

# **Introducing the 3400-3800 MHz frequency band; characteristics of current and future use**

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## **Table of Contents**

TOC

## **List of Figures**

TOC

## **Table index**

TOC

## 1. Introduction

The 3400-3800 MHz frequency band offers a significant opportunity to install high-density and high-speed broadband wireless networks, which can provide innovative electronic communication services to end-users. There is a fast increasing demand for broadband services, making the utilization of frequency bands supporting these (currently unused or used for other purposes) extremely important for the national economy.

Currently four service providers in Hungary (Invitel, Antenna Hungária, Magyar Telekom, GTS) have frequency usage rights in the 3400-3600 MHz frequency band until July, 2016, therefore the decisions and tasks concerning the future of the 3400-3600 MHz and 3600-3800 MHz frequency bands take two directions. In the 3400-3600 MHz frequency band, the existing technical conditions must be maintained until the expiry of the frequency usage rights, while in the 3600-3800 MHz frequency band new requirements can be set forth without restrictions. As soon as the permits for the 3400-3600 MHz frequency band expire, the new technical conditions need to be enforced here too. However, the possibility of a certain kind of transition for the current service providers must be examined (for example, by providing a grace period for converting existing systems, replacing equipment, etc. for the event of obtaining frequency usage rights). It is important that both those currently in the market, and existing customers learn about the opportunities after the expiry of the frequency usage period as soon as possible.

The introduction of harmonized band usage rules is also a requirement of applicable EU regulations. The RSPP<sup>1</sup> required that, subject to market demand, the 3400-3800 MHz frequency band must be made available for wireless broadband systems which are capable of providing services with high data transfer speeds for subscribers (the population).

Due to the 3400-3800 MHz frequency band propagation characteristics and the harmonized technical conditions in place, taking into account the protection of existing usage, feasible configurations with respect to the deployment of wireless broadband networks are as follows: small cell systems, fixed location wireless access systems, backhaul networks within wireless broadband networks, and the combinations of these. With the principle of service neutrality in mind, fixed and mobile systems can be operated in the band with the aforementioned configurations.

The first step of utilizing the band and the requirement for selling the usage rights for the band on the market is the assessment of market demand. If there is a demand for using the band, then the preparations for the sales process must be started in line with EU obligations.

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<sup>1</sup> Decision No 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy programme

## 2. International regulations

On the international level, there are several documents regulating the use of the 3400-3800 MHz frequency band. There exist two community decisions that specify the conditions of harmonized band usage, i.e. EU legislation fundamentally determines our obligations as a State, as well as the technical requirements to be applied in order to ensure harmonized usage of the frequency band. Commission Decision 2008/411/EC<sup>2</sup> was the first international regulatory document that defined obligations and mandatory technical parameters for the technology and service neutral use of the 3400-3800 MHz frequency band for the harmonized use by terrestrial electronic communications services. This decision was amended by Commission Implementing Decision 2014/276/EU<sup>3</sup> which determines the obligations and the technical requirements based on the latest studies. Commission Implementing Decision 2014/276/EU has to be implemented in Hungarian legislation by 30 June 2015. A brief summary of the background of the decision and the principles laid out in the decision can be found in the following.

Based on Decision 2008/411/EC, the band had to be made available for broadband mobile/fixed services subject to demand. The decision defined the Block Edge Mask applicable for MFCNs (Mobile/Fixed Communications Networks). However, this technical specification is obsolete, because the mask was developed for earlier fixed systems. In the meantime, technologies supporting mobile service systems have evolved, and devices based on these, as well as international standards have been introduced. This made it necessary to change the requirements in Commission Implementing Decision 2014/276/EU. The new decision defines power limits inside and outside the block (including the Block Edge Mask).

