

F 7/16

Tender Document

Procedure for Spectrum Award in the 3410 to 3800 MHz Range

NON-BINDING TRANSLATION

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1 Goals of the award procedure

This award procedure will bring to market the 5G pioneer band of 3.4 to 3.8 GHz, consisting of high frequency spectra with relatively unfavourable propagation characteristics. These spectra will on the one hand support mobile telecoms in providing high bandwidths (especially in urban areas); on the other hand, they can also be used by regional providers to supply broadband service to customers in peripheral areas, in this way meeting the goal of achieving universal internet access in future, even in disadvantaged regions. At 390 MHz in frequency usage rights, the bandwidth to be awarded is considerably larger than was awarded in the past. This amount of spectrum should in principle be capable of meeting the requirements of differing market participants.

The basis of any award procedure is firstly to define the goals pursued by the regulatory authority in carrying out the specific procedure. This process follows clear provisions of law. Core concerns are the legal certainty of the award procedure, efficient frequency usage, safeguarding competition and innovation, and the best possible coverage of residents and businesses with services. Maximising revenue is not an award goal – prices are determined within the framework of an auction by supply and demand.

In the government programme for 2017–2022, priority is given to making modern infrastructure available as a foundation for digitisation. Powerful digital infrastructure is framed here as a prerequisite for deploying digital technologies such as those used for autonomous driving and Industry 4.0. Access to modern broadband infrastructure will be the deciding factor in whether businesses succeed at international level, employees are able to work from their homes or young people have to relocate from rural areas. Thus, as an intermediate step along the path towards the gigabit network, it is necessary to pursue the goal of supplying every point in the country with broadband coverage at a minimum speed of 100 Mbps. The goal is to be among the pioneers to roll out 5G. The general preconditions here (such as expanded broadband networks and rolling out the 5G standard) need to be met in order to ensure the success of Austrian residents and businesses. Awarding this frequency band will contribute towards this goal.

2 General legal conditions

The Telekom-Control-Kommission (TKK) is conducting a procedure for awarding spectrum, as specified in Art. 55 of the Telecommunications Act 2003 (TKG 2003), in this case in the 3410–3800 MHz frequency range (also referred to below as the 3.4 to 3.8 GHz range).

2.1 General conditions under Austrian law

The current invitation to tender is based on the 2003 Telecommunications Act (TKG 2003), Federal Law Gazette (FLG) I No. 70/2003 as last amended by FLG I No. 6/2016. Current provisions of Austrian procedural law also apply, in particular the

1991 General Administrative Procedure Act, FLG No. 51/1991 as last amended by FLG I No. 161/2013.

The TKK's competence for the awarding of spectrum as set out in Art. 55 TKG 2003 results from Art. 54 Par. 3 No. 2 in conjunction with Art. 117 No. 10 TKG 2003. Pursuant to Art. 54 Par. 3 No. 2 TKG 2003, the regulatory authority is responsible for spectrum award as well as for any modification or revocation of a licence relating to spectra for which a provision as referred to in Art. 52 Par. 3 TKG 2003 (where the number of frequencies is limited) has been made in the frequency usage plan.

For the frequency ranges considered here, such a provision was made in the Ordinance of the Federal Minister of Transport, Innovation and Technology on frequency utilisation (*Frequenznutzungsverordnung 2013*), FLG II No. 63/2014 as last amended by FLG II No. 390/2016.

2.2 Spectrum award procedure

Art. 55 Par. 1 TKG 2003 requires the regulatory authority to assign the frequencies entrusted to the authority to that applicant who meets the general requirements set out in Art. 55 Par. 2 No. 2 TKG 2003 and guarantees the most efficient usage of the spectrum. This is determined based on the amount offered for the frequency licence fee.

The spectrum award procedure consists of two steps:

1. Once the applications have been received, the regulatory authority verifies whether the requirements set out in Art. 55 Par. 2 No. 2 TKG 2003 have been met (cf. section 5.3). Any applicants not meeting the requirements are excluded from the spectrum award procedure, as specified in Art. 55 Par. 8 TKG 2003.
2. The second step is carried out in the form of an auction.

2.3 Collusion

In the context of procedures for awarding spectrum, the Telecommunications Act refers repeatedly to the possibility of collusion.

Art. 55 Par. 8 TKG 2003 in conjunction with Art. 55 Par. 9 TKG 2003 lays down the principle that collusion of applicants prior to or during the auction procedure can lead to exclusion of those applicants from further procedures.

The regulatory authority is additionally entitled to cancel the invitation to tender and to terminate the procedure if applicants are found to have behaved collusively and an efficient, fair and non-discriminatory procedure cannot be conducted (Art. 55 Par. 12 No. 1 TKG 2003).

Other potential grounds for exclusion from the procedure are threats against competitors as well as disclosure of participation in the auction, of bids, or of bidding strategies, even prior to the auction procedure.

The auctioneer will take all suitable measures to prevent collusive behaviour. Specific mention is made here of the obligation of bidders to allow the presence of a staff member of the regulatory authority in the bidders' areas at any time during the auction.

In connection with possible offences relating to collusion, reference is made here to provisions of general competition law and to Art. 168b of the Austrian Criminal Code (*Strafgesetzbuch*).

2.4 Cancellation of the invitation to tender and termination of the procedure

Art. 55 Par. 12 TKG 2003 authorises the regulatory authority to cancel the invitation to tender and to terminate the procedure at any stage, in either case where there is good cause, and in particular under one of the following conditions:

1. the regulatory authority identifies collusive behaviour among applicants and/or an efficient, fair and non-discriminatory procedure cannot be conducted;
2. no or only one applicant meets the requirements set out in Par. 2;
3. no or only one applicant meeting the requirements set out in Par. 2 actually participates in the procedure for determining the highest bid;
4. the procedure results in the applicants requesting less frequency spectrum than has been specified for assignment.

None of these conditions justifies any claim to compensation; claims based on official liability remain unaffected thereby.

In the view of the authority calling for tenders, a 'good cause' may exist where procedures are currently pending that relate to a change in ownership structure of market participants involved in the tender procedure and, as a result, an open, fair and non-discriminatory procedure cannot be guaranteed.

2.5 Spectrum award

Spectrum is usually awarded within one month of when the TTK publishes the outcome of the auction.

2.6 Transfer of spectrum and change of ownership

Art. 56 Para. 1 TKG 2003 permits the transfer of frequency usage rights, on condition of prior approval by the TTK. Transfer refers to both the sale of – all or parts of – the frequency usage rights or the temporary transfer of rights.

2.7 Joint use under TKG 2003

As set out in Art. 8 Par. 2 TKG 2003, providers of public communications networks are entitled to joint use of antenna masts and high-voltage masts. With regard to other rights of joint use, reference is made here to the rules specified in Articles 8 et seq. TKG 2003. Reference is additionally made in this context to section 3.7 (on infrastructure sharing).

3 Goods under auction

3.1 Regions

A total of 39 frequency packages in each of twelve regions are to be put to auction. The division into regions is based on political borders (provinces/municipalities) and results in six urban and six rural regions. A detailed list of the municipalities that have been combined to form each region can be viewed in Appendix G. The figure below shows the division into regions using differing colours.

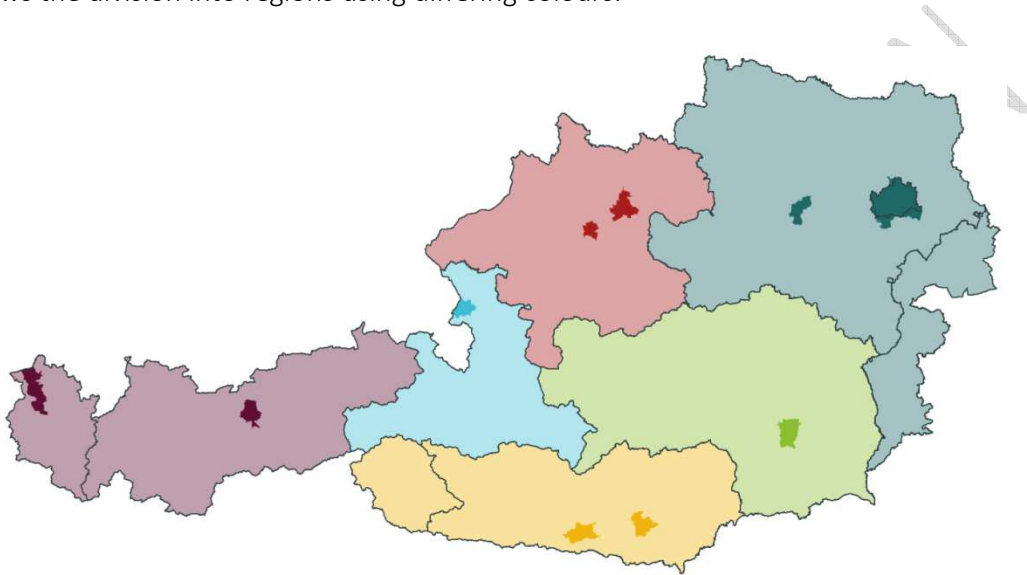


Figure 1: Division into regions

The table below describes the regions:

Region label	Region name	Description ¹
A01u	Region 1 urban	Vienna+, St Pölten
A01r	Region 1 rural	Vienna, Burgenland and Lower Austria except A01u
A02u	Region 2 urban	Linz+, Wels+
A02r	Region 2 rural	Upper Austria except A02u
A03u	Region 3 urban	City of Salzburg+
A03r	Region 3 rural	Salzburg except A03u
A04u	Region 4 urban	Innsbruck+, Bregenz+

¹ Adjoining municipalities are also incorporated into certain urban regions. Those urban regions are designated in the table with a plus sign. The detailed list of municipalities in each region can be viewed in Appendix G of the Tender Document.

A04r	Region 4 rural	North Tyrol and Vorarlberg except A04u
A05u	Region 5 urban	Villach, Klagenfurt
A05r	Region 5 rural	East Tyrol and Carinthia except A05u
A06u	Region 6 urban	Graz+
A06r	Region 6 rural	Styria except A06u

Table 1: Description of the twelve regions

The following frequency blocks of 10 MHz each are to be awarded for each region:

Designation	Frequency range	Beginning of usage period
L01	3410–3420 MHz	1 January 2020
L02	3420–3430 MHz	1 January 2020
L03	3430–3440 MHz	1 January 2020
L04	3440–3450 MHz	1 January 2020
L05	3450–3460 MHz	1 January 2020
L06	3460–3470 MHz	1 January 2020
L07	3470–3480 MHz	1 January 2020
L08	3480–3490 MHz	1 January 2020
L09	3490–3500 MHz	1 January 2020
L10	3500–3510 MHz	1 January 2020
L11	3510–3520 MHz	1 January 2020
L12	3520–3530 MHz	1 January 2020
L13	3530–3540 MHz	1 January 2020
L14	3540–3550 MHz	1 January 2020
L15	3550–3560 MHz	1 January 2020
L16	3560–3570 MHz	1 January 2020

L17	3570–3580 MHz	1 January 2020
L18	3580–3590 MHz	1 January 2020
L19	3590–3600 MHz	1 January 2020
L20	3600–3610 MHz	As of service of the award decision
L21	3610–3620 MHz	As of service of the award decision
L22	3620–3630 MHz	As of service of the award decision
L23	3630–3640 MHz	As of service of the award decision
L24	3640–3650 MHz	As of service of the award decision
L25	3650–3660 MHz	As of service of the award decision
L26	3660–3670 MHz	As of service of the award decision
L27	3670–3680 MHz	As of service of the award decision
L28	3680–3690 MHz	As of service of the award decision
L29	3690–3700 MHz	As of service of the award decision
L30	3700–3710 MHz	As of service of the award decision
L31	3710–3720 MHz	As of service of the award decision
L32	3720–3730 MHz	As of service of the award decision
L33	3730–3740 MHz	As of service of the award decision
L34	3740–3750 MHz	As of service of the award decision
L35	3750–3760 MHz	As of service of the award decision
L36	3760–3770 MHz	As of service of the award decision
L37	3770–3780 MHz	As of service of the award decision
L38	3780–3790 MHz	As of service of the award decision
L39	3790–3800 MHz	As of service of the award decision

Table 2: Frequency blocks

The frequency blocks L01 to L39 will be awarded in the auction. Where specific lots are designated in the auction, the designation is made up of a combination of the region and the frequency block.

For example, the block with the designation A03uL01 refers to the 3410–3420 MHz frequency range in the A03u region (City of Salzburg+).

3.2 Conditions for synchronisation between networks

This section contains specifications relating to temporal synchronisation between different types of network.

We wish to point out that the synchronisation frame specified here can be altered by the TKK to reflect technical and economic conditions when 5G reaches market maturity, in accordance with Art. 57 TKG 2003. If such modifications are indeed made, consideration will nonetheless have to be given in each case to the proportionality of the measure and the economic impact on the parties affected. Even if any such change is made, the spectrum holders will have the option of stipulating under private law a synchronisation frame.

3.2.1 Definitions

- ‘Default frame structure’: a frame structure as described in the section below.
- ‘Other frame structure’: a frame structure differing from the default frame structure.
- BEM: a mask used to decouple frequencies (‘BEM’ refers to ‘block edge mask’).
- Small cell: a base station with a maximum EIRP of 24 dBm per 20 MHz of carrier.

3.2.1.1 Definition of default BEM

The specifications are based on the format in the Annex to the Commission Implementing Decision of 2 May 2014 (2014/276/EU).

BEM Element	Frequency Range	Power Limit
In-block	Block assigned to the Licensee	68 dBm/5 MHz per antenna
Transitional Region	-5 to 0 MHz offset from lower block edge 0 to 5 MHz offset from upper block edge	Min(PMax -40, 21) dBm/5 MHz EIRP per antenna
Transitional Region	-10 to -5 MHz offset from lower block edge 5 to 10 MHz offset from upper block edge	Min(PMax -43, 15) dBm/5 MHz EIRP per antenna
Baseline	3400–3800 MHz (except for in-block and transitional regions)	Min(PMax -43, 13) dBm/5 MHz
Additional baseline	Below 3400 MHz and above 3800 MHz	-34 dBm/5 MHz EIRP per cell

Figure 2: Default BEM (‘permissive block edge mask’)

3.2.1.2 Definition of restrictive BEM

The specifications are also based on the format in the Annex to the Commission Implementing Decision of 2 May 2014 (2014/276/EU).

BEM Element	Frequency Range	Power Limit
In-block	Block assigned to the Licensee	68 dBm/5 MHz per antenna
Baseline	3400–3800 MHz (except for in-block frequencies)	-34 dBm/5 MHz EIRP per cell
Additional baseline	Below 3400 MHz and above 3800 MHz	-34 dBm/5 MHz EIRP per cell

Figure 3: Restrictive BEM ('restrictive block edge mask')

3.2.2 Introduction

When setting up and operating their networks, spectrum holders should work together in such a way that avoids any damaging interference to other licensees holding usage rights for spectrum in the 3410–3800 range.

Licence holders are subject to the rules for synchronisation between networks.

The following procedures relate to how the 'default BEM' and the 'restrictive BEM' can be used to minimise the risk of any damaging interference to other licence holders.

3.2.3 Conditions for the default BEM

Default frame structure: The technical conditions specified in section 3.2.1.1 apply where a licence holder's base station complies with the requirements for the default frame structure described below.

- (a) Transmissions from a licensee's base station have a frame structure that is the same as the one as shown in the figure below. The timeslots (or subframes) listed must not be used for any other purpose than downlinks (D) and uplinks (U). S refers to a special subframe. It is permitted to use TD-LTE frame configuration 2 (with a downlink to uplink ratio of 3:1) with the special subframe configuration 6 or an equivalent frame structure having transmission and reception times corresponding to that configuration.
- (b) The duration of the timeslots is one millisecond.
- (c) Licence holders are responsible for ensuring that frames are based on a uniform reference time (+/- 1.5 μ s), so that all of any licence holder's frames are aligned equally and transmissions are consequently synchronised.

DL/UL ratio	Timeslot or Subframe number									
	0	1	2	3	4	5	6	7	8	9
3:1	D	S	U	D	D	D	S	U	D	D

Figure 4: 'Default frame structure'

3.2.4 Conditions for the use of the restrictive BEM

Other frame structures: The technical conditions for the restrictive BEM as specified in section 3.2.1.2 are to be applied when the licence holder's base station has another frame structure corresponding to the description below.

- (a) It is permitted to use any frame configuration not corresponding to TD-LTE frame configuration 2 (3:1) with the special subframe configuration 6 or to an equivalent frame structure having transmission and reception times corresponding to that configuration.
- (b) Licence holders should cooperate to minimise any damaging interference caused by overlapping of subframes when different technologies are used.
- (c) Licence holders using the restrictive BEM should not cause any damaging interference to other licence holders using the default frame structure (or an equivalent structure). This can be achieved through internal guard bands and/or by reducing the power of blocks next to those belonging to other licence holders who use the default frame structure (or an equivalent).

3.2.5 Small cells inside buildings

Small cells inside buildings are exempt from synchronisation. The default BEM can be used for such small cells in buildings, provided that no damaging interference occurs to other licence holders.

3.3 Start and duration of use

Art. 54 Par. 11 TKG 2003 allows spectrum to be awarded only for a specified period.

Based on existing usage rights, the licences for frequency blocks within the 3410–3600 MHz range (L01 to L19) will be awarded for the period of 1 January 2020 to 31 December 2039.

The licences for frequency blocks within the 3600–3800 MHz range (L20 to L39) will be awarded as of when the spectrum assignment decision is served to the individual licensee. The usage rights pertaining to this frequency range are also valid until 31 December 2039.

3.4 Terms and conditions of use

3.4.1 Purpose

The available frequency spectrum is to be used for “the harmonisation of the 3400–3800 MHz frequency band for terrestrial systems capable of providing electronic communications services” (also referred to within the CEPT as MFCN systems – mobile/fixed communications networks), as set out in the following publications by the European Commission:

- Commission Decision of 21 May 2008 (2008/411/EC)
- Commission Implementing Decision of 2 May 2014 (2014/276/EU)

The 3410 to 3800 MHz frequency range to be awarded is exclusively for the time division duplex (TDD) mode of operation.

3.4.2 Specific terms and conditions of use

3.4.2.1 Principal specifications

- (1) The version of the Radio Regulations adopted by the World Radiocommunication Conference (WRC-15) as well as the provisions of the Commission Decision referred to under section 3.4.1 apply in general to frequency usage.
- (2) Based on that decision, time division duplex (TDD) is the preferred duplex mode of operation in the 3400–3600 MHz sub-band, whereas the Member States may alternatively implement the frequency division duplex (FDD) mode. Due to the incompatibility of the two modes and the lack of market demand, the frequency division duplex mode is not included in this spectrum award.
- (3) The duplex mode of operation in the 3600–3800 MHz sub-band is time division duplex (TDD).
- (4) Base station and subscriber terminal transmissions in the 3410–3800 frequency band must comply with the block edge mask (BEM) specified in the Annex to Council Decision 2014/276/EU.

3.4.2.2 Frequency usage in the vicinity of national and regional borders

3.4.2.2.1 General provisions

- (1) To ensure optimum power of the digital mobile broadband access systems used in cross-border areas, providers should, in compliance with the relevant annex to ECC/REC/(15)01, implement the code resources given by technology as well as other radio parameters, in particular when signal centre frequencies coincide in border areas.
- (2) The limits specified under this item are potentially subject to change where possible, based on the outcome of any additional coordination procedures conducted by the telecommunications authorities in accordance with specifications that might be issued in future by European bodies and/or bilateral or multilateral agreements with the telecommunications administrative authorities of the other countries concerned.
- (3) Agreements relating to individual changes affecting areas near international borders are permitted between Austrian providers and similar providers in neighbouring countries. Such agreements nonetheless require the approval of the telecommunications administrative authorities concerned and the regulatory authority is to be notified immediately. The detailed provisions can be found in the agreements as currently amended (refer to the corresponding appendix).
- (4) Agreements relating to individual changes affecting areas near regional borders are also permitted between providers in Austria. Both the telecommunications authorities and the regulatory authority are to be notified of such agreements immediately.
- (5) When determining field strengths along borders, the calculation program specified in the most recently amended official version of the “Agreement on the co-ordination of frequencies between 29.7 MHz and 43.5 GHz for the fixed service and the land mobile service” (HCM Agreement) is definitive. The calculation

program, which constitutes an integral part of these terms and conditions of use, is available from the website of the managing administration at http://www.hcm-agreement.eu/http/englisch/verwaltung/index_europakarte.htm. The topographical data additionally required for applying the HCM program as well as the HCM Agreement 2017 are also available under that link.

3.4.2.2.2 Field strengths

Without prior coordination with the neighbouring country or region, stations implementing TDD broadband technologies in the 3410–3800 MHz range may be used if the mean field strength produced by the base station does not exceed the values listed below:

- a) With neighbouring FDD networks and in non-synchronised TDD networks:
 - 32 dB μ V/m/5 MHz at a height of three metres above ground on the borderline
- b) In synchronised TDD networks:
 - 67 dB μ V/m/5 MHz at a height of three metres above ground on the borderline and
 - 49 dB μ V/m/5 MHz at a height of three metres above ground at a distance of 6 km within the neighbouring country or region.

Exclusive use of TDD has been specified, so that only the TDD to TDD field strength is accordingly applicable in the case of regional borders within Austria. It should also be noted that the field strengths listed above only apply in the absence of any agreement as referred to in section 3.4.2.2.1 (4).

3.4.2.3 Use restrictions based on frequency usages in Austria requiring protection

- (1) To protect the Aflenz earth station, an absolute protection zone in the form of a polygon is defined. The coordinates of the absolute protection zone, along with a diagram of the zone, are shown in Appendix 0. An absolute protection zone means that this zone must not be directly or indirectly affected by any base station transmissions for broadband services within the 3400–3800 MHz frequency range.
- (2) To protect other reception stations, the power flux density of the entire 3400–3800 frequency range must not at any time exceed -183.52 dBW/m²/4kHz at a height of 15 metres above ground, within a cylinder defined by the centre point coordinates and radii specified below:
 - a) 17°01'31.3" East / 48°06'53.3" North, radius of 80 metres from this centre point
 - b) 15°56'12.9" East / 48°10'34.3" North, radius of 230 metres from this centre point

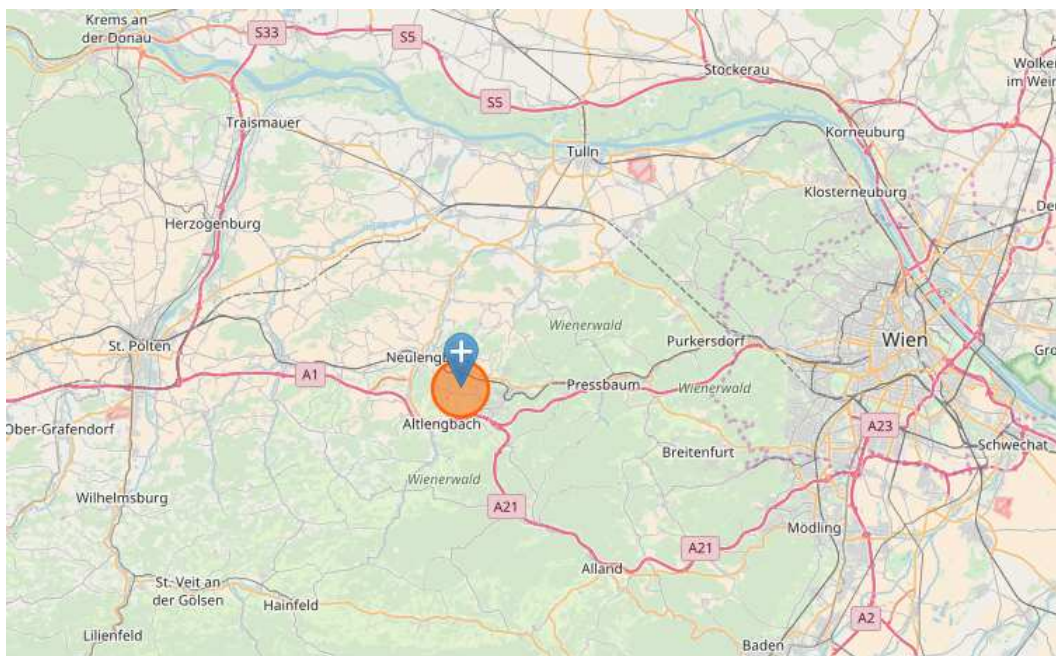


Figure 5: Protection of other receiver locations – Kohlreithberg (15°56'12.9" East / 48°10'34.3" North) (OSM CC-BY-SA 2.0)

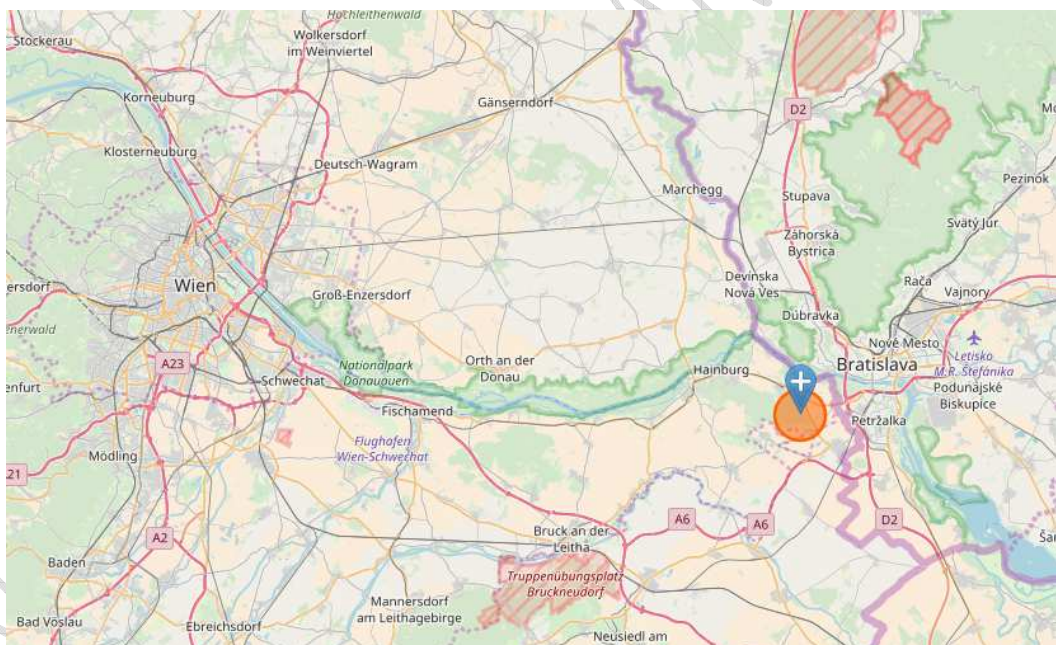


Figure 6: Protection of other receiver locations – Königswarte (17°01'31.3" East / 48°06'53.3" North) (OSM CC-BY-SA 2.0)

3.4.2.4 Changes in use and additional use restrictions

- (1) The telecommunications authorities in Austria or in other countries can order changes in use or additional use restrictions for individual frequencies or border regions, to protect existing or planned radio services.
- (2) As of the date when the agreement with Germany, Liechtenstein and Switzerland was signed, due to frequency usage in those countries, details on any corresponding protection requirements were not yet available. On receiving

further details relating to protection zones, the following apply in the entire 3400–3800 MHz range:

- a) For the protection of non-MFCN systems, a power flux density of - 122 dBW/MHz/m² must not be exceeded along the border (corresponding to a field strength of about 24 dB μ V/m/MHz).
- b) For the protection of satellite earth stations, a power flux density of - 154 dBW/(MHz*m²) must not be exceeded along the border (corresponding to a field strength of about 16 dB μ V/m/MHz).

3.4.2.5 Quarterly report on terminal stations

The data on the base stations in operation for broadband services are to be reported on a quarterly basis to the *Frequenzbüro* (frequency office). Once the regulatory authority has awarded the spectrum, the providers will receive details of the data format from the Federal Ministry of Transport, Innovation and Technology (BMVIT).

3.4.2.6 Frequency planning and usage: other international documents

- (1) The documents listed below, issued by the Conférence Européenne des Administrations des Postes et des Télécommunications (CEPT), are also to be considered as a basis for frequency planning and usage:
 - ECC Decision ECC/DEC/(11)06
 - ECC Recommendation ECC/REC/(15)01
 - CEPT Report 49
 - ECC Report 254
 - ECC Report 216
 - ECC Report 203
- (2) These documents have been published on the website of the European Communication Office at <http://www.cept.org/eco/deliverables> (under “ECO Document database”) and <http://www.ecodocdb.dk/>.

3.4.2.7 Direction finder locations requiring protection

- (1) For the protection of stationary directional receiver systems operated by telecommunications authorities, at such locations the peak field strength of signals transmitted by the base stations must not exceed 105 dB μ V/m, as measured for the bandwidth of the specific system.
- (2) The current list of the direction finder locations requiring protection can be viewed (in German) in the OFB-InfoLetter 02/2012 on the website of the BMVIT under <https://www.bmvit.gv.at/ofb> (-> Publikationen -> OFB-InfoLetters).

3.5 Coverage obligations

Every spectrum holder is obliged to use the spectrum awarded in this procedure at a specified number of locations from a specified date onwards. The coverage obligations are intended to ensure effective use of spectrum and prevent any hoarding of it, while also encouraging rapid roll-out of 5G infrastructure, in keeping with the goals for 5G defined in the government programme (see chapter 1) and in response to Austria’s 5G strategy.

Within coverage obligations, a distinction is made between various levels.

- Level 1: Every holder of spectrum in the 3410–3800 range is required to operate a minimum number of locations in every region for which that licensee has been assigned spectrum, with the number depending on the region (for the minimum number in each case, see section 3.5.2).
- Level 2: A licensee holding spectrum in the 3410–3800 MHz range who has been assigned more than 50 MHz in one region is required to operate in that region an additional number of locations depending on the particular region (for the additional number required in each case, see section 3.5.3).
- Level 3: A licensee holding spectrum in the 3410–3800 MHz range who has been assigned more than 90 MHz in one region is required to operate an additional number of locations depending on the particular region, while these locations need not be in the particular region in each case (for the additional number required in each case, see section 3.5.4).

3.5.1 Location as defined in terms of the coverage obligation

A location meeting the requirements listed below qualifies as a location as defined in terms of the coverage obligation:

- A location that is eligible for meeting the coverage obligation must have a base station capable of transmitting at a minimum level of 20 watts of electrical power. The actual transmission power level can be less.
- A location qualifies as a location within the meaning of the coverage obligation only if the frequencies transmitted there are used to connect end users.
- Only base stations operated outdoors are considered as locations within the meaning of this obligation.
- The spectrum holder must have actual, legal and technical control of any such base station.
- Locations as defined in terms of the coverage obligation are subject to the prohibition of active sharing set out in section 3.7. Exemption from that prohibition, as set out in section 3.7, is not applicable to locations as defined in terms of the coverage obligation.
- A location having an antenna system with more than one sector is still considered as only one location.
- Two locations are counted as two separate locations for the purpose of the coverage obligation only if spaced at least 25 metres apart as measured with a straight line.
- The spectrum in the 3410–3800 MHz range awarded in this procedure must be transmitted at any one location with the minimum bandwidths specified below:

Amount of spectrum awarded	Minimum transmission bandwidth
10 MHz	5 MHz
20 MHz	5 MHz

30 MHz	10 MHz
40 MHz	20 MHz
50 MHz	20 MHz
60 MHz	40 MHz
70 MHz	40 MHz
80 MHz	60 MHz
90 MHz	60 MHz
100 MHz	80 MHz
More than 100 MHz	80 MHz

Table 3: Minimum transmission bandwidth at one location

3.5.2 Level 1 coverage obligation (regardless of the amount of spectrum)

The table below lists the minimum number of locations a licensee holding spectrum in the 3410 to 3800 MHz range is required under the level 1 coverage obligation to operate within the particular region as of the particular date specified:

Label	Name	Minimum number of locations by no later than 31 December 2020	Minimum number of locations by no later than 30 June 2022
A01u	Region 1 urban	11	35
A01r	Region 1 rural	11	35
A02u	Region 2 urban	6	20
A02r	Region 2 rural	9	30
A03u	Region 3 urban	6	20
A03r	Region 3 rural	6	20
A04u	Region 4 urban	6	20
A04r	Region 4 rural	9	30
A05u	Region 5 urban	6	20

A05r	Region 5 rural	6	20
A06u	Region 6 urban	6	20
A06r	Region 6 rural	9	30

Table 4: Number of locations to be operated under the level 1 coverage obligation

3.5.3 Level 2 coverage obligation (for more than 50 MHz of spectrum)

The table below lists the minimum number of locations a licensee holding spectrum in the 3410 to 3800 MHz range is required under the level 2 coverage obligation to operate, in addition to the locations under level 1, within the particular region as of the particular date specified:

Label	Name	Additional number of locations by no later than 31 December 2020	Additional number of locations by no later than 30 June 2022
A01u	Region 1 urban	8	26
A01r	Region 1 rural	7	23
A02u	Region 2 urban	4	13
A02r	Region 2 rural	6	20
A03u	Region 3 urban	4	13
A03r	Region 3 rural	4	13
A04u	Region 4 urban	4	13
A04r	Region 4 rural	6	20
A05u	Region 5 urban	4	13
A05r	Region 5 rural	4	13
A06u	Region 6 urban	4	13
A06r	Region 6 rural	6	20

Table 5: Number of additional locations to be operated under the level 2 coverage obligation

3.5.4 Level 3 coverage obligation (for more than 90 MHz of spectrum)

The table below lists the minimum number of locations a licensee holding spectrum in the 3410 to 3800 MHz range is required under the level 3 coverage obligation to operate, in addition to the locations under level 1 and level 2, within the particular region as of the particular date specified, when that licensee holds more than 90 MHz in one region:

Label	Name	Additional number of locations by no later than 31 December 2020	Additional number of locations by no later than 30 June 2022
A01u	Region 1 urban	94	312
A02u	Region 2 urban	15	51
A03u	Region 3 urban	8	26
A04u	Region 4 urban	12	40
A05u	Region 5 urban	8	25
A06u	Region 6 urban	14	46

Table 6: Number of additional locations to be operated under the level 3 coverage obligation

3.5.5 Proof and verification of the coverage level

As proof of coverage, the spectrum holder is required to submit to the TTK the documents listed below in electronic form by no later than four weeks from the date specified in each case (31 December 2020 and 30 June 2022):

- An inventory of all base station locations including geo-coded data (GIS format or vector graphics), indicating in each case the frequency blocks used (per sector), based on the HCM Agreement 2017
- Operating permit(s) for the base stations concerned

The TTK is entitled to verify compliance with coverage obligations at any time by taking measurements. The spectrum holder(s) in each case are obliged to cover the costs of verification.

3.5.6 Failure to meet coverage obligations: fines

Any provider failing to meet the coverage obligations is subject to payment of a fine of EUR 10,000.00 per location not operated. This applies to all levels of the coverage

obligation. The amount is payable each year as of the date specified in each case and as of the same date each year thereafter, until the provider meets the required minimum number of locations.

In the event that the awarded frequency usage rights are waived until 30 December 2020, the fine is 50 per cent of the amount payable as of the date specified for failure to meet the coverage obligation.

