnote-ref-49)
50. <https://nmhh.hu/cikk/191649/Osszefoglalo_a_VHF_III_es_az_UHF_sav_hasznositasarol_szolo_nemzeti_utemterv_vegrehajtasaval_osszefuggo_feladatokrol> [↑](#footnote-ref-50)
51. <https://eur-lex.europa.eu/eli/dec/2021/2219/oj> [↑](#footnote-ref-51)
52. Technical Arrangement on border coordination for terrestrial systems capable of providing electronic communications services in the 700 MHz frequency band (Budapest, 15th February 2018) [↑](#footnote-ref-52)
53. ECC Recommendation of 13 February 2015 on cross-border coordination for mobile/fixed communications networks (MFCN) in the frequency bands: 694-790 MHz, 1452-1492 MHz, 3400-3600 MHz and 3600-3800 MHz. (Amended on 5 February 2016 and 14 February 2020) [↑](#footnote-ref-53)
54. TECHNICAL ARRANGEMENT concerning the use of the frequency band 694-790 MHz for terrestrial systems in the border areas of Hungary and Ukraine, (October 2015) [↑](#footnote-ref-54)
55. COMMISSION IMPLEMENTING DECISION of 1 September 2014 on harmonised technical conditions of radio spectrum use by wireless audio programme making and special events equipment in the Union [↑](#footnote-ref-55)