The technical requirements defined in Commission Implementing Decision 2014/276/EU are the following (in addition to the power limits for the user block):

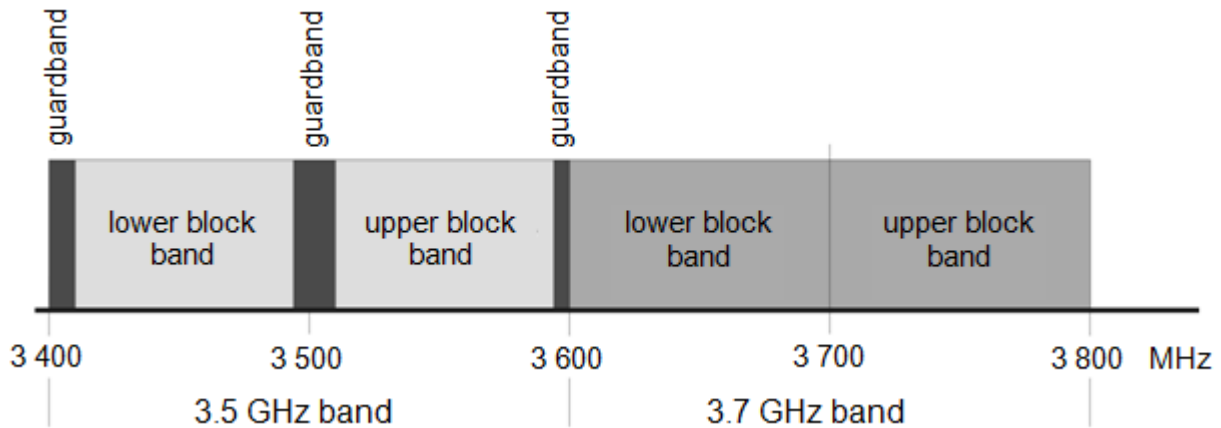
- Size of blocks: 5 MHz (aligning with the channel allocation of LTE systems) for both the 3400-3600 MHz band and the 3600-3800 MHz band.
- In the 3400-3600 MHz frequency band, both the FDD (with a duplex spacing of 100 MHz), and the TDD modes are allowed, but TDD is the preferred mode. For an FDD allocation (see Figure 1), the lower (protection of military systems in the range under 3400 MHz) and upper 10 MHz range of the duplex pair are non-allocable guard bands. An FDD mode of operation can only be used under certain conditions (see Item 5)
- In the 3600-3800 MHz frequency band, only TDD allocation is defined, therefore only TDD systems can be used here (see Figure 1).

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<sup>2</sup> 2008/411/EC: Commission Decision of 21 May 2008 on the harmonisation of the 3400 - 3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community

<sup>3</sup> 2014/276/EU: Commission Implementing Decision of 2 May 2014 on amending Decision 2008/411/EC on the harmonisation of the 3400 - 3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community

Figure 1 – FDD allocation in the 3400-3600 MHz band and TDD allocation in the 3600-3800 MHz band



Decision No 243/2012/EU of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy programme (hereinafter: RSPP) aims to promote the wider availability of wireless broadband services for the benefit of citizens and consumers in the Union.

Article 6 (2) of Decision 243/2012/EU requires Member States to make the bands covered by Decision 2008/411/EC (3,4-3,8 GHz) available under terms and conditions described in that decision, and requires that "subject to market demand, Member States shall carry out the authorisation process by 31 December 2012 without prejudice to the existing deployment of services, and under conditions that allow consumers easy access to wireless broadband services."

On the **ITU level**, the regulation is based on the Radio Regulations (RR). The mobile service allocation of the band is described in footnote 5.430A. The mobile service (except for aeronautical mobile) has a primary allocation in Hungary (in the RR table it is specified as a secondary service for Region 1) in the 3400-3600 MHz frequency band and is identified for IMT (however, applications with any other technology can also be used within the framework of the service). **With respect to coordination**, before a given country commissions a mobile service station (base or mobile), it has to prove using calculations that the spectral power density does not exceed the value of  $-154.5 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$  at a height of 3 m above the ground more than 20% of the time. In case of a mutual agreement with a neighboring country, this criterion may be departed from. Furthermore, the stations of the mobile service in the 3400-3600 MHz band cannot claim more protection against space stations, than provided for by Table 21-4 (limiting the spectral power density generated by space stations on the surface of Earth to protect terrestrial systems) of the RR (2004 release), specified by the following criterion:

Frequency band	Service*	Limit in dB(W/m <sup>2</sup> ) for angles of arrival (δ) above the horizontal plane			Reference bandwidth
		0°-5°	5°-25°	25°-90°	
3 400-4 200 MHz	Fixed-satellite (space-to-Earth) (geostationary-satellite orbit)	-152	$-152 + 0.5(\delta - 5)$	-142	4 kHz
3 400-4 200 MHz	Fixed-satellite (space-to-Earth) (non-geostationary-satellite orbit)	$-138 - Y$ <sup>17, 18</sup>	$-138 - Y + (12 + Y)(\delta - 5)/20$ <sup>17, 18</sup>	$-126$ <sup>18</sup>	1 MHz

Note: The footnote does not apply for the 3600-3800 MHz band where the mobile service is secondary according to the RR

On the **CEPT level**, Decision ECC/DEC/(11)06 (amended on 14 March 2014) specifies the base block allocation in the band and the BEM requirements (also included in the EU decision).

The frequency allocation for the currently operating point-to-multipoint systems can be found in Annex B Item B1 of Recommendation ERC/REC 14-03, however, there are no specifications for channel allocation.

In addition to these, several CEPT documents (older recommendations and reports) exist, which served as the basis of later higher-level documents.

These documents are listed (along with the standards applicable for equipment) in Annex 1 (M1).

### 3. National regulation

In accordance with Annex 5 footnote H160 of NMHH Decree 15/2012 (XII. 29.) (hereinafter: FNFT), the 3400-3800 MHz frequency band is primarily allocated for fixed, fixed satellite (space-Earth direction) and mobile (except for aeronautical mobile) services. Within these services, only civil applications are allowed to operate. In addition, the 3400-3410 MHz sub-band has a secondary allocation for the radiolocation service, which allows only non-civil applications.

- **The entire band is assigned to applications of the mobile service** (except aeronautical mobile), which can be terrestrial electronic communications networks (BWA, MWA, LTE, WMAN, WiMAX). According to the RR, the mobile service is secondary in the entire band, but footnote RR 5.430A defines a different allocation. According to this, the mobile service is primary in the 3400-3600 MHz band in Hungary, while in the 3600-3800 MHz band the mobile service is primary on the national level.
- **The entire band is also assigned to fixed service** applications, which can be terrestrial electronic communications networks:
  - Point-to-multipoint systems (BWA, FWA, NWA, WMAN, Metro, HiperMAN, WiMAX),
  - Point-to-point systems (BWA).
- **The entire band is assigned to fixed satellite service** applications, where the following stations are allowed operate:
  - Coordinated VSAT (cannot claim protection against stations for applications of the same nature operating in the band), or
  - ROES.
- **The radiolocation service is secondary** in the 3400-3410 MHz sub-band, where different non-civil radiolocation systems operate. Because of this, the interoperability of different systems must be taken into account (especially if the regulation specifies a TDD allocation for the 3400-3600 MHz band, making the lower 10 MHz the guard band in line with the EU decision).

According to the applicable legislation limiting the band usage, i.e. NMHH Decree 2/2013 (I. 7.) on the usage rules of frequency bands allowed for civil purposes (hereinafter: RAT), the entitled operator can use the awarded frequency band to build nationwide networks, and the frequency blocks can be used for providing public electronic communications services. The end-user stations can be fixed or mobile. From a technological point of view, fixed point-to-multipoint networks often use traditional or WiMAX solutions. For mobile service systems to be commissioned in the future, the use of LTE technology is expected with respect to its spectral efficiency and high data transfer speeds.

In the currently used 3400-3600 MHz frequency band, systems are operated with 1.75 MHz és 3.5 MHz channel spacing (with the option to use equipment with channel spacing as high as 7 MHz) ~ — the block sizes were defined based on this in 2001.

#### a) Allocation of the band into sub-bands as specified in RAT

3400-3410 MHz: Lower guard band of the 3.5 GHz band, not allocable;

3410-3494 MHz: Lower block band of the 3.5 GHz band;  
 3494-3510 MHz: Middle guard band of the 3.5 GHz band, not allocable;  
 3510-3594 MHz: Upper block band of the 3.5 GHz band;  
 3594-3600 MHz: Upper guard band of the 3.5 GHz band, not allocable;  
 3600-3800 MHz: 3.7 GHz band.