3.6 Obligation to disclose coverage data

Every spectrum holder is required to publish on their company website a map view showing the coverage area for the frequencies awarded in this procedure. Specifically, the map should show, by means of a realistic simulation, the data rates available to end users outdoors, broken down by downlink and uplink rates. The maximum data rate available should also be indicated. In the map view, each area supplied with service must be displayed in sectors of at least 100 m by 100 m, corresponding to the 100 m grid size used by Statistics Austria in projections of regional statistics (ETRS-LAEA grid), and show the bandwidth normally available² as well as the estimated download and upload speeds. Compliance must be given with the specified speed at every point within the particular grid.

The related raw data – at a minimum the grid, speeds and time stamp – are to be additionally made available to the public in the Open Data format (based on the CC BY 4.0 licence).

Data are to be published for the first time by 31 January 2021 at the latest. The data are to be consistently kept up to date, and revised within no more than three months.

3.7 Rules for infrastructure sharing

3.7.1 Core network

No cooperation relating to essential core network functions is permitted between two spectrum holders in the 3410 to 3800 MHz range, where more than one of the participating companies hold more than a total of 10% of the usage rights in the 800 MHz, 900 MHz, 1800 MHz, 2100 MHz (FDD) and 2600 MHz frequency ranges or are affiliated under ownership law, as defined in section 5.2.2, with parties holding more than 10% of those usage rights.

3.7.2 Active elements of the access network

The active elements of the access network are defined as follows for the context of infrastructure sharing: The active elements of the access network are usually operated using electrical energy and are responsible for functions including signal generation, processing and amplification, and control. This includes the transmitter, the receiver, the hardware and software that generate, control and amplify or receive and decode the radio signal, and the electronic control of the antenna tilt. Antennas requiring

² The bandwidth available to end users 95% of the day or per 24 hours; i.e. the bandwidth must not fall below this level for more than 72 minutes on any day.

electrical energy are also active elements, in other words antennas with an electronic amplifier or electronic controller for alignment. Agreements allowing other providers to use active elements (e.g. national roaming agreements) are considered equivalent to active sharing.

Active elements of the access network are considered 'non-replicable' where, viewed objectively, active sharing is necessary for effective competition. To determine objective necessity, an examination is required of whether competitors will be able to replicate those particular active elements of the access network in the foreseeable future and in this way limit competition in the market. In addition, corresponding demand for services must exist, and those particular active elements of the access network must be indispensable for providing those services.

For example, in an individual case statutory provisions could also require compulsory joint use of active elements of the access network. The rules described below apply only to those individual active elements of the access network which qualify as non-replicable.

3.7.2.1 Access obligation for active sharing: prerequisites

As far as technically and economically feasible, third parties must on request be allowed non-discriminatory access within the entire federal territory to active elements of the access network (active sharing) in the case of joint use:

1. The active elements are used for the coverage of areas that are limited by artificial structures and not sufficiently supplied from outdoor locations (examples include tunnels, underground railways, stadiums and shopping centres).
2. The active elements are not replicable.
3. Joint use involves spectrum in the 3410 to 3800 MHz range.
4. More than one of the companies participating in cooperation hold more than a total of 10% of the usage rights in the 800 MHz, 900 MHz, 1800 MHz, 2100 MHz (FDD) and 2600 MHz frequency ranges or are affiliated under ownership law, as defined in section 5.2.2, with parties holding more than 10% of those usage rights.
5. No third party is authorised to access non-replicable infrastructure unless the third-party company holds a licence in a frequency range suitable for supplying complete coverage with mobile services (for example, 700 MHz, 800 MHz, 900 MHz, 1800 or 2100 MHz FDD).

If a requesting third party is not granted access or no agreement on joint usage or on compensation within a period of four weeks from receipt of the request by the party entitled to access, either party involved may call upon the regulatory authority for a decision.

3.7.2.2 Prohibition of active sharing in outdoor areas in Vienna, Graz and Linz, and related exemptions

In the political municipalities of Vienna, Graz and Linz, the awarded frequency usage rights in the 3410 to 3800 MHz range are permitted to be used for outdoor coverage

– including the coverage of buildings from outdoor locations – exclusively with an access network and without active sharing.

An exemption from the prohibition of active sharing in Vienna, Graz and Linz exists where none or only one of the participating spectrum holders holds more than a total of 10% of the usage rights in the 800 MHz, 900 MHz, 1800 MHz, 2100 MHz (FDD) and 2600 MHz frequency ranges or is affiliated under ownership law, as defined in section 5.2.2, with parties holding more than 10% of such usage rights.

A further exemption from the prohibition on active sharing in Vienna, Graz and Linz exists in the case of non-replicable active elements of the access network. In this case, as far as technically and economically feasible, third parties must on request be allowed non-discriminatory access; this applies when the terms under numbers 2 to 5 of section 3.7.2.1 have been met.

If a requesting third party is not granted access or no agreement on joint usage or on compensation within a period of four weeks from receipt of the request by the party entitled to access, either party involved may call upon the regulatory authority for a decision.

3.7.3 Reporting and information obligation

By 28 February of each year at the latest, every spectrum holder is required to report to the regulatory authority any activities relating to active sharing in the previous year (throughout Austria and inside and outside buildings). Such disclosure must include the following details:

- Sharing partners
- Period
- Frequency ranges used
- Technology (e.g. 2G, 3G, 4G, 5G)
- Volume of traffic correspondingly processed in the previous year (broken down according to gigabytes of uplink and downlink traffic and voice minutes)
- Zone supplied with coverage
- Number and position of locations
- Technical description of the active elements used jointly

For non-replicable infrastructure used for outdoor coverage – including the coverage of buildings from outdoor locations – in Vienna, Graz and Linz, the following items are also required:

- Name and address of the location provider
- Proof of the non-replicability of the location (costs, demand, indispensability)

Spectrum holders are additionally required to make available to the regulatory authority at any time on request all compulsory information on any active sharing in

the access network. In particular, any and all contractual agreements relating to active sharing are to be made available to the authority on request.

4 Principles of auction design

4.1 General information

Total spectrum of 390 MHz in the 3410 MHz to 3800 MHz range is to be auctioned off. The available spectrum, divided into blocks of 10 MHz each, will be auctioned off by region.

The auction uses the format of a simple clock auction – and a possible additional bidding round for unsold lots – to determine the amount of spectrum that successful bidders receive in each region (principle stage). This is followed by a sealed bidding round in which winners of spectrum submit bids for various combinations of specific frequency blocks, thereby enabling the mutually compatible assignment of contiguous spectrum to the winners of spectrum in each region (assignment stage).

The principle stage consists of a series of open bidding rounds (clock rounds) in which the auctioneer sets a price per frequency block in each region (clock price) and bidders specify in their bid the number of blocks they desire at the respective clock prices offered. If the demand for blocks aggregated across all bidders exceeds the supply available in at least one region, then the auctioneer increases the price per block in all regions with excess demand and holds a subsequent clock round. The clock rounds end once the aggregate demand does not exceed the supply available in any region. Bidders win the blocks they requested in the last clock round in the respective region and at the respective clock price (or alternatively, in the event of exit bids, at the lowest price specified in an accepted exit bid).

If any blocks remain unawarded following the last clock round, the unsold blocks will be offered in a separate sealed bidding round, if the auctioneer regards this as suitable for meeting the goal of efficient spectrum use. In such a bidding round, bidders can submit bids for combinations of blocks. The auctioneer then determines the combination of bids with the highest total value that can be satisfied with the available number of unsold lots (with no more than one bid per bidder considered). Each successful bidder pays the amount for that successful bid.

Applicants may take part in the principle stage of the auction procedure if they have not been excluded from the spectrum award procedure as specified in Art. 55 Par. 8 of the Telecommunications Act (TKG 2003).

The maximum amount of spectrum that a bidder may acquire at auction is limited by:

- a) the spectrum caps set by the Telekom-Control-Kommission (TKK) on the one hand (see also section 4.4); and by
- b) the bank guarantee provided by the bidder as described in section 5.3.5.

The assignment stage consists of a single sealed bidding round in which the bidders place bids for the assignment options determined for them by the auctioneer. Winning bids in the assignment stage are identified by determining the combination of bids with the highest total value that enables the mutually compatible assignment of spectrum in each region. The winners receive the actual frequency blocks contained in their respective winning bids at what are termed ‘additional prices’, which are calculated on the basis of a modified second price rule. The assignment stage of the auction procedure is open to all applicants who were successful in the principle stage and acquired abstract frequency blocks for which more than one assignment option exists.

The total price to be paid by a successful bidder is calculated as the sum of the bidder’s successful bids during the principle stage plus the additional price.

The auctioneer is the TKK or a member as commissioned by that body. The TKK may also entrust the handling of the auction to members of the Telecommunications and Postal Services Division of the Austrian Regulatory Authority for Broadcasting and Telecommunications (RTR).

4.2 Minimum bid

Art. 55 Par. 4 TKG 2003 allows for the tender documentation to include details of the minimum frequency licence fee that may be bid.

These details are required to be based on the frequency assignment fees that are expected to be charged for the assigned spectrum. Where justified, the authority can depart from the rule of defining the minimum bid based on the frequency assignment fees, specifically where this appears justified considering the actual market value of the spectrum.

The following statement is taken from the explanatory comments on Art. 55 Par. 4 TKG 2003: “If the regulatory authority does not set the minimum bid based on the assignment fee, the authority is required in any case to set the bid based on national and international reference values.”

Based on the principles for defining the minimum bid that can be derived from Art. 55 Par. 4 TKG 2003, the minimum bids listed below result for the principle stage, for each block of 10 MHz in the category specified in each case:

Label (region)	Minimum bid for each 10 MHz block
A01u	EUR 311,400
A01r	EUR 92,700
A02u	EUR 50,700
A02r	EUR 58,400
A03u	EUR 25,400

A03r	EUR 19,700
A04u	EUR 39,600
A04r	EUR 42,600
A05u	EUR 24,900
A05r	EUR 23,000
A06u	EUR 45,600
A06r	EUR 48,100

Table 7: Minimum bid per frequency block

4.3 Prerequisite for participating

To be allowed to participate in the auction, an applicant is required to provide security in the amount of the lowest minimum bid for a 10 MHz block in the auction (see section 4.2), in compliance with the rules in section 5.3.5 and the Auction Rules.

4.4 Spectrum restrictions

The spectrum restrictions listed below have been specified to ensure sustained competition in the markets affected by this award procedure, as well as to avoid any unfavourable asymmetric distribution of the total amount of spectrum awarded to individual market participants.

- A1 and T-Mobile: 150 MHz in all regions
- All others: 170 MHz in all regions

If an additional bidding round is held, it is at the discretion of the auctioneer to loosen the caps for individual bidders or all bidders, provided that such loosening is in the interests of efficient spectrum use and is not opposed by competition considerations. If the auctioneer decides to loosen caps, the maximum caps listed below apply in any case to the spectrum acquired by the specified bidders during the entire principle stage (i.e. clock rounds and additional bidding round):

- A1: 160 MHz in all regions
- All others: 190 MHz in all regions

5 Spectrum award procedure

5.1 Steps of the procedure and timetable

As mentioned above in section 2.2, the spectrum award procedure is divided into two steps. Pursuant to Article 55 Par. 1 in conjunction with Par. 2 No. 2 TKG 2003, the first

step involves verification to determine whether applicants meet the criteria set out in Art. 55 Par. 2 No. 2 TKG 2003. Any applicants not meeting the requirements in Art. 55 Par. 2 No. 2 TKG 2003 are excluded from the spectrum award procedure, as specified in Art. 55 Par. 8 TKG 2003.

The main events in the timetable for the award procedure are presented below.

Activity	Anticipated time period
Publication of the invitation to tender	19 September 2018
Receipt of questions	8 October 2018 12:00 noon (local time)
TKK's responses to questions	7 November 2018
End of the tender submission period	26 November 2018 12:00 noon (local time)
Admission to the auction	December 2018 / January 2019
Actual auction	February 2019
Spectrum assignment decision	Within one month of completion of the auction

Table 8: Award procedure timetable

5.2 Requirements for the award procedure

5.2.1 Legal personality of the applicant

The applicant must have legal personality and full legal capacity as defined in Art. 9 of the General Administrative Procedure Act.

5.2.2 Affiliated companies

1. Applications are not permitted if submitted by a plurality of companies that are affiliated within a company group as defined in Art. 189a No. 6 to 8 in conjunction with Art. 244 of the Austrian Commercial Code (UGB) or Art. 15 of the Stock Corporation Act (AktG) and Art. 115 of the Limited Liability Companies Act (GmbHG), or in the manner described in Art. 7 of the 2005 Cartel Act (KartG; directly or indirectly).

The same applies where applicants exercise or intend to exercise a significant amount of direct or indirect influence on another applicant in a manner affecting competition (for example through trust or cooperation agreements, takeover agreements or similar), even where such an agreement has not yet been approved).

Whether significant influence affecting competition exists is subject to verification in the specific case. Such influence always exists, however, in the case of major holdings as defined in Articles 130 ff of the 2018 Stock Exchange Act (BörseG).

2. Where several companies currently active in the Austrian mobile market hold shares in one and the same company (for example a joint venture), such a company

is only permitted to apply on the condition that, as required by cartel law in the individual case, any documents certifying non-objection under competition law as well as any approvals are presented, whereas the rules set out above (under 1) also apply here.

When evaluating the individual case, consideration is also to be given as to whether the applicants may currently be in the midst of a merger or demerger process. Any previous decisions by competition authorities (either at national or EU level) are especially to be considered in such cases (for example, the conditions for any merger that are specified in the approvals).

In the event that two or more applicants affiliated with one another in the manner described above apply for spectrum, only the first applicant to submit an application will be allowed to participate in the auction. Where the applications are submitted on the same day, the applicant admitted to the spectrum auction will be decided by draw.

5.2.3 Changes in the ownership structure

Regulatory authority approval is required for any change in the legal person of the applicant or any significant change in the participating interest held in the applicant (even indirectly or not immediately), which occurs during the procedure. Approval must only be given if, after completion of the change, the company is fully independent of other applicants for purposes of competition. A significant change is always to be recognised in cases where the percentage thresholds specified in Articles 130 ff of the 2018 BörseG are exceeded or where major holdings, with the exception of mere financial holdings, are initially acquired, in application by analogy of Articles 130 ff of the 2018 Stock Exchange Act. Where any change in the legal person of the applicant or any change in participating interest occurs without the TTK issuing approval, the company or companies concerned will be excluded from the award procedure.

In the application, the applicant must inform the TTK of any and all pending or anticipated procedures by cartel authorities that concern the ownership structure, submitting with the application any and all related decisions in their entirety. Any and all changes in the ownership structure that are carried out in fulfilment of such obligations, even after application is made, are to be reported to the TTK.

Regarding a change in the ownership structure of companies that have been awarded frequency usage rights in a procedure as referred to in Art. 55 TKG 2003, we refer to Art. 56 Par. 2 TKG 2003.

5.2.4 Rights to application documents

When applying for a spectrum award, the applicant irrevocably consents to unlimited use by the TTK of all information disclosed and all documents submitted as part of the application, for the purpose of the procedure and for verification of compliance with the decision as well as for all other procedures relating to frequency awards.

5.2.5 Questions concerning the Tender Document

To prepare their applications, interested parties who have paid EUR 300.00 to cover the expense of being provided with the Tender Document are entitled to participate in a question and answer session with the TKK to have any questions answered. The TKK reserves the right to decide whether to respond to any individual question.

Questions may be submitted to the TKK exclusively via the email address tkfreq@rtr.at by 8 October 2018 at 12:00 noon local time (date and time of receipt), giving as the subject "F 7/16 – questions concerning the tender procedure". It is planned to provide written responses to such questions by 7 November 2018.

The questions submitted to the TKK will be collected and forwarded, without details of the parties submitting the questions and together with the responses, to all such interested parties referred to above.

In the event that the TKK finds it necessary or helpful to clarify questions with any applicants, by submitting an application, applicants irrevocably declare their willingness to respond to any such questions within the appropriate period set by the TKK in the individual case and to subsequently submit any information requested.

5.2.6 Information collection– advisors

For the purpose of collecting information and making enquiries for this tender procedure, the TKK can request support from advisors (Art. 55 Par. 11 TKG 2003). This may concern the collection of information related to Tender Document questions as referred to above in section 5.2.5 or related to the verification of eligibility criteria as referred to in Art. 55 Par. 2 No. 2 TKG 2003, as well as support in the auction procedure, while this list is by no means exhaustive.

5.2.7 Examination of files

All applicants are principally to be granted access to files on request. Those parts of files are excluded from the right to examination where disclosure would harm the justified interests of a party to the procedure or a third party or would jeopardise the activities of the authority or interfere with the purpose of the procedure. To refuse the examination of files to a party against which a procedure is pending, a procedural order is issued in accordance with Art. 17 Par. 4 of the General Administrative Procedure Act.

The TKK is aware that a large volume of the information made available in this procedure could, if released for examination, harm the justified interests of a party in the procedure or a third party. Similarly, some of the information contained in the procedure has the potential of jeopardising the activities of the authority or interfering with the purpose of the procedure, were such information to be examined by parties to the procedure. The TKK consequently reserves the right to exclude such parts of files from the right to examination.

Considering the possibility of collusive behaviour, the TKK assumes in particular that disclosure of the applicants prior to completion of the auction could interfere with the

purpose of the procedure. The TKK will therefore refrain from disclosing the applicants; not even via the right to examine files will this information be available prior to completion of the auction. After completion of the auction, the applicants will be provided with access to all information, while taking into account any business and trade secrets.

To ensure confidentiality of any sensitive information made available, applicants should indicate in their applications those data that they consider to be business and trade secrets. An additional abridged version of the application, with any business and trade secrets removed and clearly marked as an abridged version, is to be submitted. The TKK additionally reserves the right to exclude any other parts of files from the right to examination, in accordance with Art. 17 Par. 3 of the General Administrative Procedure Act. The TKK also reserves the right to make available for examination any parts of files labelled by applicants as business and trade secrets, if such disclosure is not expected to harm the justified interests of a party to the procedure or of third parties or to jeopardise the activities of the authorities.

Reference is made in this context to Art. 125 TKG 2003 and to ruling No. 2002/03/0273 of 25 February 2004 by the Administrative Court concerning business and trade secrets.

The applicants are obliged to use any information concerning other applicants that is obtained through this procedure only for the purpose of the procedure and to refrain from disclosing such information.

5.2.8 Publication

The TKK will publish the results of the auction on the regulatory authority's website.

5.3 Information in the application

Art. 55 Par. 1 TKG 2003 requires the regulatory authority to assign the frequencies entrusted to the authority to that applicant who meets the general requirements set out in Par. 2 No. 2 of that Article.

To evaluate whether the requirements set out in Art. 55 Par. 2 No. 2 TKG 2003 have been met, insight into the applicant's organisation is necessary (among other things). The information provided by the applicant must include details of the legal and financial situation and of the ownership structure.

5.3.1 Information on the applicant

The application documents must include the information on the applicant listed below (where applicable):

- a) name (company name), place of establishment (address), date and place of founding, including current excerpt from the Austrian Commercial Register or from the comparable register of the country of establishment;
- b) type and quantity of capital shares, nominal value of the capital shares, and the voting and dividend rights tied to any and all types of shares;

- c) subscribed capital for each type of capital shares as well as precise information on the shareholders as of the date when the application is submitted, as well as any and all anticipated changes in this regard;
- d) quantity, value and rights (including exchange rights) in relation to any and all options, certificates of entitlement, preferred shares and debt capital, as well as any other securities issued by the applicant;
- e) currently amended version of the articles of association;
- f) description of the business activities;
- g) name of the person meeting the requirements under Art. 9 of the Service of Documents Act (*Zustellgesetz*) who is authorised by the applicant to accept service of documents, as well as the person's phone and fax numbers and postal and email addresses (see also section 5.3.8);
- h) all other issues that, if disclosed or kept secret, could significantly influence the TKK's decision when carrying out verification as referred to in Art. 55 Par. 2 No. 2 TKG 2003 prior to the assignment of spectrum.

Any details listed above that are not provided in full will be subsequently requested by the TKK, if the authority deems the information necessary for determining the facts relevant for the decision. The TKK will request additional information in this context, if the authority deems the information necessary for determining the facts relevant for the decision.

5.3.2 Information on the applicant's owners, shareholders and similar items

The applicant is required to provide the details listed under section 5.3.1 items a) to d) and f) and h) (where applicable) for every owner or shareholder as well as every owner of options, certificates of entitlement, preferred shares, debt capital or other types of securities issued by the applicant. The following is also to be provided for every such person with an entitlement:

- i) relationship with the applicant (e.g. quantity and type of the capital shares or securities held); any trust or consortium agreements;
- j) where existing: parent company or companies of the group, higher-level company or companies in the group.

In the event that individuals hold any capital shares or other securities issued by the applicant in a trustee or similar capacity on behalf of a third party, this circumstance must be indicated and the details listed above provided for the actual beneficial owner.

5.3.3 Higher-level companies with major holdings: additional description of the ownership structure

In the event that, without directly holding shares in the applicant, several higher-level companies have holdings in the applicant (i.e. owners, shareholders, owners of options, certificates of entitlement, preferred shares, debt capital or other types of securities issued by the applicant) and these companies together hold (based on the ultimate owner) an effective total participating interest of 25% or more in the applicant, a description of such holdings must be provided in the application.

Specifically, the items of information listed in section 5.3.2 of this Tender Document are to be provided for every company that has effective participating interest of at least 25% in the applicant – regardless of the higher level at which these shares are held.

Thus, the information specified under section 5.3.2 of this Tender Document must also be provided for any companies that do not reach participating interest of 25% in the applicant through concrete holdings in a company at a level above the applicant but as a result of adding together the participating interest held in several companies at any level above the applicant.

In the event that individuals hold any capital shares or other securities issued by the applicant that equal a participating interest of at least 25% in a trustee or similar capacity on behalf of a third party – even if held indirectly by means of participating interests at a higher level – this circumstance must be indicated and the details listed above provided for the actual beneficial owner.

The details required under this section can be illustrated using tables or charts showing the participating interests held directly and indirectly as well as the type of control over the applicant, in particular the type of holding. When providing a description of the linked participating interests, care should be taken to ensure that the TKK is able to identify any business interrelationships that would allow one applicant to directly or indirectly exercise on another applicant a significant amount of influence affecting competition.

Any details listed above that are not provided in full will be subsequently requested by the TKK, if the authority deems the information necessary for determining the facts relevant for the decision. The TKK will request additional information in this context, if the authority deems the information necessary for determining the facts relevant for the decision.

5.3.4 Information on consortia

The additional items of information listed below are required in the case of a consortium or joint venture:

The type of relationship between the members, in addition to precise details of any of the following:

- Trust agreements, consortium agreements
- Joint venture agreements
- Declarations of intent
- Ownership agreements

In addition, the same details as listed under section 5.3.2 are required for the members of the consortium and are to be included with the application.

Any details listed above that are not provided in full will be subsequently requested by the TKK, if the authority deems the information necessary for determining the facts

relevant for the decision. The TKK will request additional information in this context, if the authority deems the information necessary for determining the facts relevant for the decision.

5.3.5 Bank guarantee

Applicants must provide security for bids in the principle stage in accordance with the Auction Rules. Such security must be provided by means of an abstract bank guarantee which is callable on first demand and has been issued by a bank with a good credit rating that is established in a signatory country of the European Economic Area (EEA; see Appendix B for a sample bank guarantee).

The minimum amount of the bank guarantee is determined based on the minimum bid set for the least costly 10 MHz block (EUR 19,700.00, see Table 7: Minimum bid per frequency block). The original of that bank guarantee must be supplied with the application.

The following rules apply to security for bids submitted in the principle stage of the auction:

Amount of the bank guarantee	Bid limit
Less than EUR 6 million	Bank guarantee x 1.25
Between EUR 6 million and less than EUR 20 million	Bank guarantee x 1.5
Between EUR 20 million and less than EUR 40 million	Bank guarantee x 2
EUR 40 million	Unlimited

Table 9: Amount of security for bids in the principle stage

It is also possible to present additional bank guarantees during the auction.

In the event that bank guarantees are presented later during the auction, to allow the necessary checks, such guarantees must be presented by no later than 12:00 noon (local time) of the business day (Monday to Friday) prior to submitting the bid and must have been issued by the same bank that issued the guarantee supplied with the application.

As the sole condition for becoming effective, any bank guarantee must specify the award of the spectrum designated in this tender procedure by official decision to the applicant. The guarantee must designate the Republic of Austria (the federal government) as the beneficiary and be valid for the period beginning no later than 1 February 2019 and lasting until at least 31 August 2019. Any additional bank guarantee provided later must be valid at the latest from the date of presentation until at least 31 August 2019.

No bank guarantee is required as security for the assignment stage.

The TKK reserves the right to demand additional bank guarantees or other security.

On completion of the procedure, the bank guarantees provided by those applicants who are not awarded any spectrum will be returned to them. The bank guarantees provided by those applicants who are awarded spectrum in this tender procedure will be returned to them after full payment of the frequency licence fee.

5.3.6 Information on technical capabilities, service quality and coverage

As stated in Art. 55 Par. 2 No. 2 TKG 2003, grounds must not exist for assuming that the proposed service will not be provided, in particular with regard to level of quality and fulfilment of the coverage obligation. The applicant must furthermore have the necessary technical capabilities. The information requested in the sections below is intended to allow verification of meeting these requirements.

The applicant is obliged to provide evidence of meeting the necessary requirements.

Evidence must include at least the following details:

- Description of planned spectrum use (e.g. services, technologies, data transmission rates, quality and availability)
- Planned coverage (supply of services) over the entire licence term
- Number of locations over the entire licence term
- Capabilities and expertise in the planning and operation of wireless networks

5.3.7 Information on financial strength

The applicant is required to provide evidence of having the financial resources necessary for setting up and operating a wireless network.

The application documents are to specifically include information as follows:

5.3.7.1 Business plan/balance sheet

Every applicant is required to prepare a business plan for the field of business (or fields of business) in which the applicant plans to use the requested spectrum, with the plan based on the applicant's strategy, market assessment and forecast of business operations for the three years following initial use of the frequencies in each case.

The applicant is free to structure the business plan. The breakdown should, however, show the following information:

- Which services are to be offered in this frequency range?
- Which technologies will be implemented to provide those services?
- As of which date will the services be offered?

5.3.7.2 Financing

Every applicant is also required to describe how the frequency licence fee is to be funded. This must be in accordance with the operator's financial capabilities. The following details are correspondingly required:

- Equity financing – schedule for and raising of equity capital, including any plans for issuing share capital
- Debt financing – credit lines, security made available, and the repayment terms and borrowers for any and all loans during the first four years after spectrum award

5.3.8 Authorised recipient

When applying for assignment, natural persons not having their main residence in Austria or legal persons not established in Austria are required to designate an authorised recipient as defined in Art. 9 of the Service of Documents Act, Federal Law Gazette (FLG) No. 200/1982 as amended by FLG I No. 40/2017 (see section 5.3.1). The application must include a declaration bearing the authorised company signature which designates a recipient with unlimited authorisation to accept service of documents. A new unlimited authorisation is to be submitted immediately upon any change of recipient.

5.3.9 Application form

The application form (see Appendix A) must also be completed, signed and submitted.

5.3.10 Declaration of completeness

Any duly completed application in writing is required to include the information requested under section 5.3. A declaration of completeness (Appendix D) is also required to be enclosed with the application, confirming that all information required by this Tender Document as well as all information relevant for evaluation of the case by the TTK is complete and correct as included in the application.

5.4 Submission of the spectrum award application

Spectrum award applications are to be addressed to:

Telekom-Control-Kommission
Mariahilfer Straße 77–79
1060 Vienna
Austria

The TTK must receive the complete spectrum award application, in a sealed package (e.g. envelope or parcel) labelled "F 7/16 – Spectrum Award Application", by 26 November 2018 12:00 noon (local time). Any applications received after that time will not be considered. The spectrum award application can be delivered by postal or courier service or submitted in person. If submitted in person, it is necessary to request an appointment. Appointments can be requested by sending an email to tkfreq@rtr.at no later than 12:00 noon of the day preceding the requested

appointment. Appointment requests as well as submissions can be made only on business days (Monday to Friday).

The original spectrum award application must be submitted in printed form in German and be accompanied by an electronic copy (e.g. on a USB flash drive). Any required supplements such as business reports and maps may also be in English.

Changes to applications or withdrawal of applications are not permitted after expiry of the tender submission period (Art. 55 Par. 6 TKG 2003).

5.5 Application document check list

The spectrum award application is to be structured as listed below:

- Application form (see Appendix A)
- Information on organisational structure
- Information on technical capabilities, service quality and coverage obligation (see section 5.3.6)
- Information on financial strength (see section 5.3.7)
- Bank guarantee (see sample in Appendix B)
- Authorisation to accept service (see section 5.3.8, sample in Appendix C)
- Declaration of completeness (see section 5.3.10, sample in Appendix D)

6 Costs and fees

6.1 Frequency licence fee

The successful applicants are required to deposit the frequency licence fee, as determined in the auction procedure, within four weeks of being served the spectrum assignment decision.

The frequency licence fee does not include value-added tax.

The spectrum award becomes void if the frequency licence fee is not paid (in full and on schedule). Notwithstanding this circumstance, the Republic of Austria is entitled in such a case to call on the bank guarantee or to collect the unpaid portion of the frequency licence fee by administrative execution.

6.2 Frequency usage fee

Art. 82 TKG 2003 specifies frequency usage fees for the use of spectrum, among other things. The levels of such fees are set out in the Telecommunications Fee Ordinance (*Telekommunikationsgebührenverordnung, TKGV*), FLG II No. 29/1998 as amended by FLG II no. 108/2011. The fees are prescribed by the telecommunications offices as part of issuing operating permits.

6.3 Consulting expenses

The regulatory authority is entitled to consult experts and advisors at any stage of the procedure. The fees for such consultants as well as their additional cash expenses are required to be paid by the applicant awarded the spectrum in the particular case. In the case of more than one applicant, the expenses are divided up on a pro-rated basis among the applicants awarded spectrum.

These expenses are prescribed in the spectrum assignment decision and are due for payment within four weeks of being served the decision.

NON-BINDING TRANSLATION

A. Sample application form

Application form in the procedure for spectrum award in the 3410 to 3800 MHz range

Applicant:

Address:

Security

Security in the amount of EUR _____ (in words
_____) in the form of an original bank
guarantee is enclosed with the application.

Date

(authorised company signature)

B. Sample bank guarantee

Name of bank:

Address:

Republic of Austria
c/o Telekom-Control-Kommission
Mariahilfer Straße 77–79
1060 Vienna

Guarantee number _____

(Bank) XX hereby provides to the Republic of Austria the irrevocable guarantee declaration described in the following:

It is known to the bank that (company) _____ is applying for spectrum award in the 3410 to 3800 MHz range within the framework of the tender procedure currently being conducted. As stipulated in section 5.3.5 of the TTK Tender Document of 19 September 2018, (company) _____ is required, as security for the requested bidding eligibility, to submit with its application an abstract bank guarantee issued by a bank with a good credit rating that is established in a signatory country of the European Economic Area.

(Bank) hereby guarantees payment to the Republic of Austria of a total amount up to the maximum specified below, without verification of the underlying legal relationship and under waiver of any and all objections:

EUR XX
(in words: XX euros)

Payment will be made to your designated bank account on first demand in writing, on condition that spectrum has been awarded to (company) XX based on this tender procedure. Confirmation of the fact in your written demand will be considered as proof that the condition has been met.

This guarantee cannot be used prior to 1 February 2019.

This guarantee expires automatically when this deed is returned to us and by no later than 31 August 2019 even if not returned, unless you make use of the deed by means



of a letter (sent by registered mail or by courier) which we receive by no later than that date.

Any claims under this guarantee can be assigned, pledged or restricted in transferability for the benefit of third parties only with our express consent.

.....
Date

.....
(authorised company signature)

NON-BINDING TRANSLATION

C. Sample authorisation to accept service

Authorisation to accept service

(Company) XX hereby authorises XXXX to accept any and all correspondence in Procedure F 7/16 for spectrum award in the 3410 to 3800 MHz range.

Contact details of Ms./Mr. NAME XX XXX:

Street

Postal code, city or town

Phone +43...

Fax +43....

Email@.....

.....
Date

.....
(authorised company signature)

D. Sample declaration of completeness

To:
Telekom-Control-Kommission
Mariahilfer Straße 77–79
1060 Vienna
Austria

Name and address of the applicant

Application in F 7/16 – declaration of completeness

The applicant hereby declares the following:

The enclosed application contains in complete and true form the information and documents which are requested in the Tender Document for Procedure F 7/16 and are otherwise necessary for evaluating the application in the spectrum award procedure based on the criteria set out in provisions of European Union law as well as applicable Austrian law and in particular the 2003 Telecommunications Act (TKG 2003), even where such information or documents are not expressly requested in the Tender Document.

In particular, except for those disclosed in the application, no agreements, collateral agreements or other relevant circumstances relating to

- ownership of the applicant,
- planned financing or
- the business plan

exist that could influence evaluation of the application.

.....
Date

.....
(authorised company signature)

E. Auction Rules

1 General information

1.1 Overview

1. Total spectrum of 390 MHz in the 3410 MHz to 3800 MHz range is to be auctioned off. The available spectrum, divided into blocks of 10 MHz each, will be auctioned off by region.
2. The auction uses the format of a simple clock auction – and a possible additional bidding round for unsold lots – to determine the amount of spectrum that successful bidders receive in each region (principle stage). This is followed by a sealed bidding round in which winners of spectrum submit bids for various combinations of specific frequency blocks, thereby enabling the mutually compatible assignment of contiguous spectrum to the winners of spectrum in each region (assignment stage).
3. The *principle stage* consists of a series of open bidding rounds (clock rounds) in which the auctioneer sets a price per frequency block in each region (clock price) and bidders specify in their bid the number of blocks they desire at the respective clock prices offered. If the demand for blocks aggregated across all bidders exceeds the supply available in at least one region, then the auctioneer increases the price per block in all regions with excess demand and holds a subsequent clock round. The clock rounds end once the aggregate demand does not exceed the supply available in any region. Bidders win the blocks they requested in the last clock round in the respective region and at the respective clock price (or alternatively, in the event of exit bids, at the lowest price specified in an accepted exit bid).
4. If any blocks remain unawarded following the last clock round, the unsold blocks will be offered in a separate sealed bidding round, if the auctioneer regards this as suitable for meeting the goal of efficient spectrum use. In such a bidding round, bidders can submit bids for combinations of blocks. The auctioneer then determines the combination of bids with the highest total value that can be satisfied with the available number of unsold lots (with no more than one bid per bidder considered). Each successful bidder pays the amount for that successful bid.
5. Applicants may take part in the principle stage of the auction procedure if they have not been excluded from the spectrum award procedure as specified in Art. 55 Par. 8 of the Telecommunications Act (TKG 2003).
6. The maximum amount of spectrum that a bidder may acquire at auction is limited by:
 - a. the spectrum caps set by the Telekom-Control-Kommission (TKK) on the one hand (see also section 4.4 of the Tender Document); and by

- b. the bidding restriction set out in the provisions under 42 and 59.b as determined based on the security provided by the bidder (see also section 5.3.5 of the tender documentation).
7. The **assignment stage** consists of one and only one sealed bidding round in which the bidders place bids for the assignment options determined for them by the auctioneer. Winning bids in the assignment stage are identified by determining the combination of bids with the highest total value that enables the mutually compatible assignment of spectrum in each region. The winners receive the actual frequency blocks contained in their respective winning bids at what are termed 'additional prices', which are calculated on the basis of a modified *second price rule*. The assignment stage of the auction procedure is open to all applicants who were successful in the principle stage and acquired abstract frequency blocks for which more than one assignment option exists.
8. The total price to be paid by a successful bidder is calculated as the sum of the bidder's successful bids during the principle stage plus the additional price.
9. The auctioneer is the TKK or a member as commissioned by that body. The TKK may also entrust the handling of the auction to members of the Telecommunications Division of the Austrian Regulatory Authority for Broadcasting and Telecommunications (RTR).

1.2 Bids and bid submission

10. All bids are submitted electronically via auction software. The process for bid submission is described in detail in the auction software user guide, which will be provided to bidders in good time before the commencement of the principle stage.
11. The submission of bids by fax or telephone is permitted in exceptional cases only (such as in the case of technical problems occurring that prohibit bid submission via the auction software). It is for the auctioneer to decide whether such an exceptional case applies. A detailed description of the process for submitting bids by fax and telephone is given in the rules of procedure. Bids will only be accepted if they are valid within the meaning of the Auction Rules and conform to the bank guarantee rules set out in section 5.3.5 of the Tender Document. Exit bids will be accepted either in full or not at all. Where one of the exit bids does not conform to the Auction Rules, all exit bids will then be considered invalid (but not necessarily the clock bid). With reference to the rules on providing security for bids (see the provisions under 41 and 42), if a bidder's security does not adequately cover the total bid but does cover the clock bid, all exit bids will be considered invalid. The clock bid is valid as long as it is appropriately secured.

1.3 Collusion and cancellation of the procedure

12. Any coercion of applicants or the applicants' shareholders, whether direct or indirect, with the intent of influencing the course or result of the auction (collusive behaviour) is prohibited. Collusive behaviour on the part of applicants before or

during the auction procedure can lead to their exclusion from subsequent stages of the procedure (Art. 55 Par. 9 TKG 2003). The auctioneer is entitled to take all suitable measures to prevent collusive behaviour.

13. Other potential grounds for exclusion from the procedure include threats against competitors as well as disclosure of participation in the auction, of bids, or of bidding strategies, even prior to the auction procedure.
14. In this context, reference is also made to the provisions of general competition law and to Art. 168b of the Austrian Criminal Code (StGB).
15. The TKK is entitled to cancel the auction procedure if it discovers collusion between applicants and an efficient, fair and non-discriminatory procedure cannot be conducted (Art. 55 Par. 12 No. 1 TKG 2003), or if there are other important reasons that endanger the proper and correct organisation and completion of the auction procedure. In such cases, the TKK will decide whether the procedure should be terminated in accordance with section 2.4 of the Tender Document or whether a new auction date should instead be set.

2 Auction products

16. The available frequency blocks are offered separately in the following regions (for a more detailed description of the regional demarcations, see section 3.1 of the Tender Document).

Label	Name	Description ³
A01u	Region 1 urban	Vienna+, St Pölten
A01r	Region 1 rural	Vienna, Burgenland and Lower Austria except A01u
A02u	Region 2 urban	Linz+, Wels+
A02r	Region 2 rural	Upper Austria except A02u
A03u	Region 3 urban	City of Salzburg+
A03r	Region 3 rural	Salzburg except A03u
A04u	Region 4 urban	Innsbruck+, Bregenz+
A04r	Region 4 rural	North Tyrol and Vorarlberg except A04u

³ Adjoining municipalities are also incorporated into certain urban regions. The detailed list of municipalities in each region can be viewed in the Tender Document.

A05u	Region 5 urban	Villach, Klagenfurt
A05r	Region 5 rural	East Tyrol and Carinthia except A05u
A06u	Region 6 urban	Graz+
A06r	Region 6 rural	Styria except A06u

Table 10: Overview of regions

17. A total of 39 blocks, each of 10 MHz of bandwidth, are available in each region. To designate the specific assignment options at the assignment stage, these blocks are numbered consecutively as L01–L39, starting at the lower end of the frequency range. Accordingly, the block with the designation A03uL01 refers to the 3410–3420 MHz frequency range in the A03u region (City of Salzburg).
18. For the purpose of applying the rules of activity, each block is assigned a certain number of bidding points. The number of bidding points per block varies according to region; these values are listed in Table below.
19. The clock prices for the first round of the auction procedure correspond to the minimum bids listed in Table below for a single frequency block in the respective region:

Region label	Bidding points	Minimum bid (EUR)
A01u	4	311,400
A01r	2	92,700
A02u	2	50,700
A02r	2	58,400
A03u	1	25,400
A03r	1	19,700
A04u	2	39,600
A04r	2	42,600
A05u	1	24,900
A05r	1	23,000

A06u	2	45,600
A06r	2	48,100

Table 11: Minimum bids and bidding points for the frequency blocks under auction

3 Spectrum caps

20. To safeguard competition in downstream markets, there is a limit (spectrum cap) placed on the total number of blocks that a bidder may acquire by auction in a single region. Restrictions as follows apply (refer also to section 4.4 of the Tender Document):
- a. In the clock rounds, A1 and T-Mobile may submit bids for a maximum of 15 blocks in each region (150 MHz) and all other bidders for a maximum of 17 blocks (170 MHz).
 - b. If an additional bidding round is held, it is at the discretion of the auctioneer to loosen the caps for individual bidders or all bidders, provided that such loosening is in the interests of efficient spectrum use and is not opposed by competition considerations. If the auctioneer decides to loosen caps, this will be to an extent that allows A1 to acquire a maximum of 16 blocks per region (160 MHz) in the course of the clock rounds and any additional bidding rounds as a whole, and all other bidders a maximum of 19 blocks (190 MHz).

4 Principle stage

21. The principle stage consists of one or more clock rounds, possibly followed by an additional bidding round in the eventuality that unsold frequency blocks remain after the last clock round and the auctioneer regards such an additional bidding round as being in the interests of efficient spectrum use.

4.1 Clock rounds

22. A clock round is a period of time set by the auctioneer within which bidders submit their bids; a clock round may be extended by a bidder exercising a right to extend a round (see paragraph 50).
23. The scheduling of clock rounds is at the discretion of the auctioneer. In particular, the auctioneer may schedule the round duration and the time between the rounds as is considered appropriate to ensure the proper and expeditious completion of the auction. However, it is not envisaged that a clock round should last less than 15 minutes or more than two hours.
24. Clock rounds will not start before 8 am or after 7 pm. While no limit is placed on the number of clock rounds per day, it is not envisaged that more than ten clock rounds will be held per day.

- a. The auctioneer informs bidders of the start of a clock round at least 15 minutes before the round is due to start. At the same time, the auctioneer provides each bidder with the following information:
 - b. The length of the planned clock round.
 - c. The clock prices for each region.
 - d. The total number of frequency blocks requested by the bidder in the previous clock round.
 - e. The maximum bid amount (bid limit) resulting from the bank guarantee provided by the bidder.
 - f. The number of round extension rights remaining to the bidder.
25. At the end of each auction day, the auctioneer also informs bidders about the provisional round plan for the following day. This information is non-binding and the auctioneer may elect to hold fewer rounds than the number originally planned. The number of rounds actually completed may also be reduced as a result of bidders exercising their round extension rights. The number of rounds held on an auction day never exceeds the number announced by the auctioneer the day before.

4.2 Clock prices

26. In each clock round, the auctioneer sets a price per frequency block for each region (the clock price). The clock prices in the first clock round are equivalent to the minimum bids listed in Table . In each subsequent clock round, the clock price increases for each region in which, based on the clock bids submitted in the previous round, the total demand for frequency blocks exceeds the supply available by a price increment set by the auctioneer. Clock prices remain unchanged for regions in which there is no excess demand.
27. The setting of price increments is at the discretion of the auctioneer. Price increments may vary across the individual regions and may be specified as a percentage increment or as an absolute increment (in addition, clock prices may, if required, be rounded up to the next multiple of EUR 100 or EUR 1,000).
28. The auctioneer will set the price increments so as to ensure that the auction completes in an orderly and expeditious fashion. However, the clock price will not increase from one clock round to the next by more than 10% (plus any amount needed to round up to the next multiple of EUR 1,000).
29. At the end of each auction day, the auctioneer informs bidders about the increments planned for the next auction day. This information is nonetheless non-binding, and the auctioneer may choose to set the increments at a lower level than announced if this would appear to improve the efficiency of the procedure.

30. If there is excess demand in at least one region, on the basis of the clock bids submitted in the respective clock round, the auctioneer announces a subsequent clock round. The clock rounds end once the demand as aggregated for the clock bids of all bidders does not exceed the supply available in any region.

4.3 Clock bids

31. In each clock round, bidders specify the number of frequency blocks they wish to acquire for each region at the respective clock prices (clock bid).
32. The sum of the bidding points of the lots specified in the bid for one clock round (the activity level of the clock bid) determines the bidder's bidding eligibility in the next clock round.
33. In submitting clock bids, bidders are subject to the following restrictions:
 - a. For each region, the number of blocks requested may not exceed the maximum quantity applicable for the respective bidder when the spectrum caps are applied (see the provision under 20.a).
 - b. From the second clock round onwards, the activity level of a bidder's clock bid must not exceed the bidder's bidding eligibility.

4.4 Exit bids

34. If a bidder reduces the total number of frequency blocks requested across all regions in comparison with the previous clock round, then this bidder may also place one or more exit bids in addition to the clock bid. Exit bids offer bidders the opportunity to state the concrete prices at which they reduce their demand within individual regions. Exit bids are to be given as integer amounts in EUR.
35. Specifically, bidders may submit exit bids for each region in which they have reduced their demand, and, for each reduction step, specify the price at which they thereby reduce their demand. The maximum number of exit bids in a round therefore depends on the number of regions in which individual bidders have reduced their demand and the extent to which they have done so, as well as on the bidders' bidding eligibility at the beginning of the round.
36. Exit bids play no part in the determination of demand and are taken into account only if excess supply is present following the last clock round in the region for which they were submitted, and only to an amount equal to or smaller than that excess supply.
37. The formal definition of exit bids is as follows:
 - a. Let n_t be the number of lots in a specific region in the bidder's clock bid in round t and let p_t be the corresponding clock price.

- b. For a region in which $n_t > n_{t+1}$, an exit bid is a price-quantity pair (p_e, n_e) with $p_{t+1} > p_e \geq p_t$ and $n_{t+1} < n_e \leq n_t$ that gives the maximum price p_e at which the bidder n_e would request lots.
 - c. If a bidder reduces the demand in a region by m blocks, the bidder may submit multiple exit bids $(p_e^1, n_e^1) \dots (p_e^l, n_e^l)$ with $l \leq m$, for this region, whereby $n_e^i > n_e^j \Rightarrow p_e^i \leq p_e^j$, meaning that the demand expressed by the exit bids may not increase with an increasing price.
 - d. For each region, the maximum number of blocks that a bidder can specify in an exit bid is limited by the rule that the activity in relation to the remaining clock bids and this quantity must not exceed the bidder's bidding eligibility at the beginning of the round. This restriction applies singly to each region but not across regions. In other words, if a bidder reduces their demand in several regions while simultaneously increasing demand in another region, that bidder can submit exit bids in several regions that, when totalled to include the remaining clock bids, imply an activity level exceeding the bidder's bidding eligibility. The bidder cannot, however, win with all of those exit bids. The rule set out under 46.a then determines which of the exit bids, if any, is ultimately successful.
38. Within one region, exit bids may be extended by the bidder provided that:
- a. the clock price in that region does not increase later in the auction; and
 - b. the bidder does not further reduce the bidder's demand in that region.
39. If a price increase occurs in a region – and therefore excess demand arises on the basis of clock bids – then all exit bids placed for that region become void. In the same way, all exit bids from bidders become void in a region in which those bidders further reduce their demand. Such bids are no longer active in the sense used in rules 41 and 46.
40. Extending an exit bid requires an explicit decision by the bidder and does not occur automatically. To further clarify this point: exit bids cannot be altered and cannot be selectively extended within a region (accordingly, if bidders have reduced their demand in a round by more than a block and subsequently placed several exit bids, those bids can then be extended only collectively but not singly.)

4.5 Total value of the bid and security to cover bids

41. The total value of the bids submitted by a bidder in one clock round (clock bid and active exit bids) is the sum of the highest newly submitted or extended active exit bids that could potentially be satisfied while considering the provision under 46.a and the clock bids specified by the bidder in the other regions.
42. The total value of the bids in one round must conform to the bank guarantee rules for bids as set out in section 5.3.5 of the Tender Document and must not exceed the corresponding bid limit. Bids submitted by phone or fax are exempt from the

above (see rule 11). Each bidder is individually responsible for increasing the security provided in good time in order to avoid any such restriction on submitting bids.

4.6 End of clock rounds

43. The final clock round is the round at the end of which the demand, aggregated as the clock bids from all bidders, does not exceed the supply in any region.
44. In every region in which the demand, aggregated as the clock bids from all bidders, exactly matches the supply available, the bidders win the number of frequency blocks that they have requested. The price at which each block is awarded is the current clock price in the respective region.
45. If the demand, aggregated as the clock bids from all bidders, is less than the supply available in a region, then the provisions below under 46 to 48 apply.
46. The auctioneer decides whether the exit bids submitted or extended in the last clock round (all active exit bids) can be used to assign the excess lots. The following provisions apply here:
 - a. The auctioneer considers only those combinations of a bidder's active exit bids which, when added to the clock bids submitted by that bidder in the other regions, implies an activity level that does not exceed the bidder's bidding eligibility at the beginning of the round in which the bidder first submitted the oldest and still active exit bid.
 - b. If exit bids from separate bidders could be considered, or if there are multiple combinations of exit bids that could potentially be considered for a single bidder, the auctioneer then identifies the combination of exit bids that generates the largest overall value. If several combinations could each generate this largest overall value, the combination is decided at random.
 - c. For regions in which exit bids are considered, the price at which a lot is awarded to any winner is the lowest price specified in an accepted exit bid.
47. If this does not result in the assignment of all lots and some frequency blocks therefore remain unsold at the end of the clock rounds, these are offered in an additional bidding round, if such a round is in the interests of efficient spectrum use. A decision to hold an additional bidding round is taken at the discretion of the auctioneer.
48. Examples for the clock rounds procedure and the determination of prices at which lots are awarded with exit bids are given in Appendix E-2.

4.7 Round extension rights

49. Each bidder is granted three round extension rights at the start of the clock rounds.

50. If a bidder with remaining round extension rights has submitted a clock bid for more than one frequency block in the previous clock round but does not submit a clock bid in that round within the round time set by the auctioneer, then the round is automatically extended by up to 30 minutes. While this costs the individual bidder a round extension right, the bidder thereby gains extra time to submit a bid.
51. Any round in which one or more bidders have exercised a round extension right ends no later than 30 minutes after the normal round period or, alternatively, once all bidders who have exercised a round extension right in that round have successfully submitted a bid.
52. Bidders who have submitted a bid during the prescribed round time may not use the additional period of time to revise their submitted bid. Bidders who have no further extension rights available and who did not place a bid in the prescribed round time may not submit a bid in the extension period. A zero bid is entered automatically for such bidders, i.e. a clock bid with zero demand in every region.
53. Each bidder may exercise no more than one round extension right per round.

4.8 Information at the end of clock rounds

54. After completion of each clock round, the auctioneer provides each bidder with the following information:
 - a. For each region, the aggregate excess demand (in other words, the total quantities requested in the clock bids minus the lots offered).
 - b. The clock bids submitted by each bidder.
 - c. Any exit bids that were submitted or extended.
 - d. The total value of the bids as defined in rule 41 and the amount by which this value is below the bid limit as determined by the bidder's bank guarantee.
 - e. The number of round extension rights remaining to the bidder.
55. After completion of the last clock round or at the beginning of the additional bidding round or the assignment stage, the auctioneer provides each bidder with the following information:
 - a. The number of frequency blocks awarded to the bidder in the respective region and the price at which awarded.
 - b. Whether any unsold lots exist and whether in this case an additional bidding round will be held.
 - c. In the event of an additional bidding round, the time of the start and the duration of that bidding round, plus the minimum bids applicable to each of

the unsold blocks and whether spectrum caps are being loosened, as well as the extent that the cap will be loosened for the particular bidder and the number of frequency blocks won in each region by each bidder during the principle stage.

- d. Otherwise, the number of frequency blocks won by all bidders in each region, as well as the date and time scheduled for the start of the assignment stage and its duration; this stage may not begin until after a period of at least two non-bidding days.

4.9 Additional bidding round

56. If unawarded frequency blocks remain in one or more regions after the last clock round, and if the auctioneer considers it in the interests of efficient spectrum use to attempt to award those blocks during the procedure, then those blocks are offered in an additional bidding round.
57. The auctioneer may also decide in this case to loosen spectrum caps and to apply revised caps as defined in rule 20.b.
58. The auctioneer sets a minimum bid per block for each region in which blocks are available for the additional bidding round:
 - a. If the auctioneer decides to loosen caps, then the minimum bid can be the same as the last clock price.
 - b. Otherwise, the minimum bid is the same as the clock price for the last clock round in which the activity level of all bidders together totalled at least 858 bidding points.
59. Bidders can then submit package bids for various combinations of unsold blocks. In the package bid, the bidder specifies the number of unsold blocks they wish to acquire in each region as well as the bid amount (as an integer in EUR) they are prepared to offer for those blocks. That bid amount must not be less than the value of the blocks in the package based on the valid minimum bids. In addition, the following restrictions apply:
 - a. Each bidder may specify as many blocks in a region as is permitted under the applicable spectrum cap when taking into account the blocks acquired after the last clock round.
 - b. Individual package bids are only valid if the sum of the bid amount and the price of the blocks awarded after the last clock round conforms to the bank guarantee rules set out in section 5.3.5 of the Tender Document and does not exceed the bid limit. Each bidder is individually responsible for increasing the security provided in good time in order to ensure that this restriction does not keep the bidder from submitting bids for any packages the bidder is interested in.

60. There are no round extensions in this bidding round.
61. After the end of the round, the auctioneer determines the combination of package bids with the highest total bid value that can be satisfied with the unsold blocks on offer, where no more than one bid is accepted from each bidder. If several combinations of package bids have the same highest total bid value, the combination is decided at random. The package bids belonging to that combination are considered the winning bids of the additional bidding round.
62. Successful bidders pay the price for their successful bids.
63. After completion of the additional bidding round or at the beginning of the assignment stage, the auctioneer provides each bidder with the following information:
 - a. The bidder's winning bid and the price at which it was awarded, as well as the total price of all blocks awarded to the bidder in the principle stage.
 - b. The number of frequency blocks in each region awarded to each bidder in the principle stage.
 - c. The date and time scheduled for the start of the assignment stage and its duration; this stage may not begin until after a period of at least two non-bidding days.

5 Assignment stage

64. The goal of the assignment stage is to determine how the available frequencies are to be distributed among the winners of the principle stage and which final price the winners should pay for the spectrum that they have won. The assignment stage comprises a single sealed bidding round in which the bidders place bids for the assignment options determined for them.
65. Winners of spectrum in various regions (or groups of regions) not connected geographically are divided into sub-bidders for the assignment stage and must submit separate assignment bids for those groups of regions (cf. step 1 in Appendix E-1).

5.1 Assignment options

66. At the start of the assignment stage, the auctioneer uses the auction system to provide all winners of frequency blocks with a full list of their assignment bid options for specific frequency blocks in each region, as determined in accordance with the following rules.
67. The assignment options satisfy the following conditions:
 - a. Each bidder in each region is assigned contiguous spectrum of a quantity equal to the amount of spectrum awarded in the principle stage.

- b. Bidders who have acquired an identical amount of spectrum in all regions are assigned the same specific frequencies in all regions.
 - c. For other bidders, the regional variation in the assignment of specific frequencies (in adjacent regions) is minimised to the greatest possible extent in accordance with the rules set out in Appendix E-1.
 - d. Insofar as is possible, bidders who have not acquired spectrum in all regions are assigned spectrum in the range 3410 to 3600 MHz.
68. A detailed description of the process for generating assignment options is given in Appendix E-1.

5.2 Assignment bids

69. There are no round extensions in this bidding round.
70. An assignment bid specifies the maximum amount that the bidder is prepared to pay for an assignment option in order to be assigned the spectrum specified in that option.
71. Any amount (in whole euros) can be bid for the individual assignment options. The minimum bid in the assignment stage is EUR 0 for each assignment option. There is no ceiling set for maximum bids.
72. If bidders do not submit an assignment bid for a potential assignment option designated for them, a corresponding bid of EUR 0 is generated automatically for that option. If bidders do not submit an assignment bid before the end of the assignment round, a bid with a bid amount of EUR 0 is generated automatically for each assignment option.

5.3 Determination of winners

73. After the end of the assignment bidding round, the auctioneer determines, from all bids submitted by bidders and generated automatically by the auction software, the combination of bids in each case that is able to satisfy the following conditions:
- a. Exactly one bid per bidder is considered.
 - b. The assignment of frequency blocks associated with the bids is mutually compatible and spectrum is uniquely assigned. Accordingly, the assignment results in a band plan in which individual bidders are assigned specific frequencies amounting to the spectrum won in the principle stage in each region, and no frequencies are assigned to more than one bidder. In the event that unsold blocks remain after the clock phase and the auctioneer decides not to hold an additional bidding round, an additional condition will be that the unsold spectra in each region must form a contiguous block.

- c. The sum of bid amounts is not lower than the sum of each alternative combination of bids that satisfies the first two conditions.
 - d. If only a single combination of assignment bids satisfies the conditions given in rule 73, then this is the combination of successful bids.
 - e. If multiple combinations of assignment bids meet the conditions given in rule 73, then the combination of successful assignment bids is determined at random.
74. Individual bidders receive the frequency blocks as specified in their bid within the successful combination of bids and pay the additional price in accordance with the rules below.

5.4 Price determination

75. For each successful assignment bid, an additional price required to be paid by the successful bidder is determined. Additional prices are determined collectively for all bidders and must meet the following conditions:
- a. The additional price for each and every successful bid cannot be negative. The additional price for each and every successful bid cannot be higher than the amount bid.
 - b. Additional prices are those prices with the lowest total value that satisfy the condition given in rule 75 (a) , and which ensure that the combination of successful bids at the respective additional prices satisfies the conditions given in rule 73. Accordingly, additional prices are the lowest prices that successful individual bidders would have had to bid in order to have been successful with their bids.
 - c. If only one combination of prices satisfies the conditions given in rule 75 (a) and (b), then those prices, rounded up to whole euros, are used as the additional prices.
 - d. If there are multiple groups of prices that fulfil these conditions, then the combination of prices, rounded up in each case to whole euros, used as the combination of additional prices is the combination that best approximates the combination of opportunity costs as determined individually for each individual winner (referred to as 'Vickrey nearest' prices). The opportunity costs determined individually for a bidder constitute the lowest bid in accordance with rule 75 (a) capable of ensuring that the combination of successful bids satisfies the conditions in rule 73 if all other winners pay their original bid amount.

5.5 End of the assignment stage

76. Once the auctioneer has determined the successful additional bids and the additional prices to be paid for these bids, bidders are informed about the specific frequency assignments in each of the bands.

77. Individual bidders are also informed about the additional price they have to pay.

Appendix E-1: Process for the determination of assignment options

For each bidder, the auctioneer determines the assignment options for which this bidder is eligible. This is completed on the basis of possible band plans meeting the conditions below:

- Specific frequencies are assigned to each bidder equalling the amount of spectrum acquired in each region by that bidder during the principle stage, whereby these frequency assignments do not overlap.
- Bidders who have acquired the same amount of spectrum in each region in the auction are assigned identical frequencies in each region.
- Where bidders have acquired spectrum in more than one region, but the amount of spectrum varies from one region to another, regional variation is minimised as far as possible when assigning the specific frequencies (in adjacent regions).
- Bidders who have not acquired spectrum in all regions will be placed in band 42 where possible (i.e. below 3600 MHz).

To achieve these goals, the following procedure is applied for the generation of assignment options:

- Step 1: The auctioneer identifies possible arrangements of bidders that minimise the assignment of non-identical frequencies across separate regions.
- Step 2: The auctioneer determines the band plans resulting from the possible arrangements of bidders (with each possible arrangement of bidders corresponding to precisely one band plan). If the auctioneer has decided to hold an additional bidding round, the unsold blocks remaining after the principle stage may be used to minimise any misalignment arising from assigning frequencies to bidders; otherwise, such unsold blocks will be reserved as contiguous spectrum for a future award procedure.
- Step 3: Where possible, the auctioneer eliminates band plans in which bidders who have acquired spectrum only in certain regions are assigned spectrum in band 43 (i.e. above 3600 MHz).
- Step 4: The auctioneer identifies the various frequency assignments for the individual bidders (for a specific bidder, these assignments may be identical across separate band plans).

In the following sections, these steps are illustrated with examples that are based on a simplified lot structure that comprises fewer regions and fewer frequency blocks than will be actually offered in the auction.

Step 1: Determining the possible arrangement of bidders

In the following, ‘bidder’ designates all winners of frequency blocks in the principle stage, as well as a hypothetical winner of all unsold blocks, whereby winners of frequencies in various regions (or groups of regions) not connected geographically are divided into sub-bidders.

If, for example, there are three winners having spectrum in all regions (A, B and C) and a winner D having spectrum in regions A01r, A02r, A04u and A04r, then the latter would be subdivided into two sub-bidders, D1 and D2, with one having spectrum in the regions A01r and A02r (D1) and the other in regions A04u and A04r. Band plans would subsequently be generated for the possible arrangements of six bidders, that is, for A, B, C, D1, D2 and U — the latter being the hypothetical winner of unsold lots.

Such a division into sub-bidders helps to additionally identify band plans that support better assignment of identical frequencies in geographically adjacent regions while accepting, as a compromise, the assignment of different frequencies in regions not connected geographically. The ‘regional variation in frequency amount’ (RVF) for a bidder is defined as the difference between the maximum and the minimum number of blocks that the bidder has won in a region. The RVF is therefore zero for a bidder who has won the same amount of spectrum in all regions. For a regional bidder who has acquired blocks in only one region, the RVF is equal to the number of blocks acquired. Similarly, the RVF for a group of bidders is defined as the difference between the maximum and the minimum number of blocks that this group of bidders has won in a region.

The aggregated RVF of a subdivision of bidders into non-overlapping subsets (that is, a partitioning of the overall set of bidders into non-empty and pairwise discrete subsets) is defined as the sum of the RVF of individual subsets.

The arrangements of bidders relevant for the determination of assignment options are created by successively partitioning the set of all bidders into subsets in such a way that the partition with the lowest aggregated RVF is chosen in each step.

If in one step several partitions with the same lowest aggregated RVF result, then the following criteria are applied in order to select one of those partitions:

- Criterion 1: The partition with the larger number of subsets is selected first.
- Criterion 2: Where multiple partitions satisfy that criterion, the partition having the largest subset with the fewest bidders is selected.
- Criterion 3: Where multiple partitions satisfy that criterion, a subdivision is chosen at random.

This approach creates a tree structure in which the root of the tree is the set of all bidders and the leaves of the tree are individual bidders. The possible arrangements of bidders are then derived from all possible permutations of the tree’s branches.

The following example illustrates the process.

We consider four regions of twelve blocks each, and four bidders. We assume that the result of the principle stage is as follows (with all regions connected geographically):

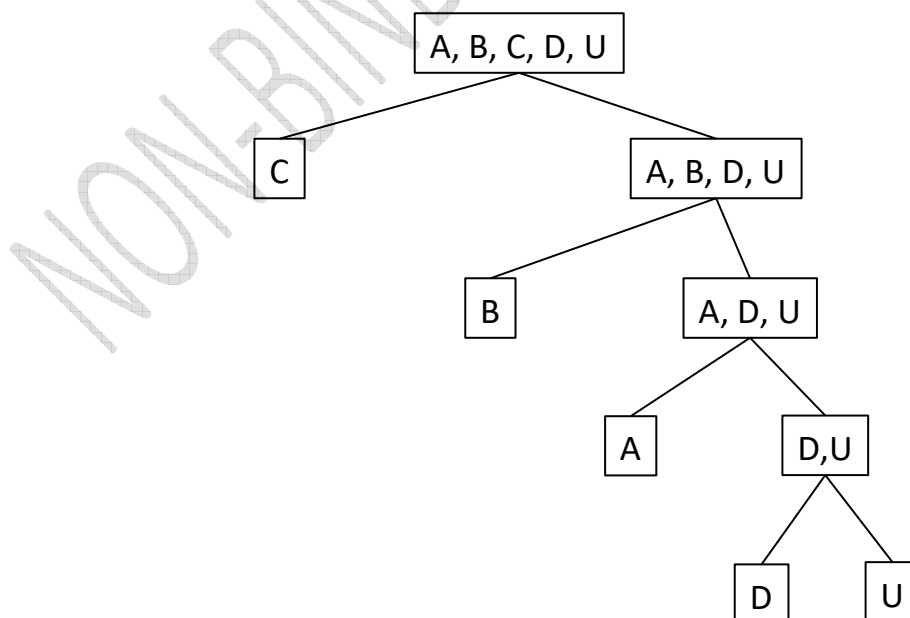
	Bidder A	Bidder B	Bidder C	Bidder D	Unsold
Region 1	4	4	4	0	0
Region 2	3	3	3	3	0
Region 3	4	3	3	2	0
Region 4	3	4	3	0	2

There are 52 possible partitions of the set of all bidders $\{A, B, C, D, U\}$ of which one is the set itself. Three of the remaining partitions have the lowest aggregated RVF of 2, namely: $\{A\}$, $\{B, C, D, U\}$; $\{B\}$, $\{A, C, D, U\}$; and $\{C\}$, $\{A, B, D, U\}$. Neither criterion 1 nor criterion 2 is applicable, and so a combination is chosen randomly. Let this be $\{C\}$, $\{A, B, D, U\}$.

For the set $\{A, B, D, U\}$, there are 15 possible partitions, of which one is again the set itself. Two of the 14 remaining partitions have the same lowest aggregated RVF of 3, namely: $\{A\}$, $\{B, D, U\}$; and $\{B\}$, $\{A, D, U\}$. Neither criterion 1 nor criterion 2 produces a definitive result, and so one of these partitions is picked at random. Let this be $\{B\}$, $\{A, D, U\}$.

For the set $\{A, D, U\}$, there are five possible partitions, of which one is again the set itself. Of the four remaining partitions, the lowest aggregated RVF is present in only one partition, namely $\{A\}$, $\{D, U\}$.

This produces the following tree structure:



This structure can in turn be used to derive the following possible bidder arrangements:

C	B	A	D	U
C	B	A	U	D
C	B	D	U	A
C	B	U	D	A
C	A	D	U	B
C	A	U	D	B
C	D	U	A	B
C	U	D	A	B
B	A	D	U	C
B	A	U	D	C
B	D	U	A	C
B	U	D	A	C
A	D	U	B	C
A	U	D	B	C
D	U	A	B	C
U	D	A	B	C

Of 120 possible arrangements of bidders, only 16 therefore remain eligible for subsequent consideration. One arrangement that is excluded is A B C D U, for example, because this arrangement would fail to take advantage of the option of placing D with A to compensate for the differences in the amount of spectrum won by the two bidders in regions 2 and 3 and thus achieve a better balancing out of regional assignments.

One consequence of this process is that bidders who win the same amount of spectrum in all regions will always receive contiguous spectrum. Such bidders are already identified in the first partitioning step as an endpoint because they have an RVF of zero and therefore do not contribute to the aggregated RVF of a partition. Since they do increase the number of subsets, however, criterion 1 is applied and other possible partitions are preferred.

Each of these arrangements represents a band plan. The arrangement A D U B C produces the following band plan, for example:

Region 1	A	A	A	A	B	B	B	B	C	C	C	C
Region 2	A	A	A	D	D	D	B	B	B	C	C	C
Region 3	A	A	A	A	D	D	B	B	B	C	C	C
Region 4	A	A	A	U	U	B	B	B	C	C	C	C

Not all of these band plans differ from one another. In the specific case, an arrangement with ... D U ... produces the exact same band plan as the arrangement ... U D ... because there is no region in which 'D winning' and 'unsold blocks' are both true.

Overall, eight different potential band plans remain after this step.

Step 2: Placing unsold blocks

If the auctioneer has decided to hold an additional bidding round and unsold blocks are left over afterwards, such blocks can be used to reduce any misalignment associated with a frequency assignment.

A misalignment associated with a frequency assignment to a bidder is defined as the difference between the frequency assignment spread and the maximum number of frequency blocks that the bidder has acquired in a single one of those regions (with winners of spectrum in regions or groups of regions not connected geographically being regarded as different sub-bidders). The frequency assignment spread is defined as the distance between the lowest and highest frequency blocks assigned in any region. Assuming, for example, that a bidder has won ten blocks in region A03u and eight in A03r, the assignment of blocks A03uL01 to A03uL10 and A03rL05 to A03rL12 would result in a misalignment of two, as the frequency assignment spread (twelve blocks: L01 to L12) would exceed the maximum number of blocks won by the bidder. If we consider the arrangement of bidders A D U B C cited in the example above, then the misalignment for bidders A, D and C is zero in each case, and equal to one for bidder B:

- The frequency assignment spread for bidders A and C is four⁴ in each case and both win a maximum of four blocks. The misalignment here is therefore zero. The same applies to bidder D, except with a maximum of three blocks and a spread of three blocks.
- The spread equals five for bidder B, who wins a maximum of four blocks. This means that the frequency assignment spread is one block larger than absolutely necessary. The misalignment is therefore equal to one.

Accordingly, the aggregate misalignment associated with a band plan is the sum of the misalignments for the individual bidders in that band plan (without accounting for the hypothetical bidder who has been awarded the unsold lots).

⁴ Block 1 is the lowest assigned to bidder A and block 4 the highest; block 9 is the lowest block assigned to bidder C while block 12 is the highest.

For each of the band plans identified in the first step, we determine whether a redistribution (separation and division) of the unsold blocks and a placement between bidders could achieve a reduction in the aggregate misalignment; note that multiple options for the distribution of unsold blocks could exist for individual band plans. Where the aggregate misalignment of any band plans can be reduced by the redistribution of unsold blocks, those band plans are replaced by others having correspondingly redistributed unsold lots. Where there are multiple options for redistributing the unsold blocks that all result in the same minimum degree of aggregate misalignment, then the band plan having the maximum number of blocks in their original position is selected; where more than one such band plan exists, the choice is made at random.

For the above band plans, it is not possible to achieve a reduction in the aggregate misalignment by splitting up and redistributing the two unsold blocks in region 4.

Step 3: Excluding where possible band plans that place regional bidders in band 43

In the next step, we determine whether it is possible to eliminate band plans that assign spectrum in band 43 to bidders that have not received spectrum in all regions. The specific procedure is as follows:

- First, the auctioneer determines the minimum aggregate misalignment for all band plans (even the ones assigning frequencies in band 43 to regional bidders).
- The auctioneer then identifies all band plans that assign only frequencies in band 42 to regional bidders (if such band plans exist).
- In the event that one of those band plans exhibits the minimum aggregate misalignment (in other words, minimises the aggregate misalignment across all band plans), then all band plans assigning frequencies in band 43 to regional bidders can be eliminated.
- Otherwise — in the event that the minimum aggregate misalignment can be achieved only through a band plan assigning frequencies in band 43 to at least one regional bidder — only those band plans are eliminated that assign spectrum in band 43 to regional bidders and have a degree of aggregate misalignment larger than the minimum aggregate misalignment.