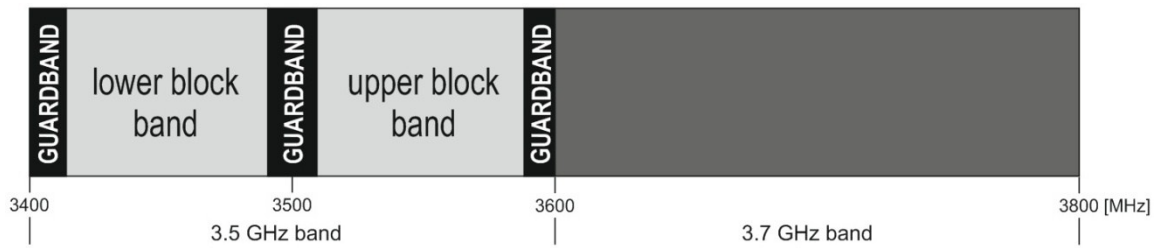


Figure 2: Band allocation based on applicable regulations (currently the 3.7 GHz band is not in use)

**b) Subdivision of the 3.7 GHz band into blocks**

The 3600-3800 MHz band consists of forty 5 MHz blocks.

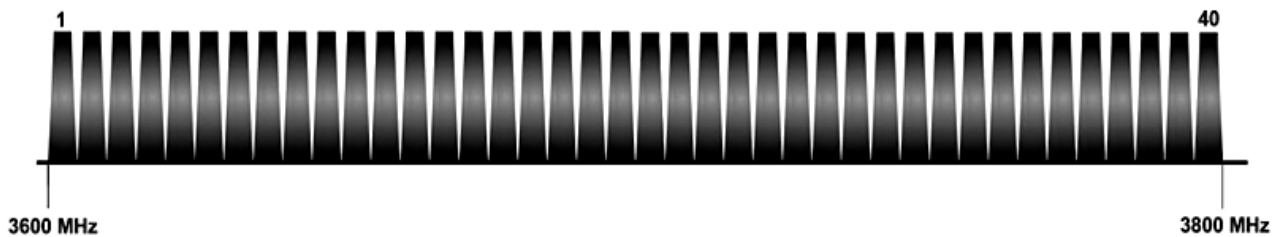


Figure 3: Block allocation of the 3.7 GHz band (basic blocks)



## 4. Current use

In the auction closed in June 2001, five 14 MHz duplex frequency blocks were sold in the 3400-3600 MHz band. The following table shows the current allocation of these. See Figure 4 for the visual representation of the allocation.

Table 1: User blocks of frequency usage rights holders in the 3.5 GHz band

Block 1	3410-3424 / 3510-3524 MHz	Invitel
Block 2	3427.5-3441.5 / 3527.5-3541.5 MHz	GTS
Block 3	3445-3459 / 3545-3559 MHz	Antenna Hungária
Block 4	3462.5-3476.5 / 3562.5-3576.5 MHz	Magyar Telekom (MT)
Block 5	3480-3494 / 3580-3594 MHz	Invitel