In the above example, we can exclude four band plans that would assign spectrum in the upper band to bidder D. Specifically, the first, third and fifth band plans, having an aggregate misalignment of one, can be eliminated, since band plans with the same degree of aggregate misalignment remain that allow an arrangement of regional winners in band 42 (namely the fourth, sixth and seventh band plans).

Anordnung	Bandplan	Bandplan		Zulässig?
		Band 42	Band 43	
	R1 R2 R3 R4			X
	R1 R2 R3 R4			X
	R1 R2 R3 R4			X
	R1 R2 R3 R4			✓
	R1 R2 R3 R4			X
	R1 R2 R3 R4			✓
	R1 R2 R3 R4			✓
	R1 R2 R3 R4			✓

Step 4: Identifying assignment options

In this last step, we identify the assignment options for each bidder that are compatible with the respective band plans. In our example, these are the following options for bidder A:

Option	Blocks
1	(5–8) in R1, (7–9) in R2, (6–9) in R3, (6–8) in R4
2	(5–8) in R1, (7–9) in R2, (6–9) in R3, (7–9) in R4
3	(1–4) in R1, (1–3) in R2, (1–4) in R3, (1–3) in R4
4	(1–4) in R1, (4–6) in R2, (3–6) in R3, (3–5) in R4

The procedure for generating band plans involves selecting a partition on the basis of specified criteria in the event that multiple partitions exist with the same degree of minimum aggregate RFV. Due to this procedure, various options could potentially be identified for arranging bidders with identical spectrum portfolios. In such a case, each of the bidders is offered all arrangement options for such bidders.

Appendix E-2: Examples for clock round progress and the handling of exit bids

The following examples serve to illustrate possible auction progress and the valuation of exit bids in particular. The examples simplify the regional structure and do not use prices that reflect the actual prices. To simplify the examples, it is also assumed that each block is assigned one bidding point.

Example 1: Clock rounds without exit bids

The following simple example illustrates clock round progress based on three bidders (X, Y and Z) and no submission of exit bids.

In clock round n, there is excess demand in regions A and B; the prices for these regions increase accordingly.

In the next round, bidder X reduces their demand in region B. Bidder Y bids for fewer blocks in regions A and B, but increases their demand in region C. Bidder Z transfers their demand from region B to region C. While there is still excess demand in A, this is no longer true for B. However, demand in C now exceeds the available supply.

In the following round, Y reduces their demand in A and C, and Z reduces their demand in C. The total demand in all regions is now the same as the available supply and the clock rounds end.

		Region (supply)		
		A (39)	B (39)	C (39)
Round n	Prices	100	50	50
	Bid X	15	15	15
	Bid Y	15	15	12
	Bid Z	12	15	12
	Total demand	42	45	39
	Excess demand?	Y	Y	N
Round n+1	Prices	110	55	50
	Bid X	15	13	15
	Bid Y	13	13	15
	Bid Z	12	13	14
	Total demand	40	39	44
	Excess demand?	Y	N	Y
Round n+2	Prices	120	55	55
	Bid X	15	13	15
	Bid Y	12	13	12
	Bid Z	12	13	12
	Total demand	39	39	39
	Excess demand?	N	N	N

The bidders win the following combinations of frequency blocks at the following prices:

	A (@ 120)	B (@ 55)	C (@ 55)	Winning price
X	15	13	15	3340
Y	12	13	12	2815
Z	12	13	12	2815

Example 2: Clock round with simple exit bids

The following example considers the actions of a single bidder (plus aggregated demand from other bidders, as appropriate).

In clock round n, the bidder submits a bid for 15 blocks in each region. We assume that the bids from other bidders are such that excess demand is created in regions A and C, and prices rise accordingly.

We assume that the bidder reduces their demand and in the next round bids for only 13 blocks in those two regions. The bidder has reduced their total demand and may now submit exit bids. More precisely: the bidder may specify the maximum price at which they would be interested in 14 or 15 blocks in each region. We assume that the bidder submits the exit bids shown below.

We further assume that the other bidders make no changes to their demand. In this case, the clock rounds end, since there is no longer any excess demand in any region. In regions A and B, the aggregated demand from the clock bids exactly equals the supply. In region C, however, there is now excess supply. However, since the bidder has specified a demand for a number of blocks that balances out supply and demand, the corresponding exit bid is accepted for 14 blocks and all bidders win their blocks in this region at the price of the accepted exit bid – i.e. 53 – instead of the clock price (55).

		Region (supply)		
		A (39)	B (39)	C (39)
Round n	Prices	100	50	50
	Clock bid	15	15	15
	Bids of other bidders	26	24	25
	Total demand	41	39	40
	Excess demand/excess supply?	2	0	1
Round n+1	Prices	110	50	55
	Clock bid	13	15	13
	Others	26	24	25
	Total demand	39	39	38
	Excess demand/excess supply?	0	0	-1
	Exit bids	15 @ 103 14 @ 106		15 @ 52 14 @ 53

Variante A: If the bidder had not submitted an exit bid for 14 blocks, but only placed an exit bid for 15 blocks, then it would not have been possible to accept a market-clearing exit bid. In this case, the clock rounds would end with the clock prices. One lot in region C would remain unsold at the end of the clock rounds and would be offered in the additional bidding round.

Variante B: If one of the other bidders had reduced their demand for lots in region C by one block (from 13 to 12 blocks, for example) and submitted a corresponding exit bid for the additional block (e.g. 13@P), then the amounts of the exit bids would have decided which of the exit bids would have been accepted. There would now be an excess supply of two blocks at the clock price and it would therefore be possible to accept our bidder's exit bid for 15 blocks. As an alternative, the auctioneer could also accept the exit bid of the other bidder and the exit bid of our bidder for 14 blocks. The auctioneer would do this if P was larger than 51: in this case, the value of the exit bids of both bidders for one block would be larger than the value of the exit bid of our bidder for two blocks. If P was 51.5, for example, then the auctioneer would accept the exit bids of both bidders for an additional block in each case, and all blocks in this region would be awarded for 51.5.

Example 3: Exit bids from a bidder with increased demand in other regions

In this example, the bidder reduces their demand in regions A and C while simultaneously increasing demand in region B. Overall, however, the number of requested blocks decreases, and our bidder may therefore submit exit bids – namely in every region in which they reduced demand. Not all exit bids can be satisfied, however.

We assume that the bidder submits the following clock bids and exit bids. Simultaneously, the other bidders reduce their demand, so that the clock rounds end with excess supply in regions A and C, but without placing any exit bids.

		Region (supply)		
		A (39)	B (39)	C (39)
Round n	Prices	100	50	50
	Clock bid	15	15	15
	Bids of other bidders	26	23	25
	Total demand	41	38	40
	Excess demand/excess supply?	2	-1	1
Round n+1	Prices	110	50	55
	Clock bid	14	16	14
	Others	24	23	24
	Total demand	38	39	38
	Excess demand/excess supply?	-1	0	-1
	Exit bids	15 @ 105		15 @ 52

Considering the excess supply, both of the bidder's exit bids could be accepted. As a result, however, the total number of blocks awarded (46) would imply an activity level (46 bidding points) that exceeds the bidder's eligibility level (45). The auctioneer may therefore accept only one of the two exit bids. The decision as to which bid to accept is made by considering which bid produces the greatest overall value.

If we are merely required to identify which of a bidder's several possible exit bids is to be accepted, we can focus solely on the relevant bidder and concentrate on the values as expressed by this bidder in the submission of the various exit bids. The total value of the bids of the other bidders is independent of the specific exit bid we accept; it would only act as an additive factor in the comparison and would therefore not influence it.

- The value expressed by the exit bid for 15 blocks in region A is $15 \times 105 + 16 \times 50 + 14 \times 55 = 3145$
- The value expressed by the exit bid for 15 blocks in region C is $14 \times 110 + 16 \times 50 + 15 \times 52 = 3120$

Accordingly, the exit bid for 15 blocks in region A would be accepted. One lot in region C remains unsold and could be subsequently offered in an additional bidding round.

The value of the bids accepted from other bidders is in both cases the same, namely $24 \times 110 + 23 \times 50 + 24 \times 55 = 5110$. If a total value comparison were to be made across all bidders, then this value would simply be added to the above values – but this would not alter the final decision.

This is summarised in the following table.

Exit bid		A	B	C	Value as expressed by bidder	Total value
15 A @ 105	Volume	15	16	14*	3145	8255
	Price	105	50	55		
15 C @ 52	Volume	14*	16	15	3120	8230
	Price	110	50	52		

* Clock bid only, so one block remains unsold

Example 4: Exit bids from multiple bidders

This example considers the case in which multiple bidders reduce their demand and submit exit bids, although not all of these bids can be accepted. To simplify matters, we concentrate on two regions.

We assume that bidders submit the following clock bids and exit bids.

		Region (supply)	
		A (39)	B (39)
Round n	Prices	100	100
	Clock bid X	15	15
	Clock bid Y	15	15
	Clock bid Z	15	15
	Total demand	45	45
	Excess demand/excess supply?	6	6
Round n+1	Prices	110	110
	Clock bid X	8	10
	Clock bid Y	10	10
	Clock bid Z	12	12
	Total demand	30	32
	Excess demand/excess supply?	-9	-7
	Exit bid X	XE-A1: 13 @ 102 XE-A2: 10 @ 105	XE-B1: 14 @ 102 XE-B2: 12 @ 105
	Exit bid Y	YE-A: 14 @ 105	YE-B: 14 @ 105
Exit bid Z	ZE-A: 15 @ 102	ZE-B: 15 @ 109	

Accordingly, there is an excess supply of nine blocks in region A and of seven blocks in region B.

If we consider the various combinations of exit bids that the auctioneer could accept, the following picture emerges.

In region A, it is not possible to accept XE-A1, YE-A and ZE-A, since this would require a total of 42 blocks. Any other combination would be possible (although some combinations would leave blocks unsold). Both the combination of XE-A1 and YE-A with Z's clock bid and the combination of XE-A2, YE-A and ZE-A would assign exactly 39 blocks. The respective total values are as follows:

- XE-A1 + YE-A + Z clock: $13 \times 102 + 14 \times 105 + 12 \times 110 = 4116$
- XE-A2 + YE-A + ZE-A: $10 \times 105 + 14 \times 105 + 15 \times 102 = 4050$

Accordingly, the first combination is accepted.⁵ The winning price per lot in region A is therefore 102.

In region B, it is not possible to accept exit bids from all three bidders. It would be possible to accept the exit bid from Y and Z, for example, but only in conjunction with the clock bid from X. If we were to accept the clock bid from Y, then a maximum of XE-B1 and ZE-B could be accepted. The clock bid from Z could be accepted in conjunction with the exit bid from Y and XE-B2.

The combination of exit bids that delivers the highest value is X clock + YE-B + ZE-B with a value of $10 \times 110 + 14 \times 105 + 15 \times 109 = 4205$, and this is accepted by the auctioneer.⁶ The winning price per lot in region B is therefore 105.

The bidders therefore win the following packages at the following prices:

	A (@ 102)	B (@ 105)	Winning price
X	13	10	2376
Y	14	14	2898
Z	12	15	2799

Example 5: Extension of exit bids

In this example, the bidder first reduces their demand in regions A and C while simultaneously increasing demand in region B; which reduces overall their bidding eligibility. Since the number of blocks requested in regions A and C decreases, our bidder may therefore submit exit bids in these regions. In the course of the auction, the bidder again reduces their demand – first in region B and then again in region C.

We assume that the bidder submits the following clock bids and exit bids, and, in so doing, extends their exit bids wherever possible. Simultaneously, the other bidders also change their demand. Accordingly, the clock rounds end with excess supply in all regions – but not before an additional round would first be held with excess demand

⁵ Every other combination that leaves blocks unsold produces a lesser value.

⁶ All other combinations (including the combination XE-B1 + Y clock + ZE-B, which awards all blocks) produce a lesser value.

in region C, however, and the size of the excess supply in region B would be reduced from the penultimate round to the last round.

As a result of the increase in demand in region C in round $n + 2$, the exit bid placed by the bidder in this region becomes void. The exit bid in region A remains valid, however. Accordingly, the oldest exit bid at the end of the clock rounds originates from round $n + 1$, in which the bidder, based on bidding eligibility, could have acquired up to 45 blocks (in the round prior to this one, the bidder placed bids for 45 blocks).

The bidder's last clock round comprises 39 blocks. Due to the bidder's bidding eligibility in round $n + 1$, all of the exit bids placed as well as the extended active exit bids could be considered, namely six blocks in total (one additional block in region A, up to four additional blocks in region B and one additional block in region C).

Considering the excess supply, however, these exit bids cannot be satisfied in their entirety. The bidder in fact wins:

- 15 blocks in region A, with an additional price for all bidders of 105 per block;
- 15 blocks in region B, with an additional price for all bidders of 51 per block; and
- 14 blocks in region C, with an additional price for all bidders of 55 per block.

This adds up to a total demand of 44 blocks, which significantly surpasses the bidder's total demand at clock prices in round $n + 2$ (the penultimate clock round). This demonstrates how exit bids, while not counting towards a bidder's total demand and therefore not contributing to the retention of bidding eligibility, nonetheless maintain the bidder's option to acquire spectrum in an amount that the bidder could have bought at the point in time when the oldest exit bid still valid was placed.

		Region (supply)		
		A (39)	B (39)	C (39)
Round n	Prices	100	50	50
	Clock bid	15	15	15
	Bids of other bidders	28	24	28
	Total demand	43	39	43
	Excess demand/excess supply?	4	0	4
Round n+1	Prices	110	50	55
	Clock bid	14	16	14
	Others	24	32	24
	Total demand	38	48	38
	Excess demand/excess supply?	-1	9	-1
	Exit bids	15 @ 105		15 @ 52
Round n+2	Prices	110	55	55
	Clock bid	14	12	14
	Others	24	23	28
	Total demand	38	35	42
	Excess demand/excess supply?	-1	-4	3
	Exit bids	15 @ 105	16 @ 50 15 @ 51 14 @ 52 13 @ 53	15 @ 52
Round n+3	Prices	110	55	60
	Clock bid	14	12	13
	Others	24	24	25
	Total demand	38	36	38
	Excess demand/excess supply?	-1	-3	-1
	Exit bids	15 @ 105	16 @ 50 15 @ 51 14 @ 52 13 @ 53	14 @ 55

F. Appendices to the terms and conditions of use

F.1 Appendix: Commission Decision of 21 May 2008 (2008/411/EC)

F.2 Appendix: Commission Implementing Decision of 2 May 2014 (2014/276/EU)

F.3 Appendix: Agreement on 3400–3800 MHz (Austria, Germany, Liechtenstein and Switzerland)

F.4 Appendix: Agreement on 3400–3800 MHz (Austria, Croatia, Hungary, Serbia, Slovak Republic, Slovenia; in English)

F.5 Appendix: Coordinates and diagram of the absolute protection zone for Aflenz

NON-BINDING TRANSLATION

ENTSCHEIDUNG DER KOMMISSION

vom 21. Mai 2008

zur Harmonisierung des Frequenzbands 3 400—3 800 MHz für terrestrische Systeme, die elektronische Kommunikationsdienste in der Gemeinschaft erbringen können

(Bekannt gegeben unter Aktenzeichen K(2008) 1873)

(Text von Bedeutung für den EWR)

(2008/411/EG)

DIE KOMMISSION DER EUROPÄISCHEN GEMEINSCHAFTEN —

auch Zugang zu gleichwertigen Diensten in jedem anderen Mitgliedstaat erhalten.

gestützt auf den Vertrag zur Gründung der Europäischen Gemeinschaft,

(4) Gemäß Artikel 4 Absatz 2 der Entscheidung Nr. 676/2002/EG erteilte die Kommission der Europäischen Konferenz der Verwaltungen für Post und Fernmeldewesen (nachfolgend „CEPT“ genannt) am 4. Januar 2006 ein Mandat zur Feststellung der Bedingungen für die Bereitstellung harmonisierter Funkfrequenzbänder in der EU für Anwendungen des drahtlosen Breitbandzugangs (BWA).

gestützt auf die Entscheidung Nr. 676/2002/EG des Europäischen Parlaments und des Rates vom 7. März 2002 über einen Rechtsrahmen für die Funkfrequenzpolitik in der Europäischen Gemeinschaft (Frequenzentscheidung) ⁽¹⁾, insbesondere auf Artikel 4 Absatz 3,

(5) In ihrem aufgrund dieses Mandats vorgelegten Bericht zum drahtlosen Breitbandzugang (CEPT-Bericht 15) kommt die CEPT zu dem Schluss, dass der Aufbau von Festnetzen, ortsungebundenen Netzen und Mobilfunknetzen im Frequenzband 3 400—3 800 MHz unter den technischen Bedingungen, die in der Entscheidung ECC/DEC/(07)02 und in der Empfehlung ECC/REC/(04)05 des Ausschusses für elektronische Kommunikation festgelegt sind, technisch durchführbar ist.

in Erwägung nachstehender Gründe:

(1) Die Kommission hat in ihrer Mitteilung „Zügiger Zugang zu Frequenzen für drahtlose elektronische Kommunikationsdienste durch mehr Flexibilität“ ⁽²⁾, in der sie sich u. a. auch auf das Frequenzband 3 400—3 800 MHz bezieht, eine flexiblere Frequenznutzung befürwortet. Technologieneutralität und Dienstneutralität sind von den Mitgliedstaaten im Rahmen der Gruppe für Frequenzpolitik (RSPG) in ihrer Stellungnahme vom 23. November 2005 zur Politik für den Drahtloszugang zu elektronischen Kommunikationsdiensten (WAPECS) als wichtige politische Ziele zur Erreichung einer flexibleren Frequenznutzung hervorgehoben worden. In dieser Stellungnahme vertritt die Gruppe für Frequenzpolitik ferner die Auffassung, dass diese Ziele nicht unvermittelt, sondern schrittweise verwirklicht werden sollten, um Marktstörungen zu vermeiden.

(6) Angesichts der großen Marktnachfrage nach terrestrischen elektronischen Kommunikationsdiensten für den Breitbandzugang in diesen Frequenzbändern sollten die Ergebnisse des der CEPT erteilten Mandats in der Gemeinschaft Anwendung finden und von den Mitgliedstaaten unverzüglich umgesetzt werden. In Anbetracht der Unterschiede, die derzeit auf nationaler Ebene bei der Nutzung und der Marktnachfrage in den Teilbändern 3 400—3 600 MHz und 3 600—3 800 MHz bestehen, sollten für die Zuweisung und Bereitstellung der beiden Teilbänder unterschiedliche Termine festgesetzt werden.

(2) Die Zuweisung des Frequenzbands 3 400—3 800 MHz für feste, ortsungebundene und mobile Anwendungen ist ein wichtiger Schritt zur Bewältigung der Konvergenz des Mobilfunk-, Festnetz- und Rundfunksektors, der auch der technischen Innovation gerecht wird. Die in diesem Frequenzband erbrachten Dienstleistungen sollten hauptsächlich den Zugang der Endnutzer zur Breitbandkommunikation ermöglichen.

(7) Die Zuweisung und Bereitstellung des Frequenzbands 3 400—3 800 MHz im Einklang mit den Ergebnissen des BWA-Mandats trägt der Tatsache Rechnung, dass es in diesen Frequenzbändern bereits andere Anwendungen gibt und auch nicht ausgeschlossen ist, dass diese Bänder künftig von anderen Systemen oder Diensten genutzt werden, denen sie im Einklang mit der ITU-Vollzugsordnung für den Funkdienst zugewiesen sind (nicht-ausschließliche Zuweisung). Geeignete Kriterien für eine gemeinsame Frequenznutzung, die ein Nebeneinander mit anderen Systemen und Diensten in denselben oder in benachbarten Frequenzbändern ermöglichen, sind im ECC-Bericht 100 enthalten. Darin wird u. a. bestätigt, dass eine gemeinsame Frequenznutzung mit Satellitendiensten angesichts des Ausbaus solcher Dienste in Europa und der geografischen Trennungserfordernisse nach einer Einzelfallprüfung der tatsächlichen topografischen Bedingungen oft möglich ist.

(3) Es wird erwartet, dass die drahtlosen elektronischen Kommunikationsdienste, denen das Frequenzband 3 400—3 800 MHz zugewiesen werden soll, weitgehend europaweite Dienste insofern sein werden, als die Nutzer solcher Kommunikationsdienste in einem Mitgliedstaat

⁽¹⁾ ABl. L 108 vom 24.4.2002, S. 1.

⁽²⁾ KOM(2007) 50.

- (8) Frequenzblock-Entkopplungsmasken (Block Edge Masks, BEM) sind technische Parameter, die für den gesamten Frequenzblock eines bestimmten Frequenznutzers gelten, und zwar unabhängig von der Anzahl der Kanäle, welche die von ihm gewählte Technik belegt. Diese Masken sollen Bestandteil des Genehmigungssystems für die Frequenznutzung sein. Sie gelten sowohl für Aussendungen innerhalb eines Frequenzblocks (blockinterne Sendeleistung) als auch die Aussendungen außerhalb des Blocks (Außerblockaussendungen). Sie stellen regulatorische Anforderungen dar, die dem Management des Risikos funkt technischer Störungen zwischen benachbarten Netzen dienen und unbeschadet der Grenzwerte gelten, die in den gemäß der Richtlinie 1999/5/EG des Europäischen Parlaments und des Rates vom 9. März 1999 über Funkanlagen und Telekommunikationsendeinrichtungen und die gegenseitige Anerkennung ihrer Konformität (FuTEE-Richtlinie) ⁽¹⁾ aufgestellten Gerätenormen festgelegt sind.
- (9) Die Harmonisierung der technischen Bedingungen für die Verfügbarkeit und effiziente Nutzung der Funkfrequenzen umfasst weder Fragen der Zuteilung, Genehmigungsverfahren oder Befristung, noch die Frage der Anwendung wettbewerbsorientierter Auswahlverfahren zur Frequenz-zuteilung; diese Aufgaben werden von den Mitgliedstaaten im Einklang mit dem Gemeinschaftsrecht wahrgenommen.
- (10) Unterschiedliche Ausgangssituationen in den Mitgliedstaaten könnten zu Wettbewerbsverzerrungen führen. Der geltende Rechtsrahmen sieht jedoch Instrumente vor, mit denen die Mitgliedstaaten solche Probleme in angemessener, nicht diskriminierender und objektiver Weise sowie unter Beachtung des Gemeinschaftsrechts bewältigen können, vor allem im Einklang mit der Richtlinie 2002/20/EG des Europäischen Parlaments und des Rates vom 7. März 2002 über die Genehmigung elektronischer Kommunikationsnetze und -dienste (Genehmigungsrichtlinie) ⁽²⁾ und der Richtlinie 2002/21/EG des Europäischen Parlaments und des Rates vom 7. März 2002 über einen gemeinsamen Rechtsrahmen für elektronische Kommunikationsnetze und -dienste (Rahmenrichtlinie) ⁽³⁾.
- (11) Aus der Nutzung des Frequenzbands 3 400-3 800 MHz durch andere bestehende Anwendungen in Drittländern können sich in mehreren Mitgliedstaaten Beschränkungen bei der Einführung und Nutzung dieser Bänder für elektronische Kommunikationsnetze ergeben. Informationen über solche Beschränkungen sollten der Kommission gemäß Artikel 7 und Artikel 6 Absatz 2 der Entscheidung 676/2002/EG übermittelt und gemäß Artikel 5 der Entscheidung 676/2002/EG veröffentlicht werden.
- (12) Um eine effektive Nutzung des Frequenzbands 3 400—3 800 MHz auch langfristig sicherzustellen, soll-

ten die Behörden weiterhin Studien zur Steigerung der Effizienz und zu innovativen Nutzungsarten, z. B. vermaschten Netzarchitekturen, durchführen. Solche Studien sollten bei Überlegungen zur Überprüfung dieser Entscheidung berücksichtigt werden.

- (13) Die in dieser Entscheidung vorgesehenen Maßnahmen stimmen mit der Stellungnahme des Funkfrequenzausschusses überein —

HAT FOLGENDE ENTSCHEIDUNG ERLASSEN:

Artikel 1

Diese Entscheidung dient der Harmonisierung der Bedingungen für die Verfügbarkeit und die effiziente Nutzung des Frequenzbands 3 400—3 800 MHz für terrestrische Systeme, die elektronische Kommunikationsdienste erbringen können, unbeschadet des Schutzes und weiteren Betriebs anderer bestehender Nutzungsarten in diesem Band.

Artikel 2

(1) Spätestens sechs Monate nach Inkrafttreten dieser Entscheidung sorgen die Mitgliedstaaten für die nicht-ausschließliche Zuweisung und Bereitstellung des Frequenzbands 3 400—3 600 MHz für terrestrische elektronische Kommunikationsnetze in Übereinstimmung mit den Parametern im Anhang dieser Entscheidung.

(2) Zum 1. Januar 2012 sorgen die Mitgliedstaaten für die nicht-ausschließliche Zuweisung und die anschließende Bereitstellung des Frequenzbands 3 600—3 800 MHz für terrestrische elektronische Kommunikationsnetze in Übereinstimmung mit den Parametern im Anhang dieser Entscheidung.

(3) Die Mitgliedstaaten stellen sicher, dass die in Absatz 1 und 2 genannten Netze einen ausreichenden Schutz der Systeme in benachbarten Frequenzbändern gewährleisten.

(4) In geografischen Gebieten, in denen die Koordinierung mit Drittländern ein Abweichen von den Parametern im Anhang dieser Entscheidung erforderlich macht, sind die Mitgliedstaaten nicht gehalten, die Verpflichtungen aus dieser Entscheidung zu erfüllen.

Die Mitgliedstaaten unternehmen alle möglichen Anstrengungen zur Behebung solcher Abweichungen, die sie der Kommission unter Angabe des betroffenen Gebiets mitteilen, und veröffentlichen die diesbezüglichen Informationen gemäß der Entscheidung Nr. 676/2002/EG.

Artikel 3

Die Mitgliedstaaten gestatten die Nutzung des Frequenzbands 3 400—3 800 MHz in Übereinstimmung mit Artikel 2 für feste, ortsungebundene und mobile elektronische Kommunikationsnetze.

⁽¹⁾ ABl. L 91 vom 7.4.1999, S. 10. Richtlinie geändert durch die Verordnung (EG) Nr. 1882/2003 (ABl. L 284 vom 31.10.2003, S. 1).

⁽²⁾ ABl. L 108 vom 24.4.2002, S. 21.

⁽³⁾ ABl. L 108 vom 24.4.2002, S. 33. Richtlinie geändert durch die Verordnung (EG) Nr. 717/2007 (ABl. L 171 vom 29.6.2007, S. 32).

Artikel 4

Die Mitgliedstaaten beobachten die Nutzung des Frequenzbands 3 400—3 800 MHz und teilen der Kommission ihre Erkenntnisse mit, um eine regelmäßige und rechtzeitige Überprüfung dieser Entscheidung zu ermöglichen.

Artikel 5

Diese Entscheidung ist an die Mitgliedstaaten gerichtet.

Brüssel, den 21. Mai 2008

Für die Kommission
Viviane REDING
Mitglied der Kommission

ANHANG

PARAMETER GEMÄß ARTIKEL 2

Die folgenden technischen Parameter werden als Frequenzblock-Entkopplungsmaske (Block Edge Mask, BEM) bezeichnet und sind ein wesentlicher Teil der notwendigen Bedingungen für ein Nebeneinander benachbarter Netze bei Fehlen bilateraler oder multilateraler Abkommen. Weniger strenge technische Parameter können angewandt werden, sofern diese zwischen den Betreibern solcher Netze vereinbart worden sind. In diesem Frequenzband betriebene Geräte können auch anderen als den folgenden EIRP-Höchstwerten ⁽¹⁾ entsprechen, sofern geeignete Störungsminderungstechniken eingesetzt werden, die den Anforderungen der Richtlinie 1999/5/EG genügen und mindestens einen gleichwertigen Störungsschutz bieten wie diese technischen Parameter ⁽²⁾.

A. HÖCHSTWERTE FÜR BLOCKINTERNE AUSSENDUNGEN

Tabelle 1

Höchstwerte der spektralen EIRP-Dichte für feste oder ortsungebundene Anwendungen zwischen 3 400—3 800 MHz

Stationsart	Maximale spektrale EIRP-Dichte (dBm/MHz) (dBm/MHz) (einschließlich Toleranzen und des Bereichs der automatischen Sendeleistungsregelung (ATPC))
Zentralstation (und Verstärkerstation auf der Abwärtsstrecke)	+ 53 Anmerkung 1
Endstelle (im Außenbereich) (und Verstärkerstation auf der Aufwärtsstrecke)	+ 50
Endstelle (im Innenbereich)	+ 42

Anmerkung 1: Der in der Tabelle für die Zentralstation angegebene Wert der spektralen EIRP-Dichte wird als geeignet für konventionelle 90°-Sektorantennen angesehen.

Tabelle 2

Höchstwerte der spektralen EIRP-Dichte für Mobilfunkanwendungen zwischen 3 400—3 800 MHz

Stationsart	Maximale spektrale EIRP-Dichte (dBm/MHz) (Mindestbereich der automatischen Sendeleistungsregelung (ATPC): 15 dB)
Zentralstation	+ 53 Anmerkung 1
Endstelle	+ 25

Anmerkung 1: Der in der Tabelle für die Zentralstation angegebene Wert der spektralen EIRP-Dichte wird als geeignet für konventionelle 90°-Sektorantennen angesehen.

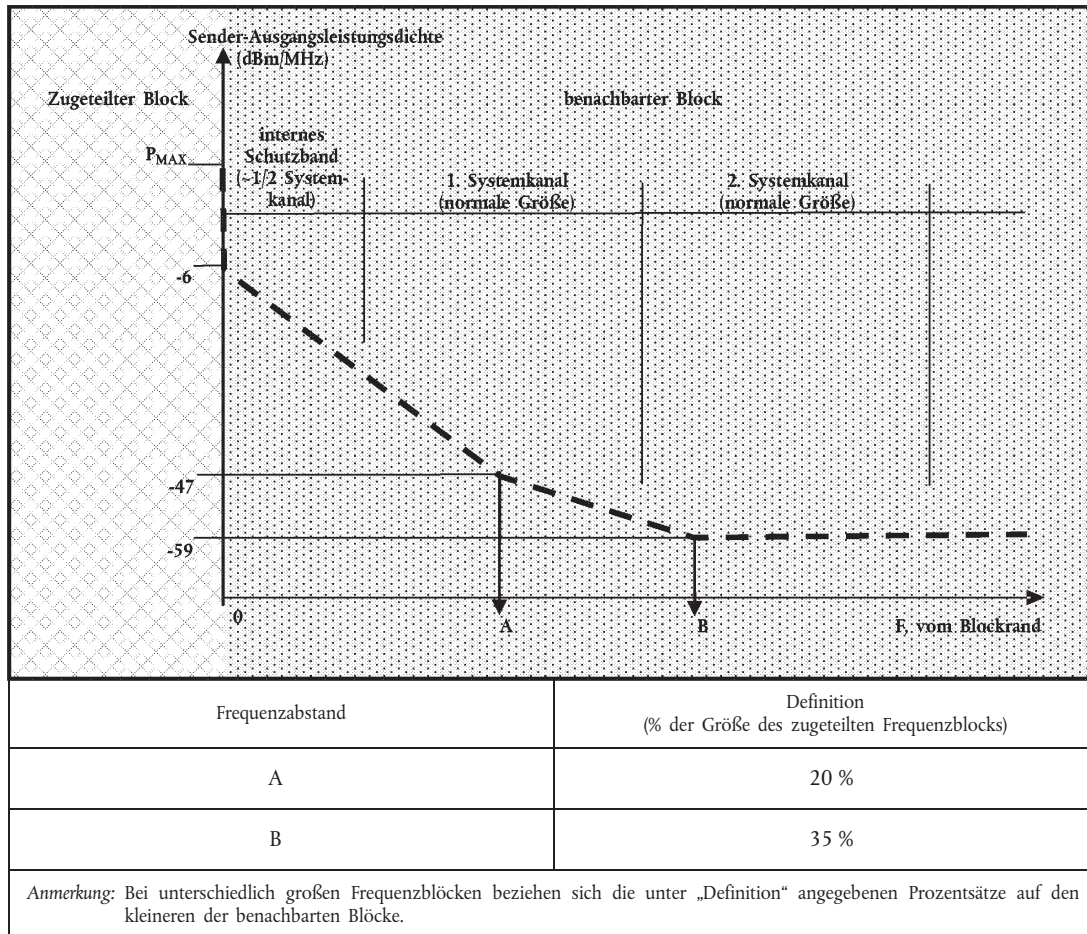
⁽¹⁾ EIRP bedeutet *äquivalente isotrope Strahlungsleistung* (Equivalent Isotropic Radiated Power).

⁽²⁾ Die allgemeinen technischen Bedingungen für feste und ortsungebundene Netze sind in den harmonisierten Normen EN 302 326-2 und EN 302 326-3 beschrieben, die auch Begriffsbestimmungen für Zentralstation und Endstelle enthalten. Der Begriff Zentralstation entspricht dem Begriff Basisstation, der im Zusammenhang mit zellularen Mobilfunknetzen verwendet wird.

B. HÖCHSTWERTE FÜR AUSSERBLOCKAUSSENDUNGEN (FREQUENZBLOCK-ENTKOPPLUNGSMASKE FÜR ZENTRALSTATIONEN)

Abbildung

Außerblockaussendungen der Zentralstation



Tabelle

Tabellarische Beschreibung der Frequenzblock-Entkopplungsmaske für die Zentralstation

Frequenzabstand	Höchstwerte für die Sender-Ausgangsleistungsdichte der Zentralstation (dBm/MHz)
Innerhalb des Bands (innerhalb des zugewellten Blocks)	Siehe Tabellen 1 und 2
$\Delta F = 0$	- 6
$0 < \Delta F < A$	$- 6 - 41 \cdot (\Delta F / A)$
A	- 47
$A < \Delta F < B$	$- 47 - 12 \cdot ((\Delta F - A) / (B - A))$
$\Delta F \geq B$	- 59

DURCHFÜHRUNGSBESCHLUSS DER KOMMISSION**vom 2. Mai 2014****zur Änderung der Entscheidung 2008/411/EG der Kommission zur Harmonisierung des Frequenzbands 3 400-3 800 MHz für terrestrische Systeme, die elektronische Kommunikationsdienste in der Gemeinschaft erbringen können***(Bekanntgegeben unter Aktenzeichen C(2014) 2798)***(Text von Bedeutung für den EWR)**

(2014/276/EU)

DIE EUROPÄISCHE KOMMISSION —

gestützt auf den Vertrag über die Arbeitsweise der Europäischen Union,

gestützt auf die Entscheidung Nr. 676/2002/EG des Europäischen Parlaments und des Rates vom 7. März 2002 über einen Rechtsrahmen für die Funkfrequenzpolitik in der Europäischen Gemeinschaft (Frequenzentscheidung) ⁽¹⁾, insbesondere auf Artikel 4 Absatz 3,

in Erwägung nachstehender Gründe:

- (1) Die Entscheidung 2008/411/EG ⁽²⁾ der Kommission harmonisiert die technischen Bedingungen für die Nutzung der Funkfrequenzen im Frequenzband 3 400-3 800 MHz für die terrestrische Bereitstellung elektronischer Kommunikationsdienste in der gesamten Union mit dem Schwerpunkt auf drahtlosen Breitbanddiensten für Endnutzer.
- (2) Mit dem Beschluss Nr. 243/2012/EU des Europäischen Parlaments und des Rates ⁽³⁾ wurde ein Mehrjahresprogramm für die Funkfrequenzpolitik aufgestellt und das Ziel der Förderung einer größeren Verfügbarkeit drahtloser Breitbanddienste zum Nutzen der Bürger und Verbraucher in der Union festgesetzt. Entsprechend diesem Programm müssen die Mitgliedstaaten die von den Anbietern durchgeführte laufende Nachrüstung ihrer digitalen Kommunikationsnetze mit den modernsten und effizientesten Technologien unterstützen, damit sie im Einklang mit dem Grundsatz der Technologie- und Dienstneutralität ihre eigenen Frequenzdividenden erzielen können.
- (3) Gemäß Artikel 6 Absatz 2 des Beschlusses Nr. 243/2012/EU müssen die Mitgliedstaaten das Frequenzband 3 400-3 800 MHz unter den in der Entscheidung 2008/411/EG festgelegten Bedingungen verfügbar machen und in Abhängigkeit von der Marktnachfrage bis zum 31. Dezember 2012 die Nutzung dieses Bandes genehmigen, und zwar unbeschadet bereits vorhandener Dienste und zu Bedingungen, die den Verbrauchern einen einfachen Zugang zu drahtlosen Breitbanddiensten ermöglichen.
- (4) Das Frequenzband 3 400-3 800 MHz bietet ein beträchtliches Potenzial für den Ausbau drahtloser Breitbandnetze mit hoher Dichte und hoher Geschwindigkeit für die Bereitstellung innovativer elektronischer Kommunikationsdienste für Endnutzer. Die Nutzung dieses Frequenzbands für drahtlose Breitbanddienste soll zur Erreichung der wirtschaftlichen und sozialen Ziele der Digitalen Agenda für Europa beitragen.
- (5) Gemäß Artikel 4 Absatz 2 der Entscheidung Nr. 676/2002/EG erteilte die Kommission der Europäischen Konferenz der Verwaltungen für Post und Telekommunikation („CEPT“) am 23. März 2012 ein Mandat zur Ausarbeitung technischer Bedingungen für die Nutzung von Funkfrequenzen im Frequenzband 3 400-3 800 MHz, um den Entwicklungen auf dem Gebiet der Technik für den drahtlosen Breitbandzugang, insbesondere mit großen Kanalbandbreiten, Rechnung zu tragen und gleichzeitig eine effiziente Frequenznutzung zu gewährleisten.

⁽¹⁾ ABl. L 108 vom 24.4.2002, S. 1.

⁽²⁾ Entscheidung 2008/411/EG der Kommission vom 21. Mai 2008 zur Harmonisierung des Frequenzbands 3 400-3 800 MHz für terrestrische Systeme, die elektronische Kommunikationsdienste in der Gemeinschaft erbringen können (ABl. L 144 vom 4.6.2008, S. 77).

⁽³⁾ Beschluss Nr. 243/2012/EU des Europäischen Parlaments und des Rates vom 14. März 2012 über ein Mehrjahresprogramm für die Funkfrequenzpolitik (ABl. L 81 vom 21.3.2012, S. 7).

- (6) Aufgrund dieses Mandats legte die CEPT am 8. November 2013 einen Bericht (CEPT-Bericht 49) über die technischen Bedingungen der Harmonisierung der Frequenzen für terrestrische Drahtlossysteme im Frequenzband 3 400-3 800 MHz vor. Er enthält auch die Ergebnisse von Untersuchungen über die am wenigsten einschränkenden technischen Bedingungen (z. B. Frequenzblock-Entkopplungsmaske) sowie Frequenzregelungen und -grundsätze für die Koexistenz und Koordinierung von drahtlosen Breitbanddiensten und bestehenden Frequenznutzungen. Die im CEPT-Bericht 49 enthaltenen Ergebnisse für eine Frequenzblock-Entkopplungsmaske und die Koordinierungsgrundsätze beruhen auf dem Bericht 203 des Ausschusses für elektronische Kommunikation (*Electronic Communications Committee*, ECC).
- (7) Angesichts des rasch steigenden Bedarfs an schnellen drahtlosen Breitbanddiensten und der derzeit geringen Nutzung des Frequenzbands 3 400-3 800 MHz für solche drahtlosen Breitbanddienste sollten die Ergebnisse des der CEPT von der Kommission erteilten Mandats in der Union Anwendung finden und von den Mitgliedstaaten unverzüglich umgesetzt werden.
- (8) Einheitliche technische Bedingungen für den gesamten Frequenzbereich würden jenen Frequenznutzern zugutekommen, die drahtlose Breitbanddienste erbringen; dies würde wiederum die Verfügbarkeit entsprechender Ausrüstungen und eine kohärente Koordinierung zwischen Netzen unterschiedlicher Betreiber gewährleisten. Zu diesem Zweck sollte unter Beachtung der Grundsätze der Technologie- und Dienstneutralität eine Regelung für die bevorzugte Kanalbelegung im Frequenzband 3 400-3 600 MHz auf der Grundlage der Ergebnisse des CEPT-Berichts 49 festgelegt werden.
- (9) Der durch die Entscheidung 2008/411/EG geschaffene rechtliche Rahmen für die Nutzung des Frequenzbands 3 400-3 800 MHz sollte unverändert bleiben und somit den fortwährenden Schutz anderer bestehender Dienste in diesem Band gewährleisten. Insbesondere für Systeme des festen Funkdienstes über Satelliten (FSS) einschließlich der Bodenstationen wäre ein fortwährender Schutz durch angemessene Einzelfall-Koordinierung zwischen solchen Systemen und drahtlosen Breitbandnetzen und -diensten seitens der nationalen Behörden erforderlich.
- (10) Eine Nutzung der Frequenzen durch Betreiber drahtloser Breitbanddienste und durch andere bestehende Dienste im Frequenzband 3 400-3 800 MHz, insbesondere FSS-Bodenstationen, müsste auf der Grundlage der im CEPT-Bericht 49 dargelegten Vorgaben, bewährten Verfahren und Koordinierungsgrundsätze koordiniert werden. Diese Grundsätze betreffen die Koordinierungsverfahren, den Informationsaustausch, die Minimierung gegenseitiger Beschränkungen sowie bilaterale Vereinbarungen für eine rasche grenzübergreifende Koordinierung, wenn sich Basisstationen terrestrischer drahtloser Breitbandnetze und FSS-Bodenstationen in Hoheitsgebieten unterschiedlicher Mitgliedstaaten befinden.
- (11) In Anbetracht der Ausbreitungseigenschaften der Funkfrequenzen im Frequenzband 3 400-3 800 MHz und der geltenden harmonisierten technischen Bedingungen würde der Schutz bestehender Frequenznutzungen durch die Beachtung bestimmter bevorzugter Konfigurationen für den Ausbau drahtloser Breitbandnetze und -dienste erleichtert. Solche Konfigurationen sind u. a. kleine Funkzellen, der drahtlose Festnetzzugang, Backhaul-Verbindungen in drahtlosen Breitbandzugangsnetzen oder Kombinationen davon.
- (12) Dieser Beschluss sollte zwar unbeschadet des Schutzes und weiteren Betriebs anderer bestehender Nutzungsarten in diesen Bändern gelten, die neuen harmonisierten technischen Bedingungen sollten jedoch, soweit erforderlich, auch auf bestehende Frequenznutzungsrechte im Frequenzband 3 400-3 800 MHz Anwendung finden, um die technische Kompatibilität zwischen bestehenden und neuen Nutzern dieses Bandes und eine effiziente Frequenznutzung zu gewährleisten und um funktechnische Störungen auch grenzübergreifend zwischen den Mitgliedstaaten der Union zu vermeiden.
- (13) Um funktechnische Störungen zu vermeiden, die Frequenznutzung effizienter zu gestalten und die Konvergenz der Frequenznutzung zu erhöhen, können zur Umsetzung der durch diesen Beschluss festgelegten Parameter durch die Mitgliedstaaten grenzübergreifende Vereinbarungen erforderlich werden.
- (14) Die im CEPT-Bericht 49 enthaltenen technischen Bedingungen zur Harmonisierung der Frequenzen für terrestrische Drahtlossysteme im Frequenzband 3 400-3 800 MHz gewährleisten nicht die Kompatibilität mit bestimmten bestehenden Nutzungsrechten für solche Systeme in diesem Band innerhalb der Union. Deshalb sollte — ohne eine Beschränkung des Zugangs zu Frequenzen dieses Bandes für jene Nutzer, die die technischen Bedingungen des CEPT-Berichts 49 einhalten — bestehenden Frequenznutzern eine angemessene Frist für die Anwendung der technischen Bedingungen des CEPT-Berichts 49 eingeräumt und nationalen Verwaltungen die Flexibilität gegeben werden, die Umsetzung der in diesem Beschluss vorgesehenen technischen Bedingungen in Abhängigkeit von den Marktnachfrage gegebenenfalls zu verschieben.
- (15) Die Entscheidung 2008/411/EG sollte daher entsprechend geändert werden.
- (16) Die in diesem Beschluss vorgesehenen Maßnahmen entsprechen der Stellungnahme des Funkfrequenzausschusses —

HAT FOLGENDEN BESCHLUSS ERLASSEN:

Artikel 1

Die Entscheidung 2008/411/EG wird wie folgt geändert:

(1) Artikel 2 erhält folgende Fassung:

„Artikel 2

(1) Unbeschadet des Schutzes und weiteren Betriebs anderer bestehender Nutzungsarten in diesen Bändern sorgen die Mitgliedstaaten für die nicht-ausschließliche Zuweisung und die anschließende Bereitstellung des Frequenzbands 3 400-3 800 MHz für terrestrische elektronische Kommunikationsnetze in Übereinstimmung mit den Parametern im Anhang. Überdies brauchen die Mitgliedstaaten die im Anhang festgelegten Parameter nicht auf die am Tag der Annahme dieses Beschlusses bestehenden Nutzungsrechte für terrestrische elektronische Kommunikationsnetze im Frequenzband 3 400-3 800 MHz anzuwenden, soweit durch die Ausübung dieser Rechte eine Nutzung des Frequenzbandes entsprechend dem Anhang nicht verhindert wird.

(2) Die Mitgliedstaaten stellen sicher, dass die in Absatz 1 genannten Netze einen ausreichenden Schutz der Systeme in benachbarten Frequenzbändern gewährleisten.

(3) In geografischen Gebieten, in denen die Koordinierung mit Drittländern ein Abweichen von den Parametern im Anhang dieser Entscheidung erforderlich macht, sind die Mitgliedstaaten nicht verpflichtet, die Verpflichtungen aus dieser Entscheidung zu erfüllen.

Die Mitgliedstaaten unternehmen alle Anstrengungen zur Behebung solcher Abweichungen, die sie der Kommission unter Angabe des betroffenen geografischen Gebiets mitteilen, und veröffentlichen die diesbezüglichen Informationen gemäß der Entscheidung Nr. 676/2002/EG.“

(2) Dem Artikel 3 wird folgender Unterabsatz angefügt:

„Die Mitgliedstaaten unterstützen grenzübergreifende Koordinierungsvereinbarungen mit dem Ziel, den Betrieb dieser Netze unter Berücksichtigung bestehender Regulierungsverfahren und Rechte zu ermöglichen.“

(3) Folgender Artikel 4a wird eingefügt:

„Artikel 4a

Die Mitgliedstaaten wenden die im Anhang festgelegten Bedingungen spätestens am 30. Juni 2015 an.

Die Mitgliedstaaten erstatten spätestens am 30. September 2015 Bericht über die Durchführung dieser Entscheidung.“

(4) Der Anhang erhält die Fassung des Anhangs des vorliegenden Beschlusses.

Artikel 2

Dieser Beschluss ist an die Mitgliedstaaten gerichtet.

Brüssel, den 2. Mai 2014

Für die Kommission
Neelie KROES
Vizepräsidentin

ANHANG

„ANHANG

PARAMETER GEMÄSS ARTIKEL 2

A. ALLGEMEINE PARAMETER

1. Der bevorzugte Duplexbetriebsmodus im Teilband 3 400-3 600 MHz ist der Zeitduplexbetrieb (*Time Division Duplex*, TDD).
2. Alternativ dazu können die Mitgliedstaaten den Frequenzduplex-Betriebsmodus (*Frequency Division Duplex*, FDD) im Teilband 3 400-3 600 MHz zu folgenden Zwecken anwenden:
 - a) Gewährleistung einer effizienteren Frequenznutzung, z. B. wenn Frequenzen mit bestehenden Nutzungsrechten während eines Zeitraums der Koexistenz geteilt werden oder eine marktorientierte Frequenzvergabe stattfindet, oder
 - b) Schutz bestehender Nutzungsarten oder Vermeidung funktechnischer Störungen oder
 - c) Koordinierung mit Nicht-EU-Ländern.

Bei Zulassung des FDD-Betriebsmodus beträgt der Duplexabstand 100 MHz, wobei die Aussendungen der Endstelle (FDD-Uplink) im unteren Teil des Bands von 3 410 MHz bis 3 490 MHz und die Aussendungen der Basisstation (FDD-Downlink) im oberen Teil des Bands von 3 510 MHz bis 3 590 MHz erfolgen.

3. Der Duplexbetriebsmodus im Teilband 3 600-3 800 MHz ist der Zeitduplexbetrieb (TDD).
4. Die zugeteilten Blöcke umfassen ganzzahlige Vielfache von 5 MHz. Die untere Frequenzgrenze eines zugeteilten Blocks wird ausgerichtet an der oder hat einen Abstand von ganzzahligen Vielfachen von 5 MHz von der betreffenden Teilbandgrenze ⁽¹⁾. In Abhängigkeit vom Duplexbetriebsmodus gelten folgende Teilbandgrenzen: 3 400 MHz und 3 600 MHz für TDD; 3 410 MHz und 3 510 MHz für FDD.
5. Die Aussendungen der Basisstationen und Endstellen im Frequenzband 3 400-3 800 MHz müssen der in diesem Anhang festgelegten Frequenzblock-Entkopplungsmaske (BEM) entsprechen.

B. TECHNISCHE BEDINGUNGEN FÜR BASISSTATIONEN — FREQUENZBLOCK-ENTKOPPLUNGSMASKE

Die folgenden technischen Parameter für Basisstationen werden als Frequenzblock-Entkopplungsmaske (*Block Edge Mask*, BEM) bezeichnet und sind ein wesentlicher Teil der notwendigen Bedingungen für die Koexistenz benachbarter Netze bei Fehlen bilateraler oder multilateraler Vereinbarungen zwischen den Betreibern solcher benachbarter Netze. Weniger strenge technische Parameter können angewandt werden, sofern diese zwischen den Betreibern solcher Netze vereinbart worden sind.

Die BEM besteht sowohl für das Teilband 3 400-3 600 MHz als auch das Teilband 3 600-3 800 MHz aus verschiedenen Elementen, die in Tabelle 1 aufgeführt sind. Der Leistungsgrundwert zum Schutz der von anderen Betreibern genutzten Frequenzen und die Leistungsgrenzwerte der Übergangsbereiche, die eine Filterdämpfung von der blockinternen Leistungsgrenze zum Leistungsgrundwert ermöglichen, werden als Außerblock-Elemente betrachtet. Die Schutzbänder gelten nur für den FDD-Betrieb im Teilband 3 400-3 600 MHz. Die BEM gilt für Basisstationen mit unterschiedlichen Leistungswerten (üblicherweise als Makro-, Mikro-, Piko- und Femto-Basisstationen ⁽²⁾ bezeichnet).

Die Tabellen 2 bis 6 enthalten die Leistungsgrenzwerte für die verschiedenen BEM-Elemente. Die blockinterne Leistungsgrenze gilt für einen Block, der einem Betreiber gehört. Auch für Schutzbänder und für den Schutz des Radarbetriebs unterhalb von 3 400 MHz sind Leistungsgrenzwerte angegeben.

Die Frequenzbereiche in den Tabellen 1 bis 6 sind abhängig von dem für das Teilband 3 400-3 600 MHz gewählten Duplexmodus (TDD oder alternativ FDD). P_{Max} ist die maximale Trägerleistung für die betreffende Basisstation, gemessen als EIRP ⁽³⁾. Synchronisierter Betrieb bedeutet Zeitduplexbetrieb (TDD) in zwei unterschiedlichen Netzen, in denen keine gleichzeitige Uplink- und Downlink-Übertragung stattfindet, wie in den geltenden Normen definiert.

⁽¹⁾ Wird zwischen zugeteilten Blöcken ein Abstand benötigt, um andere bestehende Nutzer zu bedienen, muss ein Abstandsraaster von 100 kHz verwendet werden. An der Grenze zu benachbarten Nutzern können engere Blöcke definiert werden, um eine effiziente Frequenznutzung zu ermöglichen.

⁽²⁾ Diese Begriffe sind nicht eindeutig definiert und beziehen sich auf zelluläre Basisstationen mit unterschiedlichen, in folgender Reihenfolge abnehmenden Leistungswerten: Makro, Mikro, Piko, Femto. Insbesondere Femtozellen sind sehr klein und haben Basisstationen mit den niedrigsten Leistungswerten, die üblicherweise in Innenräumen genutzt werden.

⁽³⁾ EIRP bedeutet äquivalente isotrope Strahlungsleistung (*Equivalent Isotropic Radiated Power*).

Um die BEM für einen bestimmten Block zu erhalten, werden die in Tabelle 1 definierten BEM-Elemente in folgenden Schritten miteinander kombiniert:

1. Der blockinterne Leistungsgrenzwert gilt für den Block, der dem Betreiber zugeteilt worden ist.
2. Die Übergangsbereiche werden ermittelt und die entsprechenden Leistungsgrenzwerte darauf angewandt. Übergangsbereiche können sich mit Schutzbändern überlappen. In diesem Fall gelten die Leistungsgrenzwerte der Übergangsbereiche.
3. Für die verbleibenden Frequenzen, die für FDD oder TDD zugewiesen sind, gelten die Leistungsgrundwerte.
4. Für die Frequenzen der verbleibenden Schutzbänder gelten die Leistungsgrenzwerte der Schutzbänder.
5. Für Frequenzen unterhalb von 3 400 MHz gilt einer der zusätzlichen Leistungsgrundwerte.

Die Abbildung enthält ein Beispiel für die Kombination der verschiedenen BEM-Elemente.

Bei unsynchronisierten TDD-Netzen kann die Einhaltung der BEM-Anforderungen durch zwei benachbarte Betreiber dadurch erreicht werden, dass zwischen den Blockrändern beider Betreiber ein Frequenzabstand eingeführt wird (z. B. im Genehmigungsverfahren auf nationaler Ebene). Alternativ dazu können auch sogenannte beschränkte Blöcke für zwei benachbarte Betreiber eingeführt werden, in denen diese die Sendeleistung in den oberen bzw. unteren Teilen der ihnen zugeteilten Frequenzblöcke beschränken müssen⁽¹⁾.

Tabelle 1

Definition der BEM-Elemente

BEM-Element	Definition
Blockintern (<i>In-Block</i>)	Bezieht sich auf einen Block, für den die BEM ermittelt wird.
Grundwert	Für TDD, FDD-Uplink oder FDD-Downlink genutzte Frequenzen, mit Ausnahme des dem Betreiber zugeteilten Blocks und der entsprechenden Übergangsbereiche.
Übergangsbereich	Bei FDD-Downlink-Blöcken reicht der Übergangsbereich von 0 bis 10 MHz unterhalb und von 0 bis 10 MHz oberhalb des dem Betreiber zugeteilten Blocks. Bei TDD-Blöcken reicht der Übergangsbereich von 0 bis 10 MHz unterhalb und von 0 bis 10 MHz oberhalb des dem Betreiber zugeteilten Blocks. Der Übergangsbereich umfasst dem Betreiber zugeteilte benachbarte TDD-Blöcke, wenn die Netze synchronisiert sind, oder Frequenzen zwischen benachbarten TDD-Blöcken, die durch 5 oder 10 MHz getrennt sind. Übergangsbereiche umfassen keine benachbarten, anderen Betreibern zugeteilten TDD-Blöcke, wenn die Netze nicht synchronisiert sind. Der Übergangsbereich erstreckt sich nicht auf den Bereich unterhalb von 3 400 MHz oder oberhalb von 3 800 MHz.
Schutzbänder	Im Fall einer FDD-Zuweisung gelten folgende Schutzbänder: 3 400-3 410, 3 490-3 510 (Duplexlücke) und 3 590-3 600 MHz. Falls sich Übergangsbereiche und Schutzbänder überlappen, gelten die Leistungsgrenzwerte der Übergangsbereiche.
Zusätzlicher Grundwert	Frequenzen unterhalb von 3 400 MHz.

Tabelle 2

Blockinterne Leistungsgrenzwerte

BEM-Element	Frequenzbereich	Leistungsgrenzwert
Blockintern (<i>In-Block</i>)	Dem Betreiber zugeteilter Block	Nicht obligatorisch. Falls eine Behörde eine Obergrenze wünscht, darf dieser 68 dBm/5 MHz pro Antenne nicht überschreiten.

⁽¹⁾ Ein empfohlener Wert für eine solche Leistungsgrenze ist 4 dBm/5 MHz EIRP pro Zelle im obersten bzw. untersten 5-MHz-Bereich eines dem Betreiber zugeteilten Frequenzblocks.

Erläuterung zu Tabelle 2

Bei Femto-Basisstationen sollte eine Leistungsregelung erfolgen, um Störungen benachbarter Kanäle zu minimieren. Die Leistungsregelungsanforderung für Femto-Basisstationen ergibt sich aus der Notwendigkeit, funktechnische Störungen durch Geräte zu mindern, die von Verbrauchern eingebracht und daher mit umgebenden Netzen nicht synchronisiert werden können.

Tabelle 3

Leistungsgrundwerte

BEM-Element	Frequenzbereich	Leistungsgrenzwert
Grundwert	FDD-Downlink (3 510-3 590 MHz). Synchronisierte TDD-Blöcke (3 400-3 800 MHz oder 3 600-3 800 MHz).	$\text{Min}(P_{\text{Max}} - 43,13) \text{ dBm/5 MHz EIRP pro Antenne}$
Grundwert	FDD-Uplink (3 410-3 490 MHz). Unsynchronisierte TDD-Blöcke (3 400-3 800 MHz oder 3 600-3 800 MHz).	$- 34 \text{ dBm/5 MHz EIRP pro Zelle (*)}$

(*) Für diesen Grundwert kann zwischen benachbarten Betreibern für Femtozellen eine Ausnahme ausgehandelt werden, sofern keine Gefahr besteht, dass Makro-Basisstationen dadurch gestört werden. In diesem Fall kann der Wert $- 25 \text{ dBm/5 MHz EIRP pro Zelle}$ angewandt werden.

Erläuterung zu Tabelle 3

Der Grundwert für FDD-Downlink und für synchronisiertes TDD wird als Dämpfung der maximalen Trägerleistung in Verbindung mit einem festen Höchstwert ausgedrückt. Es gilt jeweils der strengere dieser beiden Werte. Der feste Höchstwert sorgt für eine Obergrenze für die von einer Basisstation verursachte Störung. Sind zwei TDD-Blöcke synchronisiert, treten keine funktechnischen Störungen zwischen Basisstationen auf. In diesem Fall gilt derselbe Grundwert wie für den FDD-Downlink-Bereich.

Der Leistungsgrundwert für FDD-Uplink und unsynchronisiertes TDD wird nur als Festwert ausgedrückt.

Tabelle 4

Leistungsgrenzwerte der Übergangsbereiche

BEM-Element	Frequenzbereich	Leistungsgrenzwert
Übergangsbereich	$- 5 \text{ bis } 0 \text{ MHz Abstand (vom unteren Blockrand)}$ oder $0 \text{ bis } 5 \text{ MHz Abstand (vom oberen Blockrand)}$	$\text{Min}(P_{\text{Max}} - 40,21) \text{ dBm/5 MHz EIRP pro Antenne}$
Übergangsbereich	$- 10 \text{ bis } - 5 \text{ MHz Abstand (vom unteren Blockrand)}$ oder $5 \text{ bis } 10 \text{ MHz Abstand (vom oberen Blockrand)}$	$\text{Min}(P_{\text{Max}} - 43,15) \text{ dBm/5 MHz EIRP pro Antenne}$

Erläuterung zu Tabelle 4

Die Leistungsgrenzwerte der Übergangsbereiche werden festgelegt, um die Reduzierung der Leistung vom blockinternen Niveau auf das Niveau des Grundwerts oder des Schutzbandes zu ermöglichen. Die Anforderungen werden als Dämpfung der maximalen Trägerleistung in Verbindung mit einem festen Höchstwert ausgedrückt. Es gilt jeweils der strengere dieser beiden Werte.

Tabelle 5

Leistungsgrenzwerte der Schutzbänder für FDD

BEM-Element	Frequenzbereich	Leistungsgrenzwert
Schutzband	3 400-3 410 MHz	- 34 dBm/5 MHz EIRP pro Zelle
Schutzband	3 490-3 500 MHz	- 23 dBm/5 MHz pro Antennenanschluss
Schutzband	3 500-3 510 MHz	Min(P_{Max} - 43,13) dBm/5 MHz EIRP pro Antenne
Schutzband	3 590-3 600 MHz	Min(P_{Max} - 43,13) dBm/5 MHz EIRP pro Antenne

Erläuterung zu Tabelle 5

Für das Schutzband 3 400-3 410 MHz wird der gleiche Leistungsgrenzwert gewählt wie der Grundwert für den benachbarten FDD-Uplink (3 410-3 490 MHz). Für die Schutzbänder 3 500-3 510 MHz und 3 590-3 600 MHz wird der gleiche Leistungsgrenzwert gewählt wie der Grundwert für den benachbarten FDD-Downlink (3 510-3 590 MHz). Die Leistungsgrenze für das Schutzband 3 490-3 500 MHz beruht auf der Vorgabe für Nebenaussendungen von -30 dBm/MHz am Antennenanschluss, umgerechnet auf eine Bandbreite von 5 MHz.

Tabelle 6

Zusätzliche Leistungsgrundwerte für landesspezifische Fälle

Fall	BEM-Element	Frequenzbereich	Leistungsgrenzwert	
A	Unionsländer mit militärischen Funkortungssystemen unterhalb von 3 400 MHz	Zusätzlicher Grundwert	Unterhalb von 3 400 MHz für TDD- und FDD-Zuweisung (*)	- 59 dBm/MHz EIRP (**)
B	Unionsländer mit militärischen Funkortungssystemen unterhalb von 3 400 MHz	Zusätzlicher Grundwert	Unterhalb von 3 400 MHz für TDD- und FDD-Zuweisung (*)	- 50 dBm/MHz EIRP (**)
C	Unionsländer, in denen das benachbarte Band ungenutzt ist oder die Nutzung keinen zusätzlichen Schutz erfordert	Zusätzlicher Grundwert	Unterhalb von 3 400 MHz für TDD- und FDD-Zuweisung	Entfällt.

(*) Behörden können ein Schutzband unterhalb von 3 400 MHz festlegen. In diesem Fall gilt der Leistungsgrenzwert nur unterhalb des Schutzbands.

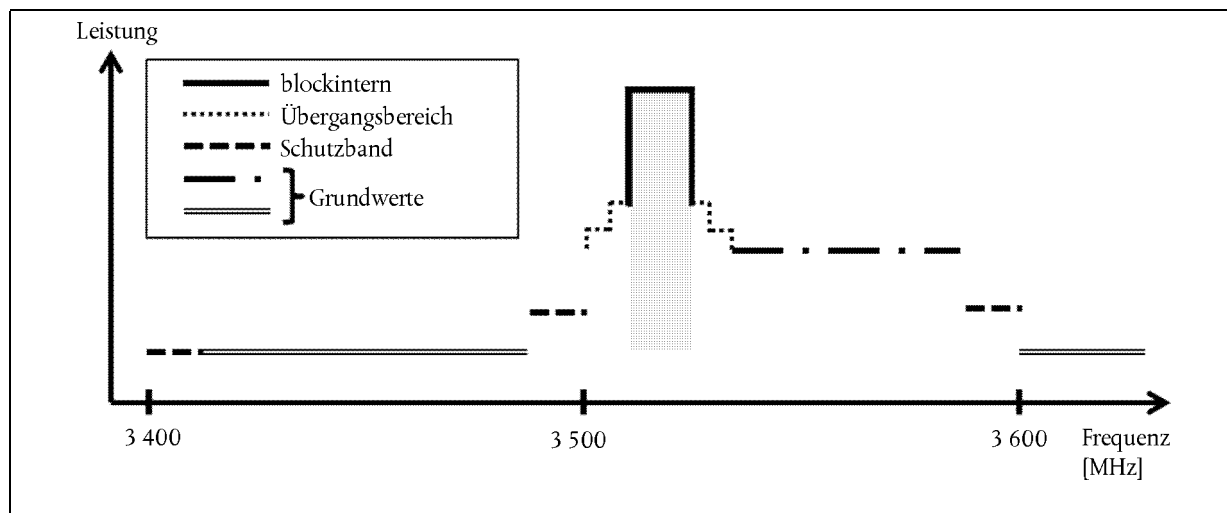
(**) In Abhängigkeit von dem für das Radar im betreffenden Gebiet erforderlichen Schutzniveau können die Behörden den Grenzwert für Fall A oder B wählen.

Erläuterung zu Tabelle 6

Die zusätzlichen Leistungsgrundwerte ergeben sich aus der Notwendigkeit des Schutzes militärischer Funkortungssysteme in einigen Ländern. Die Fälle A, B und C können pro Gebiet oder Land angewandt werden, sodass für das benachbarte Band je nach den darin genutzten Systemen in verschiedenen geografischen Gebieten oder Ländern ein unterschiedliches Schutzniveau gelten kann. Für den TDD-Betriebsmodus können andere Maßnahmen zur Störungsminderung wie geografische Trennung, Einzelfall-Koordinierung oder ein zusätzliches Schutzband erforderlich sein. Die zusätzlichen Leistungsgrundwerte in Tabelle 6 sind gelten nur für Funkzellen im Außenbereich. Bei Funkzellen in Innenräumen können die Leistungsgrenzwerte im Einzelfall gelockert werden. Bei Endstellen können sowohl für den FDD- als auch den TDD-Betriebsmodus andere Maßnahmen zur Störungsminderung wie geografische Trennung oder ein zusätzliches Schutzband erforderlich sein.

Abbildung

Beispiel für das Kombinieren der BEM-Elemente für Basisstationen zu einem FDD-Block ab 3 510 MHz (*)



(*) Insbesondere ist zu beachten, dass für unterschiedliche Teile des Frequenzbereichs unterschiedliche Grundwerte festgelegt werden und dass der Leistungsgrenzwert für den unteren Übergangsbereich auch für einen Teil des Schutzbandes 3 490-3 510 MHz gilt. Frequenzen unterhalb von 3 400 MHz sind in der Abbildung nicht berücksichtigt worden, obwohl das BEM-Element ‚Zusätzlicher Grundwert‘ zum Schutz der militärischen Funkortung angewandt werden kann.

C. TECHNISCHE BEDINGUNGEN FÜR ENDSTELLEN

Tabelle 7

Blockinterne Anforderung — blockinterner Leistungsgrenzwert der BEM für Endstellen

Maximale blockinterne Aussendungen (*)	25 dBm
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(*) Dieser Leistungsgrenzwert ist als äquivalente isotrope Strahlungsleistung (EIRP) für feste oder eingebaute Endstellen bzw. als Gesamtstrahlungsleistung (TRP) für mobile oder ortsungebundene Endstellen spezifiziert. Für isotrope Antennen sind EIRP und TRP äquivalent. Für diesen Wert kann eine in den harmonisierten Normen festgelegte Toleranz (von bis zu 2 dB) gelten, um extremen Umweltbedingungen und Exemplarstreungen Rechnung zu tragen.

Die Mitgliedstaaten können den in Tabelle 7 festgesetzten Grenzwert unter bestimmten Umständen, z. B. für feste Endstellen, lockern, sofern dies den Schutz anderer bestehender Nutzungsarten im Frequenzband 3 400-3 800 MHz sowie die Erfüllung grenzübergreifender Verpflichtungen nicht beeinträchtigt.“

Vereinbarung

**zwischen den Frequenzverwaltungen von
Deutschland, Liechtenstein, Österreich
und der Schweiz**

**über die Frequenznutzung und
Frequenzkoordinierung in den Grenzregionen
für terrestrische Mobilfunksysteme, die
elektronische Kommunikationsdienste
erbringen können**

**im Frequenzband
3400 - 3800 MHz**

Rostock, 20.09.2017

1. Einführung

Das Frequenzband 3400-3800 MHz ist für terrestrische Mobilfunksysteme vorgesehen, welche den drahtlosen Netzzugang zu elektronischen Kommunikationsdiensten gewährleisten,

- für Deutschland, Liechtenstein und Österreich:
gemäß dem Durchführungsbeschluss 2014/276/EU der Europäischen Kommission vom 02. Mai 2014 zur Harmonisierung des Frequenzbands 3400-3800 MHz für terrestrische Systeme, die elektronische Kommunikationsdienste in der Gemeinschaft erbringen können.
- für die Schweiz:
gemäß dem vom Bundesrat genehmigten Nationalen Frequenzzuweisungsplan (NaFZ).

Die Verwaltungen von Deutschland, Liechtenstein, Österreich und der Schweiz haben folgende Koordinierungsprozeduren und -parameter beschlossen:

2. Prinzipien der Frequenznutzung und der Frequenzkoordinierung in den betroffenen Grenzregionen

Die Verwaltungen von Deutschland, Liechtenstein, Österreich und der Schweiz sind über die folgenden Prozeduren betreffend der Frequenznutzung und Frequenzkoordinierung übereingekommen, die auf dem Konzept der gleichberechtigten Zugangswahrscheinlichkeit basieren. Dies erlaubt eine gleichwertige grenznahe Versorgung geographisch benachbarter Gebiete durch zwei oder mehr Funknetze gleicher oder unterschiedlicher digitaler Übertragungstechnologien, die dasselbe Frequenzband ohne Koordinierung nutzen.

Diese Vereinbarung basiert darüber hinausgehend auf den Prinzipien der Frequenznutzung und Frequenzkoordinierung wie sie in der geltenden offiziellen ECC Empfehlung ECC/REC(15)01 festgelegt sind (siehe auch www.ecodocdb.dk).

Der bevorzugte Duplexbetriebsmodus im Teilband 3400-3600 MHz ist der Zeitduplexbetrieb (TDD), wobei alternativ der Frequenzduplex-Betriebsmodus (FDD) angewandt werden kann.

Der Duplexbetriebsmodus im Teilband 3600-3800 MHz ist der Zeitduplexbetrieb (TDD).

Die Feldstärkewerte sind innerhalb eines Referenzblocks von 5 MHz definiert.