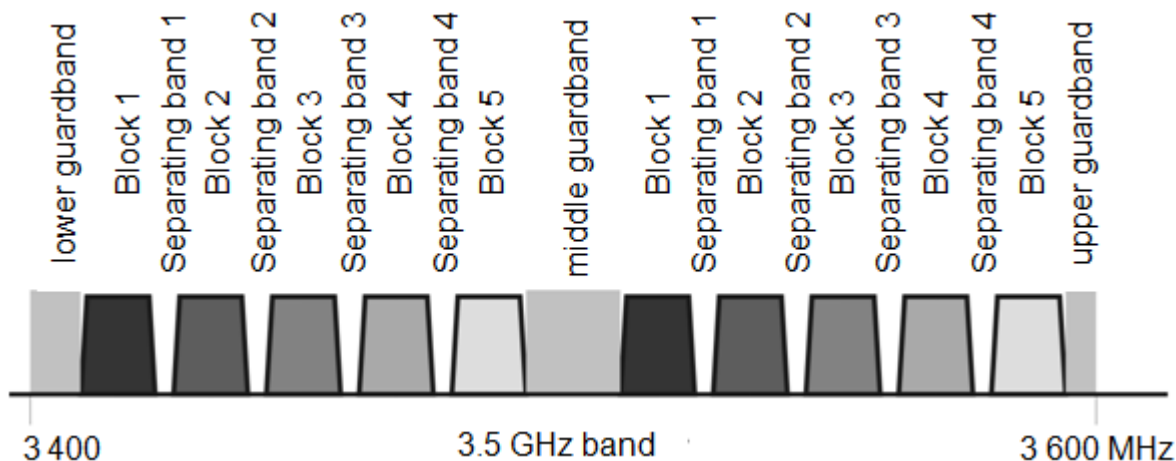


Figure 4: Position of blocks sold in the 3.5 GHz band

Frequency usage rights are awarded for a period of 15 years. The frequency usage rights acquisition date was the day when the final price was credited to the authority's account, so the expiry dates depend on the date of payment, which means that **in July 2016 the usage rights expire at different dates.**

**Currently, the rights holders operate point-to-multipoint systems.** In 2001, this was provided for in the legislation, and this is what applied to the tender. Modifications to the legislation for frequency usage would have allowed the conversion of these systems, but the rights holders did not use this opportunity. These networks are typically used for services provided to companies and banks (business-to-business networks); the subscribers are usually not natural persons.

## 5. Future use

Based on the RSPP obligation, the Authority held a public hearing in December 2012 to assess market demand, also involving the topic of the band. One of the questions at the public hearing was asked to clarify whether there is a demand for the 3600-3800 MHz band. Due to the existing usage rights, the 3400-3600 MHz band was not in the spotlight at the time. At the 2012 public hearing, none of the participants claimed a demand for the 3600-3800 MHz band, and the Authority received no written documents indicating a market demand in this respect.

Now that there are less than 2 years left until the usage rights of the 3400-3600 MHz band expire, the service providers need to rethink their plans for continuing their current services, and the Authority needs to decide on the possibilities and methods for utilizing the frequency band segment that will be freed. The tendering process related to the 3.5 GHz band did not include rules for prolongation or withdrawal from the market. The emptying of the band would mean that existing services cease to exist and the equipment can no longer be used. Without proactive, carefully planned measures this would cause loss of profits for the current rights holders, and might cause inconvenience for the subscribers. Business continuity is often a crucial factor, therefore the interested parties should know about the events to be expected after expiry well in advance (at least one year in advance).

However, should legislation allow that those currently entitled for frequency use continue providing their services on their existing networks, several questions arise:

- how will the awarded (defined for the requirements of equipment operating using traditional 1.75 MHz based channel spacing, including its integer multiples) frequency blocks align with the 5 MHz base block spacing;
- what channel spacing will be applied for equipment currently in use (only 1.75 MHz, or 5 MHz as well);
- how can TDD preference be ensured in the band; how could FDD be provided for on demand;
- frequency blocks may exist which partly overlap with the guard band range according to the new band allocation.

In order to be able to examine the overlapping ranges that arise as a result of the blocks in use and the new band allocation, the following figure might be of help.

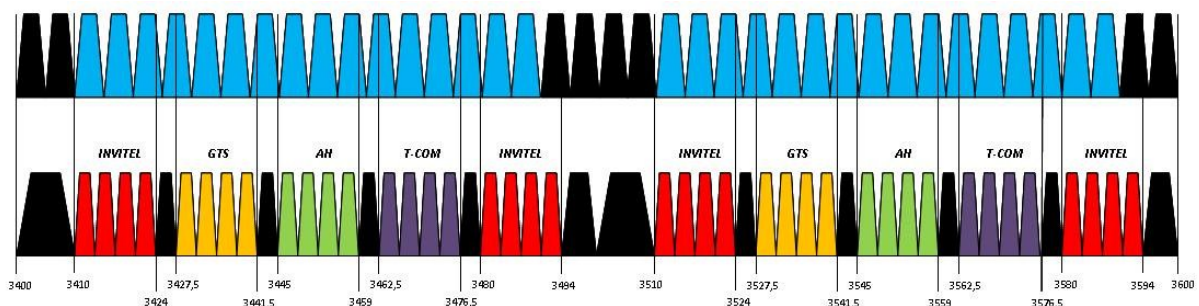


Figure 5: New position of blocks awarded in the 3.5 GHz band with respect to the new band allocation

In the future, in line with Commission Implementing Decision 2014/276/EU, the FDD band allocation can only be used instead of the preferred TDD allocation if:

- it ensures a more efficient use of the spectrum; or
- the protection of the existing services requires it; or
- the coordination with third countries makes it necessary.