Die Berechnung der Feldstärke hat die Summe aller Aussendungen des jeweiligen Antennensektors zu enthalten, welche in diesen Referenzblock fallen. Das Feldstärkelimit für jede Aussendung gilt für jeden einzelnen Antennensektor und wird um einen Faktor reduziert, der den Anteil an dem entsprechenden Referenzblock darstellt:

Reduktionsfaktor = $10 \times \log_{(10)} (\text{Frequenzblockanteil} / 5 \text{ MHz})$

Um eine optimale Leistung zwischen in Grenzgebieten eingesetzten digitalen mobilen breitbandigen Zugangssystemen (WBB) zu gewährleisten, sollten die

Netzbetreiber die von der Technologie gegebenen Coderessourcen und andere Funkparameter in Übereinstimmung mit dem relevanten Anhang der ECC/REC(15)01 anwenden, insbesondere wenn die Mittenfrequenzen der Signale in Grenzregionen zusammenfallen.

Darüberhinausgehende Nutzungen von Frequenzen gemäß ECC/REC(15)01 sind im Rahmen von Betreiberabsprachen möglich.

Folgende Prinzipien kommen zur Anwendung:

2.1 Im Falle der Anwendung von FDD-Systemen

Der Duplexabstand beträgt 100 MHz, wobei die Endgeräte (Uplink) im Frequenzbereich 3410-3490 MHz und die Basisstationen (Downlink) im Frequenzbereich 3510-3590 MHz senden.

Stationen, welche FDD-Breitbandtechnologien im Frequenzbereich 3410-3490 MHz / 3510-3590 MHz nutzen, können ohne Koordinierung mit dem benachbarten Land verwendet werden, wenn die von der Basisstation erzeugte mittlere Feldstärke folgende Werte nicht übersteigt:

2.1.1 Bei FDD-Systemen im Nachbarland

- a. Mit Nutzung von Vorzugscodes:

67 dB μ V/m/5 MHz in einer Höhe von 3 Metern über Grund auf der Grenzlinie.

49 dB μ V/m/5 MHz auf einer Höhe von 3 Metern über Grund in einer Distanz von 6 km im benachbarten Land.

In der Länderbeziehung zu Liechtenstein kommt in Anbetracht der Landesgröße von Liechtenstein zusätzlich eine 1 km Koordinationslinie mit dem Wert 61 dB μ V/m/5 MHz in einer Höhe von 3 Metern über Grund im benachbarten Land zur Anwendung.

- b. Ohne Nutzung von Vorzugscodes:

49 dB μ V/m/5 MHz in einer Höhe von 3 Metern über Grund auf der Grenzlinie.

2.1.2 Bei TDD-Systemen im Nachbarland

32 dB μ V/m/5 MHz in einer Höhe von 3 Metern über Grund auf der Grenzlinie.

2.2 Für TDD-Systeme

Stationen, welche TDD-Breitbandtechnologien in den Frequenzbereichen 3400-3600 MHz und 3600-3800 MHz nutzen, können ohne Koordinierung mit dem benachbarten Land verwendet werden, wenn die von der Basisstation erzeugte mittlere Feldstärke folgende Werte nicht übersteigt:

2.2.1 Bei FDD-Systemen im Nachbarland

32 dB μ V/m/5 MHz in einer Höhe von 3 Metern über Grund auf der Grenzlinie.

2.2.2 Bei TDD-Systemen im Nachbarland

a. In unsynchronisierten Netzen:

32 dB μ V/m/5 MHz in einer Höhe von 3 Metern über Grund auf der Grenzlinie.

b. In synchronisierten Netzen:

67 dB μ V/m/5 MHz in einer Höhe von 3 Metern über Grund auf der Grenzlinie.

49 dB μ V/m/5 MHz auf einer Höhe von 3 Metern über Grund in einer Distanz von 6 km im benachbarten Land.

2.3 Nicht-MFCN Systeme

Zum Schutz von Nicht-MFCN-Systemen im gesamten Frequenzbereich 3400-3800 MHz muss an der Grenze eine Leistungsflussdichte von $-122 \text{ dBW}/(\text{MHz}\cdot\text{m}^2)$ ¹ eingehalten werden.

2.4 Satelliten - Bodenstationen

Zum Schutz von Satelliten-Bodenstationen im gesamten Frequenzbereich 3400-3800 MHz muss an der Grenze eine Leistungsflussdichte von $-154 \text{ dBW}/(\text{MHz}\cdot\text{m}^2)$ ² eingehalten werden.

3. Betreiberabsprachen

Der Abschluss von Betreiberabsprachen ist zulässig. Die Rahmenbedingungen sind im „*Agreement between the Administrations of Austria, Germany, Liechtenstein and Switzerland concerning the approval of arrangements between operators of terrestrial systems capable of providing electronic communications services*“ in der jeweils geltenden Fassung festgehalten. In Betreiberabsprachen sollen Regelungen zur grenzüberschreitenden Synchronisation der TDD-Netze getroffen werden; siehe auch ECC-Report 216.

4. Feldstärkeprognose

Für Feldstärkeberechnungen wird die geltende offizielle Version des Berechnungsprogramms (HCM-MS) der HCM-Vereinbarung verwendet. Es kommen die Kurven für 10% Zeitwahrscheinlichkeit zur Anwendung.

5. Änderung der Vereinbarung

Diese Vereinbarung kann auf Verlangen einer Signatarverwaltung mit Zustimmung der übrigen Verwaltungen geändert werden, wenn administrative oder technische Entwicklungen eine solche Änderung notwendig machen.

¹ Entspricht in etwa einem Feldstärkewert von 24 dB μ V/m/MHz

² Entspricht in etwa einem Feldstärkewert von 16 dB μ V/m/MHz

6. Kündigung der Vereinbarung

Jede Verwaltung kann diese Vereinbarung mit einer Frist von 12 Monaten kündigen.

7. Sprache der Vereinbarung

Diese Vereinbarung wurde in deutscher Sprache abgeschlossen.

Eine Originalversion dieser Vereinbarung wird jeder unterzeichnenden Verwaltung ausgehändigt. Der geschäftsführenden Verwaltung der HCM-Vereinbarung wird eine Kopie davon übermittelt.

8. Datum des Inkrafttretens

Das Datum der Inkraftsetzung dieser Vereinbarung ist abhängig vom Austausch individueller Bestätigungsschreiben zwischen den unterzeichnenden Verwaltungen entsprechend den nationalen Voraussetzungen.

Die Anwendung dieser Vereinbarung erfolgt zwischen Verwaltungen, die das Datum der Inkraftsetzung bestätigt haben. Dies könnte ggf. auch den Abschluss weiterer Zusatzvereinbarungen erfordern.

Im Bestätigungsschreiben bzw. in der Zusatzvereinbarung können z.B. noch Angaben zum betroffenen Frequenzteilbereich und der betroffenen Region gemacht sowie Regelungen zur grenzüberschreitenden Synchronisation der TDD-Netze und der Schutzbedarf bestehender Dienste, wie auch die Außerkraftsetzung bisheriger Vereinbarungen aufgenommen werden.

Geschehen zu Rostock, 20. September 2017


Für Deutschland
Bundesnetzagentur
Tobias Schnetzer



Für Liechtenstein
Amt für Kommunikation
Kurt Bühler



Für Österreich
Bundesministerium für Verkehr,
Innovation und Technologie
Franz Ziegelwanger



Für die Schweiz
Bundesamt für Kommunikation
Konrad Vonlanthen



TECHNICAL ARRANGEMENT

**BETWEEN THE NATIONAL FREQUENCY MANAGEMENT
AUTHORITIES OF**

**Austria, Croatia, Hungary, Serbia,
The Slovak Republic and Slovenia**

ON BORDER COORDINATION

**FOR
TERRESTRIAL SYSTEMS CAPABLE
OF PROVIDING ELECTRONIC
COMMUNICATIONS SERVICES**

**IN THE FREQUENCY BAND
3400-3800 MHz**

Geneva, *24.* November 2015

1 INTRODUCTION

The aim of this Technical Arrangement is to lay down the principles, the technical provisions and administrative procedure necessary to regulate the common deployment of terrestrial systems capable of providing electronic communications services that may use different technologies in the band 3400-3800 MHz in border areas.

In the framework of article 6 of ITU Radio Regulations, of bi- or multilateral agreements, arrangements or protocols dealing with frequency coordination in general (e.g. the "HCM Agreement"), the Federal Ministry for Transport, Innovation and Technology [BMVIT] (Austria), the Croatian Regulatory Authority for Network industries [HAKOM] (Croatia), the National Media and Infocommunications Authority [NMHH] (Hungary), the Republic Agency for Electronic Communications of Republic of Serbia [RATEL] (Serbia), Regulatory Authority for Electronic Communications and Postal Services [RU] (The Slovak Republic) and Agency for Communication Networks and Services of the Republic of Slovenia [AKOS] (Slovenia), (hereinafter called Signatory Authorities) **concluded this Technical Arrangement concerning the usage of the frequencies for terrestrial systems capable of providing electronic communications services in the band 3400-3800 MHz in border areas.**

The Signatory Authorities have agreed on the following coordination procedures and rules regarding border areas detailed in the sections below.

2 PRINCIPLES OF FREQUENCY PLANNING AND FREQUENCY USAGE IN BORDER AREAS

2.1 Relevant regulations

From regulatory point of view, the following deliverables play an important role in the regulation of border coordination in the band 3400-3800 MHz:

- COMMISSION DECISION (2008/411/EC) 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 (*notified under document number C(2008) 1873*);
- COMMISSION IMPLEMENTING DECISION (2014/276/EU) 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 (*notified under document C(2014) 2798*);
- ECC Decision (ECC/DEC/(11)06) approved on 09 December 2011, amended on 14 March 2014 on harmonised conditions for mobile/fixed communications networks (MFCN) operating in the bands 3400-3600 MHz and 3600-3800 MHz;
- ECC RECOMMENDATION (ECC/REC/(15)01) approved on 13 February 2015 on

cross-border coordination for mobile/fixed communications networks (MFCN) in the frequency bands: 1452-1492 MHz, 3400-3600 MHz and 3600-3800 MHz.

2.2 Regulated bands

Within this Technical Arrangement, the band 3400-3600 MHz has been regulated concerning the FDD and TDD utilisation (except the FDD usage in the sub-bands 3400-3410 MHz, 3490-3510 MHz and 3590-3600 MHz) and TDD utilisation in the band 3600-3800 MHz.

If FDD operation is required in the sub-band 3400-3410 MHz and or 3490-3510 MHz and or 3600-3800 MHz, a separate bi- or multilateral Technical Arrangement between administrations concerned or an Operator Arrangement between operators concerned should be concluded¹.

2.3 Access to the frequency spectrum in general

One of the most important aims of this Technical Arrangement is to give simple procedure and rules so that networks in border areas may be deployed easily ensuring proper access to the frequency spectrum. From this point of view, the coordination principle applied in this Technical Arrangement is that each country concerned has the same access to the frequency spectrum, i.e. they may use all the frequencies in the whole band 3400-3800 MHz.

Nevertheless, this kind of frequency usage in the border area is only viable if the field strength thresholds given in this Technical Arrangement are kept and accurate radio wave propagation methods are used for the calculations, as well as, radio parameters of the systems are coordinated between neighbouring operators.

To apply the principle outlined above, the same interference field strength level is allowed for a domestic network and its opposite network in the neighbouring country, ensuring equitable access to the frequency spectrum for the operators in the neighbouring countries.

As a consequence of the above, traditional frequency coordination would disturb the balance in the border area. Therefore, traditional frequency coordination will not be performed according to this Technical Arrangement. If higher field strength values are required, a so-called "Operator Arrangement" may be concluded (see section 6).

2.4 Coordination procedure

In general, neither coordination nor notification of stations is required, except in cases of harmful interference.

Operators may diverge from the regulation given in this Technical Arrangement subject to the so-called Operator Arrangement (see section 6).

¹ Excluding the sub-band 3400-3410 MHz in Austria, Croatia, Hungary and Slovenia, since it cannot be assigned either for FDD or TDD systems in order that the radar systems operating in the lower adjacent band be protected from the out of band emission produced by MFCN systems.

3 GENERAL TECHNICAL PROVISIONS

In this section the general technical provisions are given while section 4 describes in detail the additional technical provisions for the values of interference field strength that shall be kept in border areas.

3.1 Band arrangement

In accordance with the COMMISSION IMPLEMENTING DECISION (2014/276/EU) of 2 May 2014 in the frequency band 3400-3600 MHz the preferred duplex mode of operation is Time Division Duplex (TDD), but Frequency Division Duplex (FDD) may also be used under certain circumstances. In the frequency band 3600-3800 MHz the duplex mode of operation is TDD.

The assigned blocks shall be in multiple of 5 MHz. The first lower block edge is at the frequency of 3400 MHz in case of TDD operation and 3410 MHz in case of FDD operation.

3.2 FDD systems

Although the preferred duplex mode of operation is TDD in the frequency band 3400-3600 MHz, FDD systems may also be used. The duplex spacing for FDD operation shall be 100 MHz with terminal station transmission in the uplink band (3410-3490 MHz) and base station transmission in the downlink band (3510-3590 MHz). Only these frequency ranges may be used for FDD operation with regulations laid down in this Technical Arrangement.

3.3 TDD systems

The whole band 3400-3800 MHz may be used for TDD systems.

3.4 Radio parameters

Parameters of mobile and base stations such as in-band power and Block Edge Mask (BEM) shall comply with the requirements given in COMMISSION IMPLEMENTING DECISION (2014/276/EU) of 2 May 2014.

In the case of LTE it is required to share the preferential physical-layer cell identities (PCI) according to ECC Recommendation ECC/REC/(15)01. The allocation of codes is given in Annex 1 to this Technical Arrangement.

In addition, it is also desirable for the operators to coordinate radio parameters of their systems to minimise the deteriorating effects of uplink interference in line with Annex 5 of the above-mentioned Recommendation.

4 TECHNICAL PROVISIONS RELATED TO FIELD STRENGTH THRESHOLDS

4.1 Basic rules

Field strength thresholds given in section 4.2 and 4.3 refer to a reference frequency block of 5 MHz. The field strength thresholds shall be modified according to the value of the bandwidth and the aggregated power correction factors given below. The modified field strength thresholds shall be applied to each individual station.

a) Bandwidth correction factor

If the nominal channel spacing of a system is not equal to 5 MHz, the value of the bandwidth correction factor according to the following equation shall be added to the field strength thresholds given in section 4.2 and 4.3:

$$10 * \log (Cs/5 \text{ MHz}) \quad (\text{dB})$$

where:

Cs: nominal channel spacing (MHz).

b) Aggregated power correction factor

If there is more than one transmission in a respective reference frequency block, the field strength thresholds shall be decreased by the value of the aggregated power correction factor according to the following equation in each antenna sector.

$$10 * \log n \quad (\text{dB})$$

where:

n: the number of the transmitters or transmissions in the respective antenna sectors.

If a transmission with nominal channel spacing falls into a respective reference frequency block (even if partly), it shall be included in the value of "n".

4.2 Frequency utilisation in the case of FDD systems are operated

If a country operates FDD systems in the band 3410-3490/3510-3590 MHz two cases may come up: FDD or TDD systems are used in the neighbouring country in the same band.

4.2.1 FDD systems are operated in the neighbouring country

Base stations of FDD systems used in the frequency band 3410-3490/3510-3590 MHz may be operated if the mean field strength of each cell produced by the base station does not exceed the value of 67 dB μ V/m/5MHz at a height of 3 m above ground level at the border line, and does not exceed the value of 49 dB μ V/m/5MHz at a height of 3 m above ground level at a line of 6 km beyond the border inside the neighbouring country.

4.2.2 TDD systems are operated in the neighbouring country

Base stations of FDD systems used in the frequency band 3410-3490/3510-3590 MHz may be operated if the mean field strength of each cell produced by the base station does not exceed the value of 32 dB μ V/m/5MHz at a height of 3 m above ground level at the border line.

4.3 Frequency utilisation in the case of TDD systems are operated

If a country operates TDD systems in the band 3400-3600/3600-3800 MHz two cases may come up: FDD or TDD systems used in the neighbouring country in the same bands.

4.3.1 FDD systems are operated in the neighbouring country

Base stations of TDD systems used in the frequency band 3410-3490/3510-3590 MHz may be operated if the mean field strength of each cell produced by the base station does not exceed the value of 32 dB μ V/m/5MHz at a height of 3 m above ground level at the border line.

4.3.2 TDD systems are operated in the neighbouring country

If both of the countries operate TDD systems in the band 3400-3600/3600-3800 MHz the networks can be synchronised or non-synchronised.

a. Non-synchronised TDD network is operated

Base stations of non-synchronised TDD networks used in the band 3400-3600 MHz and 3600-3800 MHz may be operated if the mean field strength of each cell produced by the base station does not exceed the value of 32 dB μ V/m/5 MHz at the border line at a height of 3 m above ground level.

b. Synchronised TDD network is operated in the neighbouring country

Base stations of synchronised TDD networks used in the band 3400-3600 MHz and 3600-3800 MHz may be operated if the mean field strength of each cell produced by the base station does not exceed the value of 67 dB μ V/m/5MHz at a height of 3 m above ground level at the border line, and does not exceed the value of 49 dB μ V/m/5MHz at a height of 3 m above ground level at a line of 6 km beyond the border inside the neighbouring country.

5 HARMFUL INTERFERENCE

Concerning interference calculations a two-step procedure is described below.

As the first step, in the case of harmful interference, the characteristics of stations including the necessary geographical separation shall be adjusted based upon following line calculations:

Field strength line calculations shall be carried out between the base and/or terminal stations and the receiver points of the border line and 6 km line regarding thresholds values in section 4.2 and 4.3, and depending on radio service (fixed and/or mobile) the relevant propagation models included in the Harmonised Calculation Method (HCM) shall be used. ITU-R P.1546-5 model² shall be used until the frequency band 3400-3800 MHz is included in the HCM for the land mobile service. In case of exclusion of the band from HCM for fixed service, the ITU-R P.452-13 shall be applied for fixed service systems. Time probability in all calculations is 10 %.

As the second step, if harmful interference is still suffered despite the above adjustment, measurements shall be carried out according to international/mutually agreed procedures.

6 OPERATOR ARRANGEMENTS

6.1 Operator Arrangements in general

To further improve the compatibility of terrestrial systems capable of providing electronic communications services, and to enhance the efficient use of frequency spectrum and coverage in border areas, operators may conclude so-called additional Operator Arrangements with regard to the following elements for example:

- preferential code division arrangements;
- carrier frequencies (e.g. with LTE);
- synchronisation of networks concerned.

Such Operator Arrangements are subject to prior consent of the Signatory Authorities concerned (see also Section 7).

6.2 Simplified Operator Arrangements

In some cases detailed below, operators may conclude special Operator Arrangements called "Simplified Operator Arrangements" to enhance the efficient use of the frequency spectrum and the coverage, and also to speed up the coordination procedure. This means that certain deviations from this Technical Arrangement are permitted with subsequent notification and approval of the Signatory Authorities concerned.

Simplified Operator Arrangements may only be concluded for rules and threshold values for synchronised TDD networks.

² Extrapolated field strength values related to the frequency 3000 MHz should be taken into account for the calculation in this band

It is required to get the consent of all the operators concerned in the given border areas.

The Simplified Operator Arrangement shall contain the common frequency bands and the border areas affected where the higher threshold values will be applied and shall be forwarded to the administrations concerned within one month.

7 ADMINISTRATIVE PROCEDURE

In general, neither coordination nor notification of stations is required. However, in the case of harmful interference, the data necessary to evaluate and treat the harmful interference given in Annex 3 of the ECC Recommendation ECC/REC/(15)01 shall be exchanged between Signatory Authorities concerned.

The information about bringing the frequency bands into use by the operators is available in EFIS (www.efis.dk, according to ECC/DEC/(01)03).

Operators concerned may agree to deviate from this administrative procedure by mutual consent in an "Operator Arrangement".

8 STATUS OF EXISTING STATIONS

Stations being not in line with the provisions of COMMISSION IMPLEMENTING DECISION (2014/276/EU) of 2 May 2014 that are in operation according to the existing licences listed in the Annex 2 of this Technical Arrangement shall be protected until the national regulation of the country concerned permits the operation of these stations. Administrations signing this Technical arrangement shall be informed within 15 days by the administration of the country in which the status of these stations has changed.

In order to ensure the protection of the stations of the neighbouring country listed in the Annex 2 of this Technical Arrangement, stations operated in line with the provisions of COMMISSION IMPLEMENTING DECISION (2014/276/EU) of 2 May 2014 may produce a spectral power flux density (pfd) not exceeding $-122\text{dBW}/(\text{MHz}\cdot\text{m}^2)$ at the border to the neighbouring country.

The use of the stations of the neighbouring country to be protected listed in the Annex 2 of this Technical Arrangement should be in line with the provisions laid down in the bi- or multilateral agreements, arrangements or protocols relevant to these stations.

In case of harmful interference the calculation of the interfering spectral pfd shall be based on the Recommendation ITU-R P.452-12 for free space propagation taking into account an additional statistical loss of 15 dB for the calculation to consider the influence of topography and morphology. In case of multiple interferers at a point of the interference contour the resulting interfering signal shall be derived by summing up the contributing pfd values.

In cases of harmful interference the Administrations affected shall inform each other and endeavour to achieve a mutually satisfactory solution.

9 REVISION OF THE TECHNICAL ARRANGEMENT

With the consent of the other Signatory Authorities, this Technical Arrangement may be reviewed or modified at the request of one or more Signatory Authorities where such modifications become necessary in the light of administrative, regulatory or technical developments, or if practical experience or the operation of terrestrial systems capable of providing electronic communications services require.

10 WITHDRAWAL FROM THE ARRANGEMENT

Any Authority may withdraw from this Technical Arrangement by the end of a calendar month by giving notice of its intention at least six months in advance. A declaration to that effect shall be addressed to all other Signatory Authorities.

11 LANGUAGE OF THE ARRANGEMENT

This Technical Arrangement has been concluded in English.

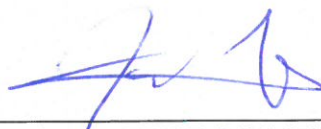
One original version of this Technical Arrangement is handed over to each Signatory Authorities and a copy is submitted to the Managing Administration of the HCM Agreement.

12 DATE OF ENTRY INTO FORCE

This Technical Arrangement will enter into force on 2015.

Done at Geneva, 2015.

For Austria
BMVIT



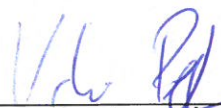
(Franz ZIEGELWANGER)

For Croatia
HAKOM



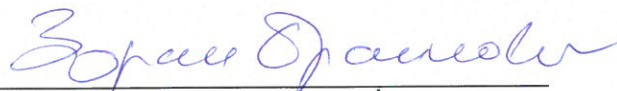
(Ivančica SAKAL)

For Hungary
NMHH



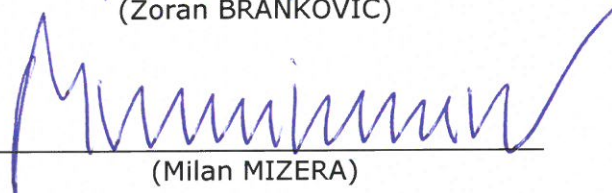
(Péter VARI)

For Serbia
RATEL



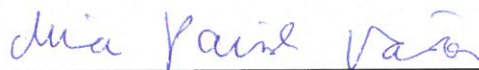
(Zoran BRANKOVIĆ)

For the Slovak Republic
RU



(Milan MIZERA)

For Slovenia
AKOS



(Meta PAVŠEK TAŠKOV)

Annex 1

PREFERENTIAL PHYSICAL-LAYER CELL IDENTITIES (PCI) FOR LTE

PCI coordination is only needed when channel centre frequencies are aligned independent of the channel bandwidth.

ETSI TS 136 211 defines 168 “unique physical-layer cell-identity groups” in §6.11, numbered 0...167, hereafter called “PCI groups”. Within each PCI group there are three separate PCIs giving 504 PCIs in total.

Administrations should agree on a repartition of these 504 PCIs on an equitable basis when channel centre frequencies are aligned as shown in the Table below. It has to be noted that dividing the PCI groups or PCIs is equivalent. Each country should only use their own preferential PCIs close to the border and can use all PCIs away from the border. This transition distance between “close to the border” and “away from the border” should be agreed between neighbouring countries.

Administrations may wish to define different field strength levels (than those defined in this Technical Arrangement) for non-preferential PCIs.

As shown in the table below, the PCIs should be divided into 6 sub-sets containing each one sixth of the available PCIs. Each country is allocated three sets (half of the PCIs) in a bilateral case and two sets (one third of the PCIs) in a trilateral case.

Four types of countries are defined in a way such that no country will use the same code set as any one of its neighbours. The following lists describe the distribution of European countries:

Type country 1: BEL, CVA, CYP, CZE, DNK, E, FIN, GRC, IRL, ISL, LTU, MCO, SMR, SUI, SVN, UKR, AZE, SRB.

Type country 2: AND, BIH, BLR, BUL, D, EST, G, HNG, I, MDA, RUS (Exclave), GEO.

Type country 3: ALB, AUT, F, HOL, HRV, POL, POR, ROU, RUS, S, MLT.

Type country 4: LIE, LUX, LVA, MKD, MNE, NOR, SVK, TUR.

(Note: Country type map can be found in the figure below).

For each type of country, the following tables and figure describe the sharing of the PCIs with its neighbouring countries, with the following conventions of writing:

	Preferential PCI
	non-preferential PCI

The 504 physical-layer cell-identities should be divided into the following 6 sub-sets when the carrier frequencies are aligned in border areas:

PCI	Set A	Set B	Set C	Set D	Set E	Set F	PCI	Set A	Set B	Set C	Set D	Set E	Set F
Country 1	0..83	84..167	168..251	252..335	336..419	420..503	Country 2	0..83	84..167	168..251	252..335	336..419	420..503
Border 1-2							Border 2-1						
Zone 1-2-3							Zone 2-3-1						
Border 1-3							Border 2-3						
Zone 1-2-4							Zone 2-1-4						
Border 1-4							Border 2-4						
Zone 1-3-4							Zone 2-3-4						

PCI	Set A	Set B	Set C	Set D	Set E	Set F	PCI	Set A	Set B	Set C	Set D	Set E	Set F
Country 3	0..83	84..167	168..251	252..335	336..419	420..503	Country 4	0..83	84..167	168..251	252..335	336..419	420..503
Border 3-2							Border 4-1						
Zone 3-1-2							Zone 4-1-2						
Border 3-1							Border 4-2						
Zone 3-1-4							Zone 4-2-3						
Border 3-4							Border 4-3						
Zone 3-2-4							Zone 4-3-1						

Notes

- 1) All PCIs are available in areas away from the border.
- 2) In certain specific cases (e.g. AUT/HRV) where the distance between two countries of the same type number is very small (< few 10s km), it may be necessary to address the situation in bilateral /multilateral coordination agreements as necessary, and may include further subdivision of the allocated codes in certain areas.

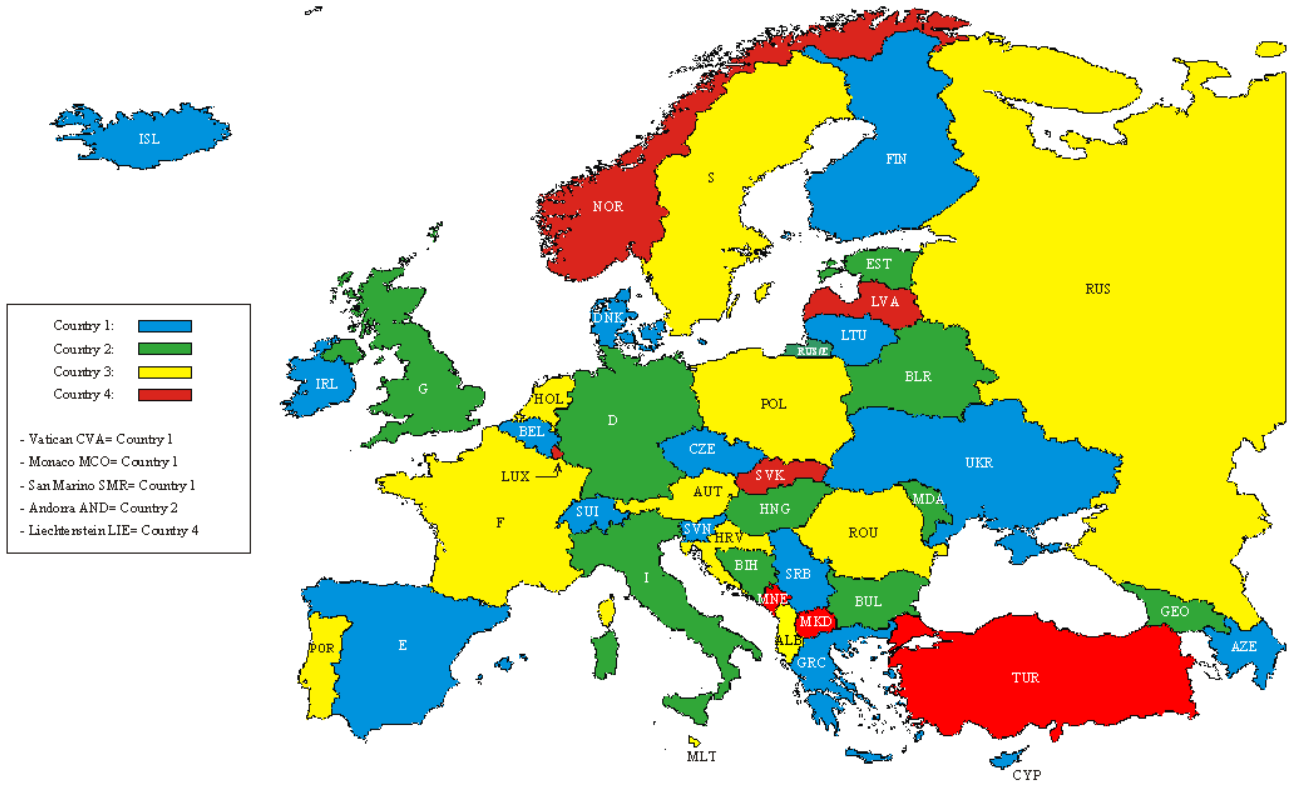


Figure 1: Country type map

Annex 2

EXISTING STATIONS TO BE PROTECTED IN SLOVENIA

Admini- stration	Name of station	Frequency range	Longitude	Latitude	Height above the ground	Protection in accordance with Budapest 2005/or Bratislava 2002 needed till:
SVN	Šmarjetna gora_	3410-3431 /3510- 3531 MHz	'014E3367	46N2438	633	23. 05. 2021
SVN	Dobrča Zadnja vas 30	3410-3431 /3510- 3531 MHz	'014E2458	46N3762	1664	23. 05. 2021
SVN	Ambrož pod Krvavcem 31	3410-3431 /3510- 3531 MHz	'014E5291	46N2961	1675	23. 05. 2021
SVN	Lubnik_1 Vincarje 23	3410-3431 /3510- 3531 MHz	'014E2613	46N1710	1020	23. 05. 2021
SVN	Ravni pod stolom_	3410-3431 /3510- 3531 MHz	'014E1385	46N4280	1294	23. 05. 2021
SVN	Vogel_1 Ukanc 180	3410-3431 /3510- 3531 MHz	'013E8409	46N2638	1506	23. 05. 2021
SVN	Trstelj-RTV	3410-3431 /3510- 3531 MHz	'013E7033	45N8580	643	23. 05. 2021
SVN	HE2- Gradnikove brigade 33	3410-3431 /3510- 3531 MHz	'013E6473	45N9614	105	23. 05. 2021
SVN	Mozirje	3410-3431 /3510- 3531 MHz	,014E5636	46N1704	720	27. 10. 2021
SVN	Nazarje	3410-3431 /3510- 3531 MHz	014 E 5705	46N1911	344	27. 10. 2021
SVN	G. Radgona	3410-3431 /3510- 3531 MHz	015E5917	46N4059	267	27. 10. 2021
SVN	Cankova	3410-3431 /3510- 3531 MHz	016E0123	46N4307	216	27. 10. 2021

EXISTING STATIONS TO BE PROTECTED IN CROATIA

Location	Longitude	Latitude	Lower edge of frequency block	Upper edge of frequency block	EIRP (dBm)
Mohokos R1	016E2211	46N2700	3410,0/ 3510,0	3448,5 / 3548,5	38
Čakovec (Trg Republike 6)	016E2626	46N2327	3410,0/ 3510,0	3448,5 / 3548,5	38
BS VARAŽDIN, Stanka Vraza 4 (vodotoranj)	016E2022	46N1825	3410,0/ 3510,0	3448,5 / 3548,5	38
BS MOHOKOS R1	016E2211	46N2700	3410,0/ 3510,0	3448,5 / 3548,5	43
BS ČAKOVEC, Trg republike 6	016E2626	46N2326	3410,0/ 3510,0	3448,5 / 3548,5	38
BS DONJI KRALJEVEC (radio M)	016E3935	46N2219	3410,0/ 3510,0	3448,5 / 3548,5	38

EXISTING STATIONS TO BE PROTECTED IN HUNGARY

The latest expiry date of licence of the stations is July 26, 2016

Tx (MHz)	Rx (MHz)	Longitude	Latitude	Location	Tx (MHz)	Rx (MHz)	Longitude	Latitude	Location	Tx (MHz)	Rx (MHz)	Longitude	Latitude	Location
3429.25	3529.25	19 E 04 01	47 N 31 09	Budapest	3532.75	3432.75	20 E 07 51	46 N 15 49	Szeged	3439.75	3539.75	19 E 02 03	47 N 35 12	Budapest
3429.25	3529.25	19 E 02 40	47 N 28 03	Budapest	3532.75	3432.75	19 E 03 28	47 N 29 36	Budapest	3439.75	3539.75	19 E 03 08	47 N 29 03	Budapest
3429.25	3529.25	19 E 08 20	47 N 30 55	Budapest	3532.75	3432.75	20 E 07 51	46 N 15 49	Szeged	3439.75	3539.75	19 E 02 03	47 N 35 12	Budapest
3429.25	3529.25	19 E 02 44	47 N 35 02	Budapest	3532.75	3432.75	19 E 01 47	47 N 32 52	Budapest	3439.75	3539.75	19 E 00 53	47 N 29 24	Budapest
3429.25	3529.25	19 E 03 45	47 N 30 37	Budapest	3532.75	3432.75	17 E 38 16	47 N 41 14	Győr	3529.25	3429.25	19 E 05 49	47 N 31 29	Budapest
3429.25	3529.25	19 E 02 40	47 N 28 03	Budapest	3532.75	3432.75	18 E 57 29	47 N 30 36	Budapest	3529.25	3429.25	19 E 02 09	47 N 27 55	Budapest
3429.25	3529.25	19 E 02 44	47 N 35 02	Budapest	3536.25	3436.25	19 E 05 49	47 N 31 29	Budapest	3529.25	3429.25	19 E 05 30	47 N 28 46	Budapest
3432.75	3532.75	21 E 37 32	47 N 31 16	Budapest	3536.25	3436.25	19 E 02 09	47 N 27 55	Budapest	3529.25	3429.25	19 E 03 07	47 N 35 45	Budapest
3432.75	3532.75	21 E 37 56	47 N 33 52	Budapest	3536.25	3436.25	19 E 05 30	47 N 28 46	Budapest	3529.25	3429.25	19 E 03 18	47 N 30 40	Budapest
3432.75	3532.75	19 E 01 60	47 N 33 15	Budapest	3536.25	3436.25	19 E 03 07	47 N 35 45	Budapest	3529.25	3429.25	19 E 02 09	47 N 27 55	Budapest
3432.75	3532.75	19 E 05 27	47 N 26 56	Budapest	3536.25	3436.25	19 E 03 18	47 N 30 40	Budapest	3529.25	3429.25	19 E 03 07	47 N 35 45	Budapest
3432.75	3532.75	18 E 13 17	46 N 04 08	Pécs	3536.25	3436.25	19 E 02 09	47 N 27 55	Budapest	3532.75	3432.75	21 E 37 37	47 N 31 15	Debrecen
3432.75	3532.75	18 E 13 05	46 N 03 12	Pécs	3536.25	3436.25	19 E 03 07	47 N 35 45	Budapest	3532.75	3432.75	19 E 01 47	47 N 32 52	Budapest
3432.75	3532.75	20 E 08 55	46 N 15 39	Szeged	3539.75	3439.75	19 E 00 27	47 N 24 28	Budapest	3532.75	3432.75	19 E 00 27	47 N 24 28	Budapest
3432.75	3532.75	19 E 02 00	47 N 30 29	Budapest	3539.75	3439.75	19 E 01 47	47 N 32 52	Budapest	3532.75	3432.75	18 E 13 40	46 N 02 25	Pécs
3432.75	3532.75	19 E 03 13	47 N 31 24	Budapest	3539.75	3439.75	19 E 03 28	47 N 29 36	Budapest	3532.75	3432.75	18 E 13 40	46 N 02 25	Pécs
3432.75	3532.75	20 E 06 42	46 N 15 39	Szeged	3539.75	3439.75	19 E 01 47	47 N 32 52	Budapest	3532.75	3432.75	18 E 57 29	47 N 30 36	Budapest
3432.75	3532.75	20 E 08 53	46 N 15 09	Szeged	3539.75	3439.75	18 E 57 29	47 N 30 36	Budapest	3413.5	3413.5	18 E 11 60	46 N 04 09	Pécs
3432.75	3532.75	17 E 38 58	47 N 41 14	Győr	3410.875	3510.875	18 E 53 14	47 N 26 27	Törökbálint	3413.5	3413.5	18 E 24 31	47 N 33 46	Tatabánya
3432.75	3532.75	19 E 01 60	47 N 33 15	Budapest	3410.875	3510.875	18 E 59 03	47 N 31 31	Budapest	3413.5	3413.5	20 E 18 48	46 N 24 15	Hódmezővásárhely
3432.75	3532.75	17 E 38 08	47 N 41 09	Győr	3410.875	3510.875	19 E 03 10	47 N 28 03	Budapest	3414.375	3514.375	19 E 01 43	47 N 28 41	Budapest
3432.75	3532.75	17 E 38 08	47 N 41 09	Győr	3410.875	3510.875	19 E 03 13	47 N 29 29	Budapest	3414.375	3514.375	19 E 04 55	47 N 27 52	Budapest
3432.75	3532.75	19 E 02 00	47 N 30 29	Budapest	3410.875	3510.875	19 E 03 31	47 N 31 18	Budapest	3414.375	3514.375	19 E 04 58	47 N 31 45	Budapest
3436.25	3536.25	19 E 06 19	47 N 31 08	Budapest	3410.875	3510.875	19 E 56 24	47 N 46 17	Gyöngyös	3416.125	3516.125	16 E 33 56	47 N 41 23	Sopron
3436.25	3536.25	19 E 02 21	47 N 28 28	Budapest	3412.625	3512.625	16 E 36 60	47 N 13 26	Szombathely	3416.125	3516.125	16 E 36 33	47 N 40 07	Sopron
3436.25	3536.25	19 E 06 16	47 N 27 28	Budapest	3412.625	3512.625	16 E 38 24	47 N 14 39	Szombathely	3416.125	3516.125	17 E 39 31	47 N 41 11	Győr
3436.25	3536.25	19 E 03 38	47 N 34 42	Budapest	3412.625	3512.625	17 E 38 07	47 N 41 06	Győr	3416.125	3516.125	19 E 03 00	47 N 29 49	Budapest
3436.25	3536.25	19 E 03 08	47 N 30 51	Budapest	3412.625	3512.625	19 E 03 12	47 N 27 46	Budapest	3416.125	3516.125	19 E 03 52	47 N 31 54	Budapest
3436.25	3536.25	19 E 02 21	47 N 28 28	Budapest	3412.625	3512.625	19 E 04 44	47 N 30 44	Budapest	3416.125	3516.125	20 E 22 36	47 N 54 03	Eger
3436.25	3536.25	19 E 03 38	47 N 34 42	Budapest	3412.625	3512.625	20 E 22 56	47 N 53 54	Eger	3416.125	3516.125	21 E 35 40	47 N 32 32	Debrecen
3439.75	3539.75	19 E 01 29	47 N 24 32	Budapest	3412.625	3512.625	21 E 37 53	47 N 33 45	Debrecen	3416.125	3516.125	21 E 35 50	47 N 32 34	Debrecen

Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location	Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location	Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location
3417.875	3517.875	19 E 05 56	47 N 28 30	Budapest	3482.625	3582.625	19 E 03 56	47 N 29 09	Budapest	3491.375	3591.375	19 E 00 40	47 N 30 59	Budapest
3417.875	3517.875	19 E 07 33	47 N 34 15	Budapest	3482.625	3582.625	19 E 04 40	47 N 29 31	Budapest	3491.375	3591.375	19 E 01 47	47 N 30 17	Budapest
3417.875	3517.875	19 E 10 01	47 N 30 56	Budapest	3482.625	3582.625	19 E 08 31	47 N 30 13	Budapest	3491.375	3591.375	19 E 02 17	47 N 28 27	Budapest
3419.625	3519.625	19 E 02 54	47 N 30 00	Budapest	3483.5	3483.5	17 E 38 34	47 N 41 20	Győr	3491.375	3591.375	19 E 03 22	47 N 31 36	Budapest
3419.625	3519.625	19 E 06 31	47 N 29 46	Budapest	3483.5	3483.5	20 E 36 18	46 N 34 00	Orosháza	3493.125	3593.125	16 E 59 56	46 N 27 28	Nagykanizsa
3419.625	3519.625	19 E 09 22	47 N 29 52	Budapest	3483.5	3483.5	20 E 40 47	46 N 33 51	Orosháza	3493.125	3593.125	17 E 38 07	47 N 41 04	Győr
3420.5	3420.5	18 E 11 32	46 N 04 07	Pécs	3483.5	3483.5	21 E 41 33	47 N 57 26	Nyíregyháza	3493.125	3593.125	18 E 10 45	46 N 03 49	Pécs
3420.5	3420.5	18 E 23 53	47 N 35 07	Tatabánya	3484.375	3584.375	19 E 00 58	47 N 30 36	Budapest	3493.125	3593.125	18 E 18 44	47 N 28 25	Oroszlány
3420.5	3420.5	20 E 20 24	46 N 25 29	Hódmezővásárhely	3484.375	3584.375	19 E 01 32	47 N 28 44	Budapest	3493.125	3593.125	19 E 02 28	47 N 28 23	Budapest
3421.375	3521.375	19 E 01 25	47 N 29 36	Budapest	3484.375	3584.375	19 E 05 44	47 N 28 40	Budapest	3493.125	3593.125	19 E 03 36	47 N 29 41	Budapest
3421.375	3521.375	19 E 04 29	47 N 28 55	Budapest	3484.375	3584.375	19 E 08 05	47 N 33 08	Budapest	3493.125	3593.125	19 E 05 05	47 N 28 14	Budapest
3421.375	3521.375	19 E 04 51	47 N 29 56	Budapest	3486.125	3586.125	19 E 02 10	47 N 30 56	Budapest	3493.125	3593.125	19 E 07 29	47 N 30 31	Budapest
3421.375	3521.375	19 E 05 22	47 N 32 27	Budapest	3486.125	3586.125	19 E 03 20	47 N 30 40	Budapest	3513.5	3513.5	18 E 14 35	46 N 04 34	Pécs
3423.125	3523.125	19 E 02 14	47 N 31 30	Budapest	3486.125	3586.125	19 E 03 36	47 N 29 41	Budapest	3513.5	3513.5	20 E 19 08	46 N 25 25	Hódmezővásárhely
3423.125	3523.125	19 E 02 45	47 N 32 47	Budapest	3486.125	3586.125	19 E 03 55	47 N 28 56	Budapest	3520.5	3520.5	18 E 12 39	46 N 03 37	Pécs
3423.125	3523.125	19 E 02 59	47 N 34 52	Budapest	3486.125	3586.125	19 E 08 46	47 N 31 55	Budapest	3520.5	3520.5	18 E 23 10	47 N 34 27	Tatabánya
3423.125	3523.125	19 E 14 22	47 N 29 41	Budapest	3487.875	3587.875	16 E 49 42	46 N 49 25	Zalaegerszeg	3520.5	3520.5	20 E 20 51	46 N 24 44	Hódmezővásárhely
3423.125	3523.125	21 E 36 24	47 N 31 45	Debrecen	3487.875	3587.875	18 E 11 15	47 N 22 18	Mór	3583.5	3583.5	17 E 37 31	47 N 40 24	Győr
3480.875	3580.875	18 E 11 20	47 N 22 18	Mór	3487.875	3587.875	19 E 03 31	47 N 29 33	Budapest	3583.5	3583.5	18 E 56 50	47 N 27 17	Budaörs
3480.875	3580.875	19 E 04 05	47 N 32 13	Budapest	3487.875	3587.875	19 E 04 29	47 N 30 40	Budapest	3583.5	3583.5	19 E 03 36	47 N 25 28	Budapest
3480.875	3580.875	19 E 06 13	47 N 27 30	Budapest	3487.875	3587.875	19 E 07 56	47 N 28 23	Budapest	3583.5	3583.5	19 E 03 36	47 N 36 41	Budakalász
3480.875	3580.875	19 E 55 50	47 N 44 29	Gyöngyös	3487.875	3587.875	20 E 08 47	46 N 14 55	Szeged	3583.5	3583.5	19 E 14 29	47 N 28 57	Budapest
3480.875	3580.875	21 E 43 54	47 N 57 20	Nyíregyháza	3489.625	3589.625	18 E 26 22	47 N 33 17	Tatabánya	3583.5	3583.5	20 E 22 56	47 N 53 54	Eger
3416.125	3516.125	21 E 41 33	47 N 57 26	Nyíregyháza	3489.625	3586.625	19 E 04 43	47 N 26 32	Budapest	3583.5	3583.5	20 E 39 21	46 N 34 08	Orosháza
3416.125	3516.125	21 E 43 05	47 N 57 33	Nyíregyháza	3489.625	3586.625	19 E 07 20	47 N 30 57	Budapest	3583.5	3583.5	20 E 39 32	46 N 33 32	Orosháza
3417.875	3517.875	19 E 01 08	47 N 29 39	Budapest	3490.5	3490.5	16 E 39 10	47 N 14 22	Szombathely	3583.5	3583.5	20 E 47 23	48 N 06 45	Miskolc
3417.875	3517.875	19 E 02 54	47 N 30 33	Budapest	3490.5	3490.5	17 E 37 51	47 N 40 36	Győr	3583.5	3583.5	21 E 41 44	47 N 56 49	Nyíregyháza
3417.875	3517.875	19 E 02 59	47 N 29 40	Budapest	3490.5	3490.5	18 E 56 23	47 N 27 13	Budaörs	3590.5	3590.5	16 E 39 10	47 N 14 22	Szombathely
3482.625	3582.625	18 E 25 40	47 N 32 44	Tatabánya	3490.5	3490.5	20 E 40 07	46 N 33 04	Orosháza	3590.5	3590.5	17 E 39 22	47 N 40 57	Győr
3482.625	3582.625	19 E 00 37	47 N 29 47	Budapest	3490.5	3490.5	20 E 40 32	46 N 34 02	Orosháza	3590.5	3590.5	18 E 53 60	47 N 27 28	Budaörs
3482.625	3582.625	19 E 03 16	47 N 30 14	Budapest	3490.5	3490.5	21 E 37 59	47 N 32 23	Debrecen	3590.5	3590.5	20 E 22 35	47 N 54 10	Eger

Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location	Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location	Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location
3590.5	3590.5	20 E 47 19	48 N 07 13	Miskolc	3571.25	3471.25	20 E 08 43	46 N 16 16	Szeged	3590.5	3590.5	20 E 41 32	46 N 34 44	Orosháza
3590.5	3590.5	21 E 36 24	47 N 31 45	Debrecen	3471.25	3571.25	20 E 12 20	46 N 15 41	Szeged	3571.25	3471.25	18 E 35 36	47 N 23 04	Vértesacsca
3590.5	3590.5	21 E 43 05	47 N 57 33	Nyíregyháza	3574.75	3474.75	20 E 08 43	46 N 16 16	Szeged	3471.25	3571.25	18 E 35 13	47 N 22 05	Vértesacsca
3564.25	3464.25	20 E 08 43	46 N 16 16	Szeged	3474.75	3574.75	20 E 08 48	46 N 15 19	Szeged	3574.75	3474.75	18 E 35 36	47 N 23 04	Vértesacsca
3464.25	3564.25	20 E 14 14	46 N 13 01	Szeged	3574.75	3474.75	19 E 20 47	47 N 35 54	Gödöllő	3474.75	3574.75	18 E 34 19	47 N 22 01	Vértesacsca
3567.75	3467.75	20 E 08 43	46 N 16 16	Szeged	3474.75	3574.75	19 E 19 48	47 N 36 56	Gödöllő	3550.250	3450.250	19 E 00 05	47 N 33 00	Budapest
3467.75	3567.75	20 E 08 43	46 N 14 51	Szeged	3564.25	3464.25	19 E 08 23	47 N 46 25	Vác	3450.250	3550.250	19 E 07 41	47 N 38 19	Dunakeszi
3571.25	3471.25	20 E 08 43	46 N 16 16	Szeged	3464.25	3564.25	19 E 06 11	47 N 48 28	Vác	3557.250	3457.250	18 E 58 45	47 N 29 30	Budapest
3471.25	3571.25	20 E 06 55	46 N 15 15	Szeged	3571.25	3471.25	19 E 08 23	47 N 46 25	Vác	3457.250	3557.250	19 E 00 53	47 N 31 20	Budapest
3564.25	3464.25	20 E 08 43	46 N 16 16	Szeged	3471.25	3571.25	19 E 09 46	47 N 46 12	Vác	3557.250	3457.250	21 E 09 33	48 N 16 10	Abaújszántó
3464.25	3564.25	20 E 05 48	46 N 16 29	Szeged	3574.75	3474.75	19 E 08 23	47 N 46 25	Vác	3457.250	3557.250	21 E 14 06	48 N 20 21	Boldogkővávalja
3574.75	3474.75	20 E 08 43	46 N 16 16	Szeged	3474.75	3574.75	19 E 08 23	47 N 46 25	Vác	3546.750	3446.750	19 E 18 08	48 N 04 12	Balassagyarmat
3474.75	3574.75	20 E 10 49	46 N 17 53	Szeged	3564.25	3464.25	18 E 22 54	47 N 23 30	Gánt	3446.750	3546.750	19 E 17 37	48 N 04 39	Balassagyarmat
3571.25	3471.25	20 E 08 43	46 N 16 16	Szeged	3464.25	3564.25	18 E 23 24	47 N 23 31	Gánt	3553.750	3453.750	21 E 02 24	46 N 41 17	Békéscsaba
3471.25	3571.25	20 E 12 20	46 N 15 41	Szeged	3571.25	3471.25	18 E 22 54	47 N 23 30	Gánt	3453.750	3553.750	21 E 07 57	46 N 46 20	Békés
3574.75	3474.75	18 E 35 36	47 N 23 04	Vértesacsca	3471.25	3571.25	18 E 23 05	47 N 23 16	Gánt	3557.250	3457.250	19 E 00 05	47 N 33 00	Budapest
3474.75	3574.75	18 E 34 19	47 N 22 02	Vértesacsca	3564.25	3464.25	18 E 32 41	47 N 30 24	Nagyegyháza	3457.250	3557.250	19 E 05 22	47 N 33 38	Budapest
3567.75	3467.75	18 E 32 41	47 N 30 24	Nagyegyháza	3464.25	3564.25	18 E 32 23	47 N 31 19	Nagyegyháza	3546.750	3446.750	19 E 00 05	47 N 33 00	Budapest
3467.75	3567.75	18 E 34 01	47 N 29 39	Óbarok	3567.75	3467.75	18 E 32 41	47 N 30 24	Nagyegyháza	3446.750	3546.750	19 E 02 17	47 N 31 50	Budapest
3574.75	3474.75	18 E 32 41	47 N 30 24	Nagyegyháza	3467.75	3567.75	18 E 34 01	47 N 29 39	Óbarok	3553.750	3453.750	18 E 57 23	47 N 30 42	Budapest
3474.75	3574.75	18 E 34 25	47 N 29 26	Óbarok	3574.75	3474.75	18 E 32 41	47 N 30 24	Nagyegyháza	3453.750	3553.750	18 E 55 43	47 N 30 41	Budakeszi
3564.25	3464.25	20 E 08 43	46 N 16 16	Szeged	3474.75	3574.75	18 E 34 25	47 N 29 26	Óbarok	3550.250	3450.250	18 E 06 48	47 N 44 39	Komárom
3464.25	3564.25	20 E 14 14	46 N 13 01	Szeged	3564.25	3464.25	18 E 35 36	47 N 23 04	Vértesacsca	3450.250	3550.250	18 E 07 00	47 N 44 41	Komárom
3567.75	3467.75	20 E 08 43	46 N 16 16	Szeged	3464.25	3564.25	18 E 35 01	47 N 22 22	Vértesacsca	3546.700	3446.700	18 E 06 48	47 N 44 39	Komárom
3467.75	3567.75	20 E 08 43	46 N 14 51	Szeged	3567.75	3467.75	18 E 35 36	47 N 23 04	Vértesacsca	3446.700	3546.700	18 E 10 03	47 N 44 07	Komárom
3571.25	3471.25	20 E 08 43	46 N 16 16	Szeged	3467.75	3567.75	18 E 34 50	47 N 22 26	Vértesacsca	3553.750	3453.750	18 E 58 45	47 N 29 30	Budapest
3471.25	3571.25	20 E 06 55	46 N 15 15	Szeged	3571.25	3471.25	18 E 35 36	47 N 23 04	Vértesacsca	3453.750	3553.750	19 E 01 06	47 N 24 28	Budapest
3564.25	3464.25	20 E 08 43	46 N 16 16	Szeged	3471.25	3571.25	18 E 35 13	47 N 22 05	Vértesacsca	3557.250	3457.250	18 E 58 45	47 N 29 30	Budapest
3464.25	3564.25	20 E 05 48	46 N 16 29	Szeged	3574.75	3474.75	18 E 35 36	47 N 23 04	Vértesacsca	3557.250	3457.250	19 E 04 11	47 N 31 58	Budapest
3574.75	3474.75	20 E 08 43	46 N 16 16	Szeged	3474.75	3574.75	18 E 34 19	47 N 22 02	Vértesacsca	3457.250	3557.250	18 E 59 10	47 N 30 22	Budapest
3474.75	3574.75	20 E 10 49	46 N 17 53	Szeged	3564.25	3464.25	18 E 35 36	47 N 23 04	Vértesacsca	3553.750	3453.750	19 E 07 32	47 N 28 07	Budapest

Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location	Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location	Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location
3464.25	3564.25	18 E 35 01	47 N 22 22	Vértesacsca	3557.250	3457.250	21 E 40 16	47 N 41 44	Téglás	3445.875	3545.875	21 E 17 01	48 N 23 26	Fony
3567.75	3467.75	18 E 35 36	47 N 23 04	Vértesacsca	3457.250	3557.250	21 E 45 01	47 N 43 59	Bököny	3545.875	3445.875	21 E 24 44	47 N 19 39	Földes
3467.75	3567.75	18 E 34 50	47 N 22 26	Vértesacsca	3545.875	3445.875	22 E 32 43	48 N 09 26	Beregsurány	3445.875	3545.875	21 E 18 12	47 N 18 57	Tetétlen
3453.750	3553.750	19 E 07 45	47 N 29 00	Budapest	3445.875	3545.875	22 E 33 11	48 N 09 41	Beregsurány	3557.250	3457.250	18 E 29 38	47 N 40 34	Gerecse
3557.250	3457.250	19 E 07 32	47 N 28 07	Budapest	3550.250	3450.250	18 E 32 38	46 N 17 47	Bonyhád	3457.250	3557.250	18 E 30 37	47 N 36 38	Tarján
3457.250	3557.250	19 E 08 32	47 N 27 29	Budapest	3450.250	3550.250	18 E 31 53	46 N 17 33	Bonyhád	3553.750	3453.750	18 E 29 38	47 N 40 34	Gerecse
3550.250	3450.250	19 E 07 32	47 N 28 07	Budapest	3557.250	3457.250	21 E 02 24	46 N 41 17	Békéscsaba	3453.750	3553.750	18 E 30 37	47 N 36 38	Tarján
3450.250	3550.250	19 E 05 40	47 N 27 13	Budapest	3457.250	3557.250	21 E 06 20	46 N 40 10	Békéscsaba	3546.750	3446.750	18 E 29 38	47 N 40 34	Gerecse
3546.750	3446.750	18 E 57 48	46 N 10 27	Baja	3550.250	3450.250	21 E 02 24	46 N 41 17	Békéscsaba	3446.750	3546.750	18 E 30 37	47 N 36 38	Tarján
3446.750	3546.750	18 E 58 32	46 N 10 43	Baja	3450.250	3550.250	20 E 51 28	46 N 38 01	Csorvás	3545.875	3445.875	17 E 40 06	47 N 39 38	Győr
3553.750	3453.750	21 E 50 22	47 N 52 40	Nagykálló	3551.125	3451.125	22 E 27 32	48 N 09 40	Csaroda	3445.875	3545.875	17 E 44 19	47 N 37 19	Töltéstava
3453.750	3553.750	21 E 50 51	47 N 52 30	Nagykálló	3451.125	3551.125	22 E 33 11	48 N 09 41	Beregsurány	3550.250	3450.250	17 E 40 06	47 N 39 38	Győr
3546.750	3446.750	16 E 34 06	47 N 39 44	Sopron	3547.625	3447.625	22 E 27 32	48 N 09 40	Csaroda	3450.250	3550.250	17 E 38 01	47 N 43 13	Győr
3446.750	3546.750	16 E 35 12	47 N 41 14	Sopron	3447.625	3547.625	22 E 18 46	48 N 11 13	Tiszaszalka	3550.250	3450.250	19 E 55 21	47 N 46 24	Gyöngyös
3551.125	3451.125	18 E 44 54	46 N 07 30	Báta	3553.750	3453.750	21 E 37 36	47 N 31 15	Debrecen	3450.250	3550.250	19 E 55 25	47 N 46 47	Gyöngyös
3451.125	3551.125	18 E 57 14	46 N 10 56	Baja	3453.750	3553.750	21 E 37 35	47 N 32 47	Debrecen	3557.250	3457.250	21 E 23 21	47 N 26 56	Hajdúszoboszló
3550.250	3450.250	18 E 29 38	47 N 40 34	Gerecse	3550.250	3450.250	21 E 37 36	47 N 31 15	Debrecen	3457.250	3557.250	21 E 13 41	47 N 23 18	Kaba
3450.250	3550.250	17 E 58 36	47 N 38 37	Bábolna	3450.250	3550.250	21 E 39 01	47 N 32 47	Debrecen	3549.375	3449.375	16 E 39 05	46 N 57 26	Hegyhátsál
3557.250	3457.250	17 E 40 06	47 N 39 38	Győr	3546.750	3446.750	21 E 37 36	47 N 31 15	Debrecen	3449.375	3549.375	16 E 33 14	47 N 03 56	Nagykölked
3457.250	3557.250	17 E 37 54	47 N 41 01	Győr	3446.750	3546.750	21 E 39 01	47 N 30 50	Debrecen	3545.875	3445.875	16 E 39 05	46 N 57 26	Hegyhátsál
3546.750	3446.750	22 E 03 50	48 N 14 08	Kisvárd	3550.250	3450.250	18 E 44 33	47 N 44 59	Dorog	3445.875	3545.875	16 E 25 22	46 N 56 27	Rábagyarmat
3446.750	3546.750	22 E 04 50	48 N 12 43	Kisvárd	3450.250	3550.250	18 E 44 24	47 N 47 35	Esztergom	3550.250	3450.250	20 E 19 04	46 N 25 24	Hódmezővásárhely
3553.750	3453.750	20 E 00 31	47 N 52 21	Kékes	3550.250	3450.250	22 E 35 11	47 N 59 53	Fehérgyarmat	3450.250	3550.250	20 E 19 13	46 N 25 03	Hódmezővásárhely
3550.250	3450.250	20 E 46 31	48 N 05 57	Miskolc	3450.250	3550.250	22 E 23 43	48 N 02 37	Panyola	3550.250	3450.250	19 E 47 22	48 N 09 24	Karancs
3450.250	3550.250	20 E 48 26	48 N 09 22	Szirmabesenyő	3546.750	3446.750	22 E 35 11	47 N 59 53	Fehérgyarmat	3450.250	3550.250	19 E 48 14	48 N 05 48	Salgótarján
3546.750	3446.750	20 E 39 44	46 N 33 48	Orosháza	3446.750	3546.750	22 E 43 47	47 N 59 09	Csaholc	3553.750	3453.750	20 E 37 55	48 N 14 55	Kazincbarcika
3446.750	3546.750	20 E 37 24	46 N 29 07	Kardoskút	3557.250	3457.250	22 E 35 11	47 N 59 53	Fehérgyarmat	3453.750	3553.750	20 E 37 12	48 N 14 59	Kazincbarcika
3557.250	3457.250	20 E 08 42	46 N 16 15	Szeged	3457.250	3557.250	22 E 37 25	48 N 05 09	Szatmárcseke	3550.250	3450.250	19 E 28 17	46 N 26 00	Kiskunhalas
3457.250	3557.250	20 E 08 47	46 N 15 06	Szeged	3553.750	3453.750	22 E 35 11	47 N 59 53	Fehérgyarmat	3450.250	3550.250	19 E 28 28	46 N 25 50	Kiskunhalas
3550.250	3450.250	18 E 24 31	47 N 35 12	Tatabánya	3453.750	3553.750	22 E 37 22	47 N 51 56	Pátyod	3557.250	3457.250	22 E 03 50	48 N 14 08	Kisvárd
3450.250	3550.250	18 E 24 14	47 N 34 36	Tatabánya	3545.875	3445.875	21 E 14 13	48 N 21 16	Fony	3457.250	3557.250	22 E 00 18	48 N 15 19	Kékcse

Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location	Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location	Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location
3553.750	3453.750	22 E 03 50	48 N 14 08	Kisvárd	3553.750	3453.750	16 E 59 56	46 N 27 49	Nagykanizsa	3457.250	3557.250	19 E 47 05	48 N 04 09	Salgótarján
3453.750	3553.750	22 E 09 12	48 N 14 16	Jéke	3453.750	3553.750	16 E 59 02	46 N 27 18	Nagykanizsa	3546.750	3446.750	19 E 48 12	48 N 06 30	Salgótarján
3547.625	3447.625	21 E 29 37	47 N 01 06	Komádi	3553.750	3453.750	21 E 42 58	47 N 56 51	Nyíregyháza	3446.750	3546.750	19 E 48 33	48 N 06 20	Salgótarján
3447.625	3547.625	21 E 26 01	47 N 08 01	Zsáka	3453.750	3553.750	21 E 42 49	47 N 57 29	Nyíregyháza	3550.250	3450.250	18 E 19 55	45 N 52 47	Siklós
3551.125	3451.125	21 E 29 37	47 N 01 06	Komádi	3557.250	3457.250	21 E 42 58	47 N 56 51	Nyíregyháza	3450.250	3550.250	18 E 19 50	45 N 48 34	Egyházasharaszti
3451.125	3551.125	21 E 21 31	46 N 59 15	Újiráz	3457.250	3557.250	21 E 44 00	47 N 53 58	Nyíregyháza	3557.250	3457.250	19 E 23 20	46 N 35 22	Soltvadkert
3557.250	3457.250	21 E 29 37	47 N 01 06	Komádi	3553.750	3453.750	16 E 32 14	47 N 13 43	Ondód	3457.250	3557.250	19 E 23 36	46 N 34 42	Soltvadkert
3457.250	3557.250	21 E 33 48	47 N 01 51	Magyarhomorog	3453.750	3553.750	16 E 39 43	47 N 12 02	Szombathely	3546.750	3446.750	20 E 08 42	46 N 16 15	Szeged
3551.125	3451.125	20 E 00 31	47 N 52 21	Kékes	3557.250	3457.250	16 E 32 14	47 N 13 43	Ondód	3446.750	3546.750	20 E 08 42	46 N 15 08	Szeged
3451.125	3551.125	20 E 01 19	47 N 56 32	Bodony	3457.250	3557.250	16 E 35 09	47 N 19 33	Szombathely	3450.250	3550.250	20 E 09 09	46 N 15 20	Szeged
3546.750	3446.750	20 E 00 31	47 N 52 21	Kékes	3550.250	3450.250	20 E 39 44	46 N 33 48	Orosháza	3450.250	3550.250	20 E 09 09	46 N 15 20	Szeged
3446.750	3546.750	19 E 55 58	47 N 49 45	Gyöngyössolymos	3450.250	3550.250	20 E 40 11	46 N 33 37	Orosháza	3553.750	3453.750	20 E 09 05	46 N 13 57	Újszeged
3457.250	3557.250	17 E 36 14	47 N 21 36	Csót	3553.750	3453.750	20 E 39 44	46 N 33 48	Orosháza	3453.750	3553.750	19 E 58 59	46 N 10 33	Röszke
3557.250	3457.250	16 E 46 37	46 N 28 17	Letenye	3453.750	3553.750	20 E 40 11	46 N 33 37	Orosháza	3546.750	3446.750	18 E 41 41	46 N 21 40	Szekszárd
3457.250	3557.250	16 E 44 00	46 N 26 05	Letenye	3549.375	3449.375	19 E 41 51	47 N 55 13	Pásztó	3446.750	3546.750	18 E 42 09	46 N 20 54	Szekszárd
3557.250	3457.250	21 E 52 29	47 N 22 46	Létavértes	3449.375	3549.375	19 E 42 32	47 N 55 43	Pásztó	3550.250	3450.250	18 E 41 36	46 N 20 48	Szekszárd
3457.250	3557.250	21 E 58 10	47 N 22 46	Létavértes	3545.875	3445.875	19 E 41 51	47 N 55 13	Pásztó	3450.250	3550.250	18 E 43 08	46 N 21 18	Szekszárd
3557.250	3457.250	20 E 46 31	48 N 05 57	Miskolc	3445.875	3545.875	19 E 41 48	47 N 51 52	Szurdokpüspöki	3547.625	3447.625	17 E 47 04	46 N 03 00	Szigetvár
3457.250	3557.250	20 E 46 45	48 N 06 10	Miskolc	3553.750	3453.750	18 E 13 12	46 N 05 56	Pécs	3447.625	3547.625	17 E 42 00	46 N 04 25	Merenye
3546.750	3446.750	20 E 46 31	48 N 05 57	Miskolc	3453.750	3553.750	18 E 13 35	46 N 02 53	Pécs	3549.375	3449.375	17 E 47 04	46 N 03 00	Szigetvár
3446.750	3546.750	20 E 47 19	48 N 06 11	Miskolc	3546.750	3446.750	18 E 13 12	46 N 05 56	Pécs	3449.375	3549.375	18 E 01 29	45 N 59 36	Gerde
3545.875	3445.875	17 E 15 17	47 N 51 47	Mosonmagyaróvár	3446.750	3546.750	18 E 20 16	46 N 10 38	Hosszúhetény	3553.750	3453.750	16 E 55 33	47 N 15 47	Sárvár
3445.875	3545.875	17 E 10 10	47 N 51 02	Mosonszolnok	3557.250	3457.250	18 E 13 12	46 N 05 56	Pécs	3453.750	3553.750	16 E 55 14	47 N 15 34	Sárvár
3553.750	3453.750	17 E 15 17	47 N 51 47	Mosonmagyaróvár	3457.250	3557.250	18 E 12 07	45 N 57 48	Szilvás	3557.250	3457.250	21 E 37 54	48 N 24 06	Sátoraljaújhely
3453.750	3553.750	17 E 15 16	47 N 51 58	Mosonmagyaróvár	3550.250	3450.250	18 E 13 12	46 N 05 56	Pécs	3457.250	3557.250	21 E 41 20	48 N 20 37	Alsóberecki
3557.250	3457.250	17 E 17 47	47 N 50 21	Mosonmagyaróvár	3450.250	3550.250	18 E 16 18	46 N 05 10	Pécs	3546.750	3446.750	18 E 24 31	47 N 35 12	Tatabánya
3457.250	3557.250	17 E 16 13	47 N 52 32	Mosonmagyaróvár	3553.750	3453.750	18 E 13 12	46 N 05 56	Pécs	3446.750	3546.750	18 E 21 47	47 N 38 51	Baj
3545.875	3445.875	22 E 16 56	48 N 17 02	Mátyus	3453.750	3553.750	18 E 20 16	46 N 10 38	Hosszúhetény	3545.875	3445.875	21 E 22 54	48 N 07 13	Tokaj
3445.875	3545.875	22 E 15 59	48 N 19 22	Lónya	3553.750	3453.750	17 E 20 14	47 N 27 28	Rábasantandrás	3445.875	3545.875	21 E 20 32	48 N 10 16	Bodrogkeresztúr
3549.375	3449.375	22 E 16 56	48 N 17 02	Mátyus	3453.750	3553.750	17 E 16 17	47 N 19 41	Szergény	3553.750	3453.750	21 E 22 54	48 N 07 13	Tokaj
3449.375	3549.375	22 E 18 13	48 N 15 32	Tiszakerecseny	3557.250	3457.250	19 E 48 12	48 N 06 30	Salgótarján	3453.750	3553.750	21 E 27 23	48 N 02 31	Tiszaeszlár

Tx(MHz)	Rx(MHz)	Longitude	Latitude	Location
3550.250	3450.250	21 E 22 54	48 N 07 13	Tokaj
3450.250	3550.250	21 E 30 51	48 N 01 09	Bashalom
3557.250	3457.250	21 E 22 54	48 N 07 13	Tokaj
3457.250	3557.250	21 E 12 25	48 N 08 54	Szerencs
3557.250	3457.250	22 E 18 08	48 N 07 55	Vásárosnamény
3457.250	3557.250	22 E 18 53	48 N 07 43	Vásárosnamény
3453.750	3553.750	22 E 18 49	48 N 11 11	Tiszaszalka
3453.750	3553.750	22 E 18 49	48 N 11 11	Tiszaszalka
3546.750	3446.750	16 E 33 00	46 N 43 01	Zalabaksa
3446.750	3546.750	16 E 28 31	46 N 36 59	Rédics
3551.125	3451.125	17 E 01 07	46 N 33 46	Újudvar
3451.125	3551.125	16 E 56 01	46 N 30 51	Hosszúvölgy
3553.750	3453.750	18 E 44 54	46 N 07 30	Báta
3453.750	3553.750	18 E 56 11	45 N 55 53	Hercegszántó
3557.250	3457.250	19 E 08 56	46 N 11 49	Csávoly
3457.250	3557.250	18 E 57 21	46 N 10 59	Baja
3557.250	3457.250	20 E 39 44	46 N 33 48	Orosháza
3457.250	3557.250	20 E 37 24	46 N 29 07	Kardoskút
3550.250	3450.250	18 E 58 45	47 N 29 30	Budapest
3450.250	3550.250	19 E 04 21	47 N 29 35	Budapest
3553.750	3453.750	16 E 34 06	47 N 39 44	Sopron
3453.750	3553.750	16 E 35 33	47 N 41 02	Sopron