In upper part of the figure the FDD allocation can be seen with the 5 MHz basic blocks, and the FDD allocation with the 14 MHz blocks is depicted below (illustrated with 3.5 MHz channel spacing).

It is apparent that due to the different block sizes and channel spacings, the current usage is not compatible with the new allocation, so the block boundaries in relation to the new allocation are also indicated. It is obvious that a single 14 MHz block would fit in three 5 MHz (new allocation) basic blocks, but the 3.5 MHz guard bands between adjacent blocks in the new allocation make the situation more difficult, offsetting the band boundaries in the current and the new allocation.

The FDD or TDD preference is influenced by the availability of compatible and cost-efficient equipment (taking into account the return on investment for network deployment) on the market. Furthermore, the planned allocation type of neighbouring countries should also be considered, because the coordination between TDD and FDD systems can cause problems (just like unsynchronized TDD systems), or it can cause threshold values so small that it significantly hinders the efficient use of the systems.

The issue should also be considered from another aspect: how much interference would stations cause to radars operating under 3400 MHz when using TDD allocation (although the decision defines additional basic requirements for this case, but whether the equipment filters can actually meet those requirements remains to be seen) and vice versa, how much interference would radars cause in the operation of TDD stations. The decision specifies additional basic requirements for FDD systems as well, and defines a guard band in the 3400-3410 MHz range.

## 6. International coordination

Currently, preferred frequency coordination agreements are in effect for the 3400-3600 MHz band with neighbouring countries. These agreements specify the rules that still apply to fixed location systems, as in most countries fixed point-to-multipoint systems are in operation in this band. If mobile service systems will be allowed to operate in the band (in line with new harmonized conditions and the advance of technology), these agreements will no longer be sufficient to manage border area usage, especially because the preferred block agreement specifies 7 MHz blocks (in accordance with the channel spacing of fixed systems).

The following table shows the current preferred block allocation.

Table 2: Preferred block allocation for the 3.5 GHz band

Segment	Frequency band [MHz]	AUT	SVK	UKR	ROU	SRB	HRV	SVN	AUT SVK	SVK UKR	UKR ROU	ROU SRB	SRB HRV	HRV SVN	SVN AUT

1	3410-3417 3510-3517	pr	-	pr	pr	-	pr	-	-	-	pr	-	-	-	-	
2	3417-3424 3517-3524	-	pr	-	-	-	-	-	-	-	-	-	-	-	-	
3	3424-3431 3524-3531	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	
4	3431-3438 3531-3538	pr	-	-	-	pr	-	-	-	-	-	-	-	-	-	
5	3438-3445 3538-3545	-	-	pr	-	-	-	pr	-	-	-	-	pr	-	-	
6	3445-3452 3545-3552	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	-	pr	pr
7	3452-3459 3552-3559	-	-	-	pr	-	-	-	-	-	-	-	-	-	-	
8	3459-3466 3559-3566	-	-	-	-	pr	-	-	-	-	-	-	-	-	-	
9	3466-3473 3566-3573	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	pr	
10	3473-3480 3573-3580	-	-	-	-	-	pr	-	-	-	-	-	-	-	-	
11	3480-3487 3580-3587	-	pr	pr	-	-	-	pr	pr	pr	-	-	-	-	-	
12	3487-3494 3587-3594	pr	pr	-	pr	pr	pr	pr	-	-	-	pr	pr	pr	pr	

The agreements apply to FWA (Fixed Wireless Access) applications in the entire 3.5 GHz band.

For FDD transmissions, "pr" indicates preference, and "-" indicates dispreference.

In the case of preference, the transmission across the national border is such that the maximum value of the surface power density measured in the neighbouring country at a distance of 15 km from the national border does not exceed  $-122 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ .

In the case of dispreference, the maximum value of the surface power density measured at the national border does not exceed  $-122 \text{ dB(W/(m}^2 \cdot \text{MHz))}$ .

Currently TDD stations are considered tertiary with respect to international coordination.

The CEPT working group PT1, responsible for preparing the legislation governing mobile services, is currently working on a coordination recommendation which specifies requirements across multiple frequency bands (including the 3400-3800 MHz band). If neighbouring countries also commission MFCN systems, an agreement based on this should be considered as an option.

However, as mobile service networks have a fairly small cell radius (even compared to those operating in the 2.6 GHz band), base stations are expected to be installed in high data traffic areas of large cities only. Because of this, the transmission into neighbouring countries is not a significant issue (and the interference field strength can be kept at a low value), especially if the antenna of the base station is oriented to keep transmission at a minimum. Apart from this, the limit field strengths to be included in the recommendation of PT1 must also be taken into account (the current agreement specifies surface power density values, as usual with microwave fixed systems).

Furthermore, the TDD preference needs to be considered, which means that only a very low field strength can be generated at the border if mobile networks operating in neighbouring countries are not synchronized. However, synchronization would cause the system to lose its flexibility (option to change download and upload rates).

## 7. Frequency fee

By imposing neutrality, the 3400-3600 MHz band will be available for all mobile services and fixed systems, and the new frequency usage rights for this band can be obtained – in accordance with RAT – in a tender. Taking this into account, the fee to be paid for the 3400-3800 MHz frequency band is specified by the rules and methodology in NMHH Decree 1/2011 (III. 31.) (hereinafter: Fee Decree) on the fees to be paid for service type bands with block allocation, sold at an auction or a tender (Section 20, Annex 9).

Table 3: Band multipliers for the 3400-3800 MHz frequency band

Frequency Range	Band Multiplier Value
For bands in use on 1 January 2014 in the 3400-3800 MHz frequency range	0.004
For bands not in use on 1 January 2014 in the 3400-3800 MHz frequency range	0.0067

### Calculation method

A uniform fee of HUF 7500/kHz per month shall apply to all frequency band sold and acquired.

This fee shall be multiplied by the cumulative frequency in kHz of bands sold and acquired, and by the band multiplier.

When defining the amount expressed in kHz of the bands sold and acquired, both parts of duplex bands shall be taken into account.

## 8. Availability of equipment

During the 2012 public hearing, none of the participants indicated a demand for using the 3600-3800 frequency band. This might be attributed to the fact that there were no available equipment for mobile network operation on the market at the time, or that acquiring such devices or implementing such a network would have incurred significant costs. Furthermore, only TDD systems were allowed in this band according to the 2008 community regulations.

As the first step of standardizing equipment operating in the 3400-3800 frequency band, 3GPP (3rd Generation Partnership Project – the umbrella organization of standardization bodies) decided to specify the entire band as one of the frequency bands capable of supporting the introduction of LTE. The applicable ETSI standards were published in 2012, defining the technical parameters for base stations and mobile terminal equipment operating in the framework of broadband wireless access systems in the 3400-3800 MHz frequency band.

Commission Implementing Decision 2014/276/EU continues to allow only the TDD access mode in the 3600-3800 MHz band, while in the 3400-3600 MHz band TDD is the preferred option, with the use of FDD available under certain conditions. The majority of equipment available on the market today can be used in fixed point-to-multipoint networks, but there are some devices that can be used in mobile networks as well (including network and end-user equipment).

As the market is continuously evolving, the demand for the band will be less and less restricted by the available technology.

## **9. Questions arising in relation to the preparation for sale**

The following market information are needed for preparing the sale of bands and for making the necessary decisions

- Are there specific user demands for the usage of the band or any of the sub-bands? If yes, which band is needed and for what applications?
- How do current users with a demand for the band see the transition to the new system according to new regulations?
- Do potential band users think that the supply of equipment is suitable for their needs in achieving their goals? What do manufacturers think about the equipment supply?
- Do potential band users prefer the TDD or the FDD duplex mode in the 3400-3600 MHz band?

The answers to the questions listed in this summary can be found by retrieving the necessary information from potential users and manufacturers in the framework of a public hearing.

## 10. Annex

### International documents

#### a) EU documents

- 2008/411/EC: *Commission Decision of 21 May 2008 on the harmonisation of the 3400 - 3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community*
- 2012/243/EC: *Decision of the European Parliament and of the Council of 14 March 2012 establishing a multiannual radio spectrum policy programme*
- 2014/276/EU: *Commission Implementing Decision of 2 May 2014 on amending Decision 2008/411/EC on the harmonisation of the 3400 - 3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community*

#### b) ITU documents

- **RR, footnote 5.430A**

#### c) CEPT documents

- **CEPT decisions:**
  - ECC/DEC/(07)02 (2007): *ECC Decision of 30 March 2007 on availability of frequency bands between 3400-3800 MHz for the harmonised implementation of Broadband Wireless Access systems (BWA)*
  - ECC/DEC/(11)06 (2014): *ECC Decision of 9 December 2011 on harmonised frequency arrangements for mobile/fixed communications networks (MFCN) operating in the bands 3400-3600 MHz and 3600-3800 MHz*
- **CEPT recommendations:**
  - ERC REC 14-03 (1997): *Harmonised radio frequency channel arrangements for low and medium capacity systems in the band 3400 MHz to 3600 MHz*
  - ERC/REC 12-08 (1998): *Harmonised radio frequency channel arrangements and block allocations for low, medium and high capacity systems in the band 3600 MHz to 4200 MHz*
  - ECC/REC/(04)05 (2006): *Guidelines for accommodation and assignment and assignment of Multipoint Fixed Wireless systems in frequency bands 3.4-3.6 GHz and 3.6-3.8 GHz*
- **CEPT reports:**
  - ECC Report 100 (2007): *Compatibility studies in the band 3400- 3800 MHz between Broadband Wireless Access (BWA) systems and other services*
  - ECC Report 203 (2013): *Least Restrictive Technical Conditions suitable for Mobile/Fixed Communication Networks (MFCN), including IMT, in the frequency bands 3400-3600 MHz and 3600-3800 MHz*

- CEPT Report 049 (2013): *Report from CEPT to the European Commission in response to the Mandate “Technical conditions regarding spectrum harmonisation for terrestrial wireless systems in the 3400-3800 MHz frequency band”*

#### d) Standards, technical reports

- **European standards (Hungarian equivalent):**
  - MSZ EN 301 753: *Fixed Radio Systems. Multipoint equipment and antennae. Generic harmonised standard for multipoint digital fixed radio systems and antennas covering the essential requirements under article 3.2 of the Directive 1999/5/EC*
  - MSZ EN 302 217-2-2: *Fixed Radio Systems. Characteristics and requirements for point-to-point equipment and antennas. Part 2-2: Digital systems operating in frequency bands where frequency co-ordination is applied; Harmonised EN covering the essential requirements of article 3.2 of the R&TTE Directive*
  - MSZ EN 302 217-4-2: *Fixed Radio Systems. Characteristics and requirements for point-to-point equipment and antennas. Part 4-2: Harmonised EN covering the essential requirements of article 3.2 of R&TTE Directive*
  - MSZ EN 302 326-2: *Fixed radio systems. Multipoint equipment and antennas. Part 2: Harmonised European standard listing the essential requirements of article 3.2 of the R&TTE Directive for digital multipoint radio equipment*
  - MSZ EN 302 326-3: *Fixed radio systems. Multipoint equipment and antennas. Part 3: Harmonised European standard listing the essential requirements of article 3.2 of the R&TTE Directive for multipoint radio antennae*
  - MSZ EN 302 623: *Broadband wireless access systems (BWA) in the 3400 - 3800 MHz frequency band. Mobile terminal devices. Harmonised European standard covering the essential requirements of Article 3 Section (2) of the R&TTE Directive*
  - MSZ EN 302 774: *Broadband wireless access systems (BWA) in the 3400 - 3800 MHz frequency band. Base stations. Harmonised European standard covering the essential requirements of Article 3 Section (2) of the R&TTE Directive*
- **3GPP document:**
  - 3GPP TR 37.801 (2011): *3rd Generation Partnership Project; Technical Specification Group Radio Access Network; UMTS-LTE 3500 MHz Work Item Technical Report (Release 10)*