EXISTING STATIONS TO BE PROTECTED IN THE SLOVAK REPUBLIC

Location	Longitude	Latitude	Tx (MHz)	Rx (MHz)
Fíľakovo	19E4919	48N1628	3511.75	3411.75
Bánovce nad Ondavou	21E4949	48N4034	3576.5	3476.5
Bánovce nad Ondavou	21E4949	48N4034	3585.25	3485.25
Bánovce nad Ondavou	21E4949	48N4034	3518.75	3418.75
Bratislava	16E5900	48N1339	3511.75	3411.75
Bratislava	17E0221	48N1104	3518.75	3418.75
Bratislava	17E0221	48N1104	3515.25	3415.25
Bratislava	16E5844	48N1226	3583.5	3583.5
Bratislava	16E5844	48N1226	3576.5	3576.5
Bratislava	16E5844	48N1227	3515.25	3415.25
Bratislava	17E1321	48N0727	3513.5	3513.5
Bratislava	17E0828	48N0908	3574.75	3474.75
Bratislava	17E0828	48N0908	3578.25	3478.25
Čierna nad Tisou	22E0500	48N2451	3511.75	3411.75
Číž	20E1648	48N1846	3511.75	3411.75
Dunajská Lužná	17E1541	48N0454	3513.5	3513.5
Dunajská Lužná	17E1541	48N0454	3583.5	3583.5
Dunajská Lužná	17E1541	48N0454	3520.5	3520.5
Dunajská Streda	17E3559	47N5939	3581.25	3481.25
Dunajská Streda	17E3559	47N5939	3574.75	3474.75
Dunajská Streda	17E3559	47N5939	3511.75	3411.75
Dunajská Streda	17E3559	47N5939	3515.25	3415.25
Ďurkovce	19E1042	48N0759	3476.5	3476.5
Figa	20E1549	48N2416	3515.25	3415.25
Figa	20E1549	48N2416	3515.25	3415.25
Glabušovce	19E2722	48N0920	3513.5	3513.5
Hodejovec	20E0101	48N1658	3413.5	3413.5
Hurbanovo	18E1153	47N5243	3518.75	3418.75
Chrastince	19E1501	48N0528	3511.75	3411.75
k.ú. Mýtna Ludany	18E3822	48N1048	3415.25	3515.25
k.ú. Mýtna Ludany	18E3822	48N1048	3481.75	3581.75
k.ú. Mýtna Ludany	18E3822	48N1048	3585.25	3485.25
k.ú. Mýtna Ludany	18E3822	48N1048	3518.75	3418.75
k.ú. Stredné Plachtince	19E1521	48N1359	3413.5	3413.5
Koláre	19E1452	48N0411	3511.75	3411.75
Kolárovo	17E5937	47N5459	3518.75	3418.75
Komárno	18E0741	47N4516	3518.75	3418.75
Komárno	18E0711	47N4529	3581.75	3481.75
Komárno	18E0711	47N4529	3513.5	3413.5

Location	Longitude	Latitude	Tx (MHz)	Rx (MHz)
Kosihy nad Ipľom	19E1033	48N0432	3511.75	3411.75
Košice	21E1342	48N4427	3522.25	3422.25
Košice	21E1342	48N4427	3518.75	3418.75
Košice	21E1342	48N4427	3511.75	3411.75
Košice	21E1534	48N4208	3511.75	3411.75
Košice - Čaňa	21E1816	48N3644	3511.75	3411.75
Košice - Čaňa	21E1816	48N3644	3515.25	3415.25
Košice-Šaca	21E1030	48N3748	3511.75	3411.75
Kováčovce	19E2704	48N0620	3476.5	3476.5
Kováčovce	19E2704	48N0620	3513.5	3513.5
Kováčovce	19E2726	48N0530	3511.75	3411.75
Leváre	20E1528	48N3040	3413.5	3413.5
Levice	18E3554	48N1300	3585.25	3485.25
Levice	18E3626	48N1302	3515.25	3415.25
Levice	18E3626	48N1302	3511.75	3411.75
Levkuška	20E1536	48N2736	3576.5	3576.5
Ľuboreč	19E3023	48N1706	3513.5	3513.5
Lučenec	19E4001	48N1959	3578.25	3478.25
Lučenec	19E3952	48N1942	3511.75	3411.75
Lučenec	19E3952	48N1942	3518.75	3418.75
Malé Straciny	19E2449	48N1238	3413.5	3413.5
Malé Zlievce	19E2716	48N1046	3513.5	3513.5
Marcelová	18E1554	47N4756	3511.75	3411.75
Martin	18E5513	49N0422	3511.75	3411.75
Martin	18E5514	49N0423	3518.75	3418.75
Martin	18E5513	49N0423	3518.75	3418.75
Medovarce	18E5955	48N1340	3413.5	3413.5
Moldava nad Bodvou	20E5959	48N3709	3511.75	3411.75
Mučín	19E4332	48N1358	3513.5	3513.5
Nižný Medzev	20E5327	48N4212	3511.75	3411.75
Nová Ves	19E2153	48N1006	3476.5	3476.5
Nové Zámky	18E0938	47N5908	3511.75	3411.75
Nové Zámky	18E0943	47N5926	3515.25	3415.25
Poltár	19E4740	48N2552	3511.75	3411.75
Rašice	20E1419	48N2812	3413.5	3413.5
Rimavská Sobota	20E0051	48N2302	3574.75	3474.75
Rimavská Sobota	20E0051	48N2302	3511.75	3411.75
Rožňava	20E3223	48N3909	3511.75	3411.75
Rožňava	20E3223	48N3909	3511.75	3411.75

Location	Longitude	Latitude	Tx (MHz)	Rx (MHz)
Rykynčice	18E5738	48N1203	3576.5	3576.5
Sečianky	19E0428	48N0552	3413.5	3413.5
Seľany	19E1127	48N0932	3413.5	3413.5
Sitno	18E5234	48N2407	3476.5	3476.5
Sobrance	22E1044	48N4443	3522.25	3422.25
Sobrance	22E1044	48N4443	3581.75	3481.75
Stupava	17E0149	48N1614	3522.25	3422.25
Šamorín	17E1903	48N0128	3518.75	3418.75
Šivetice	20E1616	48N3538	3511.75	3411.75
Španie Pole	20E0746	48N3156	3511.75	3411.75
Španie Pole	20E0746	48N3156	3515.25	3415.25
Štúrovo	18E4245	47N4732	3511.75	3411.75
Trebušovce	19E1151	48N0654	3511.75	3411.75
Truská Voľa nad Popradom	20E5614	49N1752	3413.5	3413.5
Tuhár	19E3012	48N2543	3413.5	3413.5
Tupá	18E5530	48N0648	3511.75	3411.75
Tupá	18E5530	48N0648	3515.25	3415.25
TVP Konrádovce	19E5457	48N1750	3576.5	3576.5
TVP Konrádovce	19E5457	48N1750	3476.5	3476.5
TVP Opava	19E1022	48N1121	3576.5	3576.5
TVP Opava	19E1022	48N1121	3513.5	3513.5
TVP Rimavská Sobota	20E0731	48N2437	3513.5	3513.5
TVP Veľký Lom	19E2238	48N1937	3576.5	3576.5
Veľké Kapušany	22E0426	48N3314	3511.75	3411.75
Veľké Straciny	19E2344	48N1147	3476.5	3476.5
Veľký Krtíš	19E2105	48N1233	3511.75	3411.75
Vinica	19E0710	48N0547	3518.75	3418.75
Vinica	19E0709	48N0547	3515.25	3415.25
Vrbovka	19E2430	48N0526	3511.75	3411.75
Zombor	19E2655	48N0810	3513.5	3513.5
Želiezovce	18E3942	48N0305	3518.75	3418.75

EXISTING STATIONS TO BE PROTECTED IN AUSTRIA

The expiry date of licence of the stations is 31th December 2019

Tx / Rx (MHz)	Coordinates		Name of Station	Bandwidth	ERP (dBW)	a.s.l. (m)	Height of Antenna (m)
	Longitude	Latitude					
3.443.00	016E1550,00	48N1246,00	RUNDSTAB SATZBERG	10M0	25	360	6
3.526.00	016E1738,00	48N1614,00	N-KL-HEKFS-01	10M0	11	521	32
3.562.00	016E1937,00	48N0828,00	ROM-RUND	10M0	25	200	8
3.545.00	016E2043,00	48N1005,00	TT-01	10M0	31	225	110
3.445.00	016E2126,00	48N1054,00	RIST-01	10M0	31	198	60
3.450.25	014E3257,00	48N0054,00	N-AM-PLAFS-01	3M50	12	745	35
3.475.50	014E4017,00	48N0240,00	N-AM-SEIM81-01	5M00	12	339	38
3.412.50	014E4347,00	47N5938,00	N-WY-WYM105-01	5M00	12	443	39
3.428.50	014E4347,00	47N5938,00	N-WY-WYM105-02	5M00	12	443	39
3.481.00	014E5918,00	48N4543,00	N-GD-GMDUW-01	5M00	12	506	39
3.528.50	014E5918,00	48N4543,00	N-GD-GMDUW-02	5M00	12	506	39
3.589.00	015E0634,00	47N5914,00	N-SB-BUCFM-01	10M0	20	870	35
3.491.50	015E0634,00	47N5914,00	N-SB-BUCFM-02	5M00	12	870	29
3.481.00	015E1041,00	48N3556,00	N-ZT-ZWEUW-01	5M00	12	569	43
3.478.00	015E1050,00	48N1109,00	N-ME-ERLKW-01	10M0	14	221	45
3.425.00	015E1634,00	48N4825,00	N-WT-JASUW-01	10M0	14	510	40
3.489.00	015E1650,00	48N3149,00	N-ZT-LOSFM-01	10M0	14	792	45
3.475.50	015E1912,00	48N0422,00	N-ME-KIRNB-01	5M00	6	330	12
3.523.00	015E2038,00	48N2021,00	N-KR-JAUFM-01	5M00	12	952	45
3.528.50	015E2038,00	48N2021,00	N-KR-JAUFM-02	5M00	12	952	45
3.512.50	015E2038,00	48N2021,00	N-KR-JAUFM-03	5M00	12	952	45
3.415.00	015E2100,00	48N4736,00	N-WT-FRAFM-01	10M0	22	681	50
3.515.00	015E2100,00	48N4736,00	N-WT-FRAFM-02	10M0	22	681	50
3.445.00	015E2828,00	48N4015,00	WINKL-RUND	10M0	25	467	40
3.591.50	015E2911,00	48N2539,00	N-KR-SANFS-01	5M00	12	705	20
3.415.00	015E2933,00	48N1540,00	N-SP-LAUFS-01	10M0	12	577	33
3.475.50	015E3027,00	48N2328,00	N-KR-ROSWN-01	5M00	12	244	10
3.491.50	015E3027,00	48N2328,00	N-KR-ROSWN-02	5M00	12	244	10
3.581.00	015E3227,00	48N3546,00	N-HO-SLEOFM-01	5M00	12	576	43
3.412.50	015E3227,00	48N3546,00	N-HO-SLEOFM-02	5M00	12	576	43
3.475.50	015E3227,00	48N3546,00	N-HO-SLEOFM-03	5M00	12	576	43
3.412.50	015E3308,00	48N0628,00	N-PL-LUBWN-01	5M00	12	376	12
3.425.00	015E3623,00	48N1156,00	N-SP-UWWMF-01	10M0	20	291	32
3.445.00	015E3649,00	48N1206,00	STPOEL-RUND	10M0	25	281	40
3.586.50	015E3747,00	48N0755,00	N-SP-M44HS-01	5M00	12	305	29
3.575.50	015E3747,00	48N0755,00	N-SP-M44HS-02	5M00	12	305	29
3.589.00	015E3913,00	48N0244,00	N-LF-WISHS-01	10M0	6	369	20
3.489.00	015E3924,00	48N1821,00	N-PL-STDWR-01	10M0	22	379	25
3.478.00	015E3924,00	48N1821,00	N-PL-STDWR-02	10M0	14	379	25
3.545.00	015E4010,00	48N4435,00	HOETZELSD-RUND	10M0	25	500	40
3.545.00	015E4009,00	48N3958,00	HORN-RUND	10M0	25	308	40

Tx / Rx (MHz)	Coordinates		Name of Station	Bandwidth	ERP (dBW)	a.s.l. (m)	Height of Antenna (m)
	Longitude	Latitude					
3.415.00	015E4231,00	48N2337,00	N-KS-THEKW_01	10M0	20	193	122
3.425.00	015E4231,00	48N2337,00	N-KS-THEKW_02	10M0	20	193	122
3.515.00	015E4231,00	48N2337,00	N-KS-THEKW_03	10M0	20	193	122
3.545.00	015E4356,00	48N4126,00	SIG-RUND	10M0	25	438	43
3.445.00	015E4423,00	48N3607,00	HARM-RUND	10M0	25	426	50
3.415.00	015E4734,00	48N0836,00	N-PL-NEL09-01	10M0	12	360	9
3.415.00	015E4954,00	48N3948,00	N-HO-EGGUW-01	10M0	14	327	30
3.478.00	015E5248,00	48N2541,00	N-KR-KIRUW-01	10M0	14	185	45
3.415.00	015E5525,00	48N1932,00	N-TU-DUEKW_01	10M0	20	182	200
3.425.00	015E5525,00	48N1932,00	N-TU-DUEKW_02	10M0	20	182	200
3.515.00	015E5525,00	48N1932,00	N-TU-DUEKW_03	10M0	20	182	200
3.445.00	015E5652,00	48N3608,00	SITZ-RUND	10M0	25	254	35
3.491.50	015E5707,00	47N4001,00	N-NK-ENZRHS-01	5M00	12	464	32
3.478.00	015E5715,00	48N4527,00	N-HL-RETUW-01	10M0	14	248	24
3.591.50	016E0227,00	48N1850,00	N-TU-UWWFM-01	5M00	6	180	43
3.585.25	016E0259,00	48N4151,00	N-HL-PEIUW-01	3M50	14.1	228	43
3.545.00	016E0308,00	48N3834,00	GUNTERSD-RUND	10M0	25	249	40
3.478.00	016E0353,00	48N2905,00	N-HL-HABFM-01	10M0	22	413	45
3.489.00	016E0353,00	48N2905,00	N-HL-HABFM-02	10M0	22	413	45
3.578.00	016E0353,00	48N2905,00	N-HL-HABFM-03	10M0	22	413	45
3.455.00	016E0414,00	48N4235,00	HAUGSD-RUND	10M0	25	197	40
3.545.00	016E0424,00	48N3355,00	HOLLA-RUND	10M0	25	224	45
3.489.00	016E0431,00	47N3712,00	N-ED-EDLFS-01	10M0	11	895	30
3.415.00	016E0623,00	47N4332,00	N-NK-HWAKW-01	10M0	22	357	70
3.515.00	016E0623,00	47N4332,00	N-NK-HWAKW-02	10M0	22	357	70
3.545.00	016E0626,00	48N2328,00	HAUS-RUND	10M0	25	177	48
3.445.00	016E0640,00	48N1328,00	TROPP-01	10M0	31	528	30
3.415.00	016E0732,00	47N3639,00	N-ED-EDLBZL-01	10M0	11	411	15
3.445.00	016E1031,00	48N2554,00	SIERN-D-RUND	10M0	25	188	40
3.443.00	016E1040,00	47N4210,00	WEISSJ-01	10M0	31	547	30
3.565.00	016E1040,00	47N4210,00	WEISSJ-02	10M0	31	547	30
3.445.00	016E1311,00	48N3740,00	DUERNLEIS-RUND	10M0	25	213	40
3.555.00	016E1315,00	48N2255,00	STOCK-RUND	10M0	25	172	40
3.455.00	016E1435,00	47N5317,00	FEDOFAB-01	10M0	31	277	44
3.445.00	016E1436,00	47N4950,00	WRNEU-01	10M0	31	270	45
3.555.00	016E1436,00	47N4950,00	WRNEU-02	10M0	31	270	45
3.415.00	016E1439,00	48N0008,00	N-BN-BADBL-01	10M0	14	227	49
3.478.00	016E1439,00	48N0008,00	N-BN-BADBL-02	10M0	22	227	49
3.425.00	016E1439,00	48N0008,00	N-BN-BADBL-03	10M0	22	227	49
3.415.00	016E1611,00	47N4858,00	N-WN-WRNNL-01	10M0	20	264	50
3.425.00	016E1611,00	47N4858,00	N-WN-WRNNL-02	10M0	20	264	50
3.515.00	016E1611,00	47N4858,00	N-WN-WRNNL-03	10M0	20	264	50
3.455.00	016E1719,00	48N0031,00	TRAI-01	10M0	31	207	45
3.555.00	016E1719,00	48N0031,00	TRAI-02	10M0	31	207	45

Tx / Rx (MHz)	Coordinates		Name of Station	Bandwidth	ERP (dBW)	a.s.l. (m)	Height of Antenna (m)
	Longitude	Latitude					
3.483.50	014E5655,79	46N4747,03	Koralpe	21M0	25	1890	8
3.565.00	016E1719,00	48N0031,00	TRAIS-03	10M0	31	207	45
3.460.00	016E1749,00	47N5057,00	EGDO-02	10M0	31	251	66
3.445.00	016E1749,00	47N5057,00	EGDO-01	10M0	31	251	66
3.545.00	016E1828,00	47N5727,00	FEDO-OFFICE_RUND	10M0	25	226	10
3.425.00	016E1840,00	48N0540,00	N-MD-MAEDI-01	10M0	20	205	35
3.515.00	016E1840,00	48N0540,00	N-MD-MAEDI-02	10M0	20	205	35
3.545.00	016E1935,00	48N0241,00	GUNTR-01	10M0	31	185	50
3.478.00	016E2023,00	48N1955,00	N-KO-KORKW-01	10M0	22	166	70
3.578.00	016E2023,00	48N1955,00	N-KO-KORKW-02	10M0	22	166	70
3.415.00	016E2047,00	48N2033,00	N-KO-BISWA-01	10M0	14	166	36
3.455.00	016E2254,00	48N2329,00	RUECKERSD-RUND	10M0	25	179	40
3.445.00	016E2425,00	47N5753,00	EBREICH-01	10M0	31	193	50
3.445.00	016E2647,00	48N0503,00	HIM-01	10M0	31	176	48
3.545.00	016E2647,00	48N0503,00	HIM-02	10M0	31	176	48
3.545.00	016E2903,00	47N1740,00	GERAS-01	10M0	31	279	46
3.555.00	016E2903,00	47N1740,00	GERAS-02	10M0	31	279	46
3.489.00	016E3020,00	48N2140,00	N-GF-EIBUW-01	10M0	14	172	40
3.425.00	016E3105,00	48N2953,00	N-MI-NBAFM-01	10M0	14	299	42
3.415.00	016E3405,00	48N1816,00	N-GF-DWANL-01	10M0	16	163	43
3.425.00	016E3405,00	48N1816,00	N-GF-DWANL-02	10M0	16	163	43
3.515.00	016E3405,00	48N1816,00	N-GF-DWANL-03	10M0	20	163	43
3.415.00	016E3408,00	47N5844,00	N-BL-WASUW-01	10M0	14	180	45
3.445.00	016E3612,00	47N5837,00	MANN-01	10M0	31	192	48
3.425.00	016E3654,00	48N0356,00	N-BL-EDFUW-01	10M0	14	170	30
3.591.50	016E4059,00	48N1927,00	N-GF-STRAWA-01	5M00	6	167	10
3.491.50	016E4250,00	48N2039,00	N-GF-UWFM-01	5M00	12	161	41
3.475.50	016E4250,00	48N2039,00	N-GF-UWFM-02	5M00	12	161	39
3.415.00	016E4402,00	48N0053,00	N-BL-WIFFM-01	10M0	22	158	50
3.515.00	016E4402,00	48N0053,00	N-BL-WIFFM-02	10M0	14	158	50
3.415.00	016E4449,00	48N3512,00	N-MI-STBFM-01	10M0	14	314	30
3.515.00	016E4449,00	48N3512,00	N-MI-STBFM-02	10M0	22	314	30
3.478.00	016E5419,00	48N1400,00	N-GF-GROFM-01	10M0	12	169	30
3.415.00	016E0926,00	46N5845,00	B-JE-HENN-01	10M0	19	359	32
3.478.00	016E1819,00	47N4154,00	B-MA-HEU-01	10M0	20	723	38
3.443.00	016E1924,00	47N1410,00	B-OW-GPRLH-01	10M0	20	306	40
3.515.00	016E1924,00	47N1410,00	B-OW-GPRLH-01	10M0	20	306	40
3.415.00	016E2315,00	47N2040,00	B-OW-HIRSCH-01	10M0	19	848	39
3.425.00	016E2315,00	47N2040,00	B-OW-HIRSCH-02	10M0	19	848	30
3.415.00	016E2341,00	47N4341,00	B-MA-PIEL-01	10M0	20	300	15
3.526.00	016E2341,00	47N4341,00	B-MA-PIEL-02	10M0	20	300	15
3.445.00	016E2343,00	47N4950,00	RUNDSTAB M3	10M0	25	272	19
3.589.00	016E2834,00	47N5231,00	N-EU-SONFM-01	10M0	19	473	30
3.425.00	016E3247,00	47N5039,00	B-EU-EISDI-01	10M0	20	156	39

Tx / Rx (MHz)	Coordinates		Name of Station	Bandwidth	ERP (dBW)	a.s.l. (m)	Height of Antenna (m)
	Longitude	Latitude					
3.515.00	016E3247,00	47N5039,00	B-EU-EISDI-02	10M0	13	156	39
3.425.00	016E5015,00	47N5744,00	B-ND-NEUJW-01	10M0	20	179	35
3.490.00	015E0030,00	47N0323,00	Gößnitz	10M0	7	977	5
3.480.00	015E0531,00	47N0347,00	Köflach	10M0	8.7	442	50
3.480.00	015E0737,00	47N0413,00	Bärnbach	10M0	8.7	424	15
3.480.00	015E0851,00	46N5440,00	Rosenkogel	10M0	7	1140	5
3.585.00	015E1055,00	47N0129,00	Voitsberg	20M0	15	550	5
3.480.00	015E1055,00	47N0129,00	Voitsberg	10M0	8.7	550	5
3.490.00	015E1408,00	47N0306,00	Stallhofen	10M0	7	454	8
3.490.00	015E1657,00	47N0238,00	Neureitereg	10M0	7	449	5
3.585.00	015E2020,00	47N0647,00	Judendorf	20M0	15	431	12
3.480.00	015E2020,00	47N0647,00	Judendorf	10M0	8.7	431	12
3.580.00	015E2020,00	47N0647,00	Judendorf	10M0	8.7	431	12
3.585.00	015E2255,00	47N1232,00	Taschen	20M0	15	842	8
3.485.00	015E2255,00	47N1232,00	Taschen	10M0	7	842	8
3.585.00	015E2804,00	47N1155,00	Schöckl	20M0	21	1423	12
3.490.00	015E2804,00	47N1155,00	Schöckl	10M0	7	1423	12
3.480.00	015E2943,00	46N5219,00	Bockberg	10M0	7	436	8
3.590.00	015E4620,00	47N2339,00	Wildwiesen	10M0	7	1248	30
3.585.00	015E4633,00	46N5944,00	Studenzen	20M0	15	306	60
3.480.00	015E4633,00	46N5944,00	Studenzen	10M0	7	306	60
3.485.00	015E4801,00	46N5806,00	Berndorf	20M0	15	302	30
3.585.00	015E5557,00	46N5043,00	Stradner Kogel	20M0	8.7	609	30
3.480.00	015E5557,00	46N5043,00	Stradner Kogel	10M0	7	609	30
3.483.50	012E5906,00	46N4047,50	Kötschach	21M0	21.8	946	14
3.483.50	013E0148,80	46N4428,30	Gröfelhof	21M0	16	619	12
3.483.50	013E0258,08	46N3839,46	Dellach	21M0	21.8	899	12
3.583.50	013E0258,08	46N3839,46	Dellach	21M0	22	899	12
3.483.50	013E0258,08	46N3839,46	Dellach	21M0	25	899	12
3.583.50	013E0914,90	46N4327,20	Greifenburg	21M0	21.8	978	6
3.483.50	013E0914,90	46N4327,20	Greifenburg	21M0	22	978	6
3.483.50	013E1357,10	46N4106,60	Weißbriach	21M0	21.8	1067	10
3.483.50	013E1633,20	46N3612,70	Schlanitzen	21M0	21.8	850	20
3.483.50	013E1633,20	46N3612,70	Schlanitzen	21M0	21.8	850	20
3.583.50	013E1633,20	46N3612,70	Schlanitzen	21M0	22	850	20
3.483.50	013E1817,40	46N4212,60	Weissensee	21M0	21.8	1252	5
3.583.50	013E2218,20	46N3735,10	Hermagor	21M0	16	592	30
3.583.50	013E2647,90	46N3749,30	Presseggen	21M0	16	575	10
3.583.50	013E2730,73	46N4533,47	Goldeck	21M0	21.8	2130	8
3.483.50	013E2730,73	46N4533,47	Goldeck	21M0	22	2130	8
3.483.50	013E2730,73	46N4533,47	Goldeck	21M0	22	2130	8
3.583.50	013E3137,80	46N5015,00	Treffling	21M0	22	792	8
3.483.50	013E3327,70	46N4411,80	Goldeck	21M0	21.8	1096	16
3.583.50	013E3633,00	46N3729,00	Bleiberg-Kreuth	21M0	18	984	13

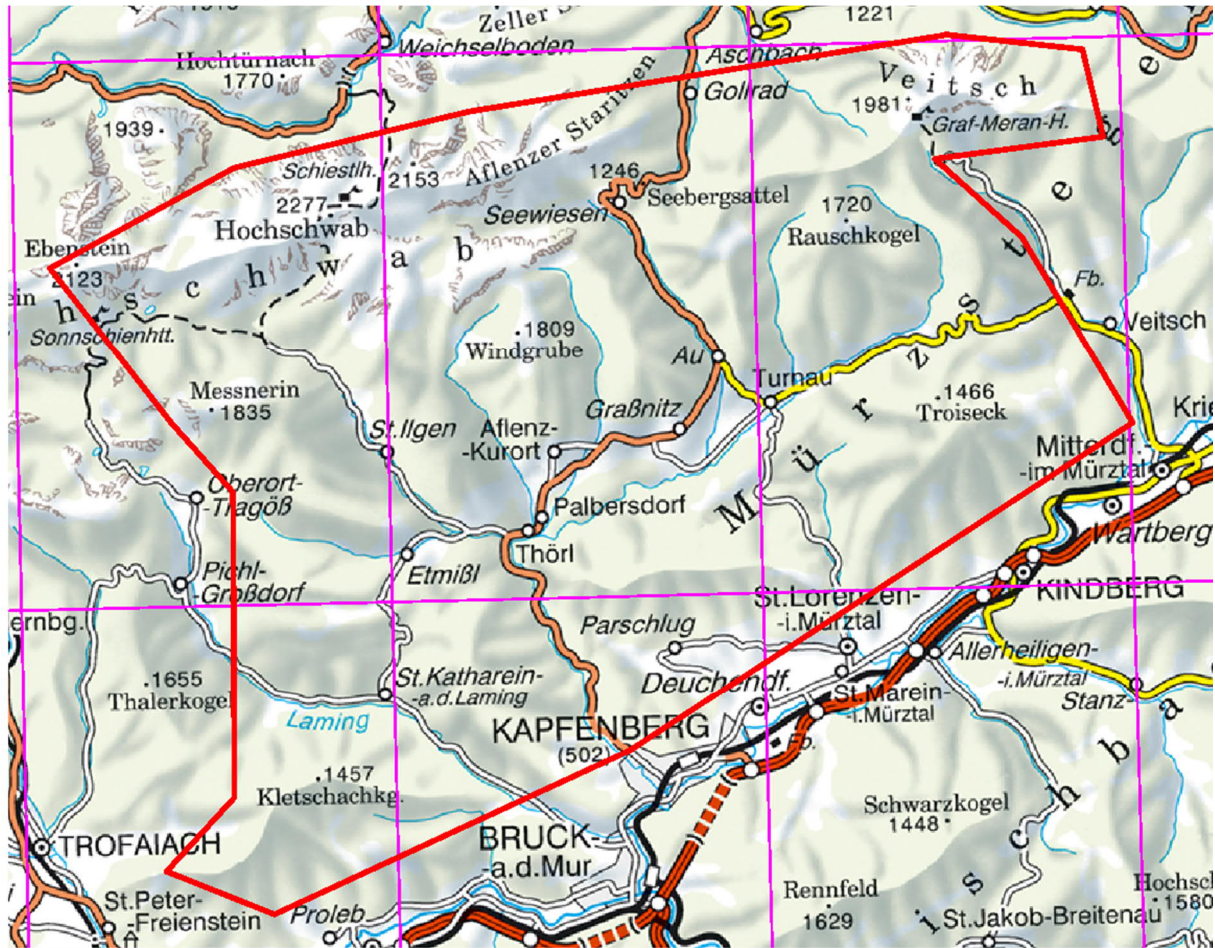
Tx / Rx (MHz)	Coordinates		Name of Station	Bandwidth	ERP (dBW)	a.s.l. (m)	Height of Antenna (m)
	Longitude	Latitude					
3.583.50	013E3701,60	46N4511,70	Insberg	21M0	21.8	839	10
3.483.50	013E3701,60	46N4511,70	Insberg	21M0	25	839	10
3.483.50	013E3920,00	46N3326,00	Hohenthurn	21M0	16	676	12
3.520.00	013E4015,51	46N3611,57	Dobratsch	20M0	21.8	2137	8
3.445.00	013E4015,51	46N3611,57	Dobratsch	20M0	21.8	2137	8
3.545.00	013E4015,51	46N3611,57	Dobratsch	20M0	21.8	2137	8
3.420.00	013E4015,51	46N3611,57	Dobratsch	20M0	21.8	2137	8
3.565.00	013E4015,51	46N3611,57	Dobratsch	20M0	21.8	2137	8
3.483.50	013E4015,51	46N3611,57	Dobratsch	20M0	30	2137	8
3.483.50	013E4245,90	46N4825,00	Radenthein	21M0	21.8	1002	10
3.483.50	013E4334,70	46N3128,40	Arnoldstein	21M0	21.8	1345	15
3.583.50	013E4334,70	46N3128,40	Arnoldstein	21M0	21.8	1345	15
3.483.50	013E4429,90	46N5012,50	Bad Kleinkirchheim	21M0	21.8	1968	8
3.583.50	013E4429,90	46N5012,50	Bad Kleinkirchheim	21M0	21.8	1968	8
3.483.50	013E4429,90	46N5012,50	Bad Kleinkirchheim	21M0	22	1968	8
3.483.50	013E4737,00	46N4723,00	Bad Kleinkirchheim	21M0	21.8	1758	15
3.483.50	013E4737,00	46N4723,00	Bad Kleinkirchheim	21M0	21.8	1758	15
3.583.50	013E4806,00	46N4841,00	Bad Kleinkirchheim	21M0	16	1084	10
3.483.50	013E5131,00	46N3312,00	Finkenstein	21M0	21.8	608	6
3.483.50	013E5303,77	46N3636,95	TPV/Villach	21M0	21.8	490	28
3.483.50	013E5449,00	46N4143,10	Gerlitzen	21M0	21.8	1902	15
3.483.50	013E5450,50	46N4133,44	Gerlitzen	21M0	21.8	1881	15
3.483.50	013E5523,27	46N4139,58	Gerlitzen	21M0	25	1769	20
3.483.50	013E5523,27	46N4139,58	Gerlitzen	21M0	21.8	1769	20
3.483.50	013E5827,40	46N3315,70	Ledenitzen	21M0	21.8	620	10
3.583.50	014E0003,70	46N4100,00	Ossiach	21M0	16	516	14
3.483.50	014E0432,60	46N3511,90	Kathreinkogel	21M0	22	1292	8
3.583.50	014E0841,00	46N3632,00	Pyramidenkogel	21M0	22	834	80
3.483.50	014E0841,00	46N3632,00	Pyramidenkogel	21M0	21.8	834	80
3.483.50	014E0841,00	46N3632,00	Pyramidenkogel	21M0	21.8	834	80
3.483.50	014E0947,90	46N4619,00	Simonhöhe	21M0	25	1333	10
3.583.50	014E0947,90	46N4619,00	Simonhöhe	21M0	16	1333	10
3.483.50	014E3210,70	46N3810,30	Tainach	21M0	16	439	8
3.483.50	014E4107,50	46N5715,70	Hohenwart	21M0	21.8	1814	6
3.483.50	014E4107,50	46N5715,70	Hohenwart	21M0	21.8	1814	6
3.483.50	014E4618,00	46N3105,00	Petzen	21M0	21.8	1629	8
3.583.50	014E4618,00	46N3105,00	Petzen	21M0	30	1629	8
3.483.50	014E5619,30	46N4841,20	Koralpe	21M0	21.8	1487	40
3.583.50	014E5633,50	46N5753,70	Koralpe	21M0	21.8	1080	12
3.483.50	014E5633,50	46N5753,70	Koralpe	21M0	21.8	1080	12

Anhang 5

Die Schutzzone AFLENZ, definiert durch die folgenden 16 Koordinatenpunkte

	Ost	Nord
1.	15°25'23"	47°40'06"
2.	15°12'23"	47°38'56"
3.	15°06'00"	47°38'00"
4.	15°00'57"	47°36'15"
5.	15°04'08"	47°33'22"
6.	15°05'46"	47°32'04"
7.	15°05'37"	47°26'29"
8.	15°03'45"	47°25'10"
9.	15°06'37"	47°24'20"
10.	15°16'18"	47°27'10"
11.	15°30'05"	47°32'55"
12.	15°27'14"	47°36'22"
13.	15°24'56"	47°37'51"
14.	15°29'30"	47°38'10"
15.	15°29'00"	47°39'46"
16.	15°25'18"	47°40'07"

Kartenausschnitt der Schutzzone AFLENZ



G. Regional structure – classification of municipalities

Urban regions 1 to 6

Urban region 1

Region	Province	Municipality ID	Municipality
A01u	Vienna	90001	Vienna
	Lower Austria	30201	St. Pölten
		30740	Schwechat
		31214	Langenzersdorf
		31704	Brunn am Gebirge
		31716	Maria Enzersdorf
		31717	Mödling
		31719	Perchtoldsdorf
		31723	Vösendorf
		31725	Wiener Neudorf

Table 12: Municipalities in urban region 1



Figure77: Urban region 1 – St. Pölten



Figure 8: Urban region 1 – Vienna and selected neighbouring municipalities

Urban region 2

Region	Province	Municipality ID	Municipality
A02u	Upper Austria	40101	Linz
		40301	Wels
		41012	Leonding
		41017	Pasching
		41021	Traun
		41823	Thalheim bei Wels

Table 13: Municipalities in urban region 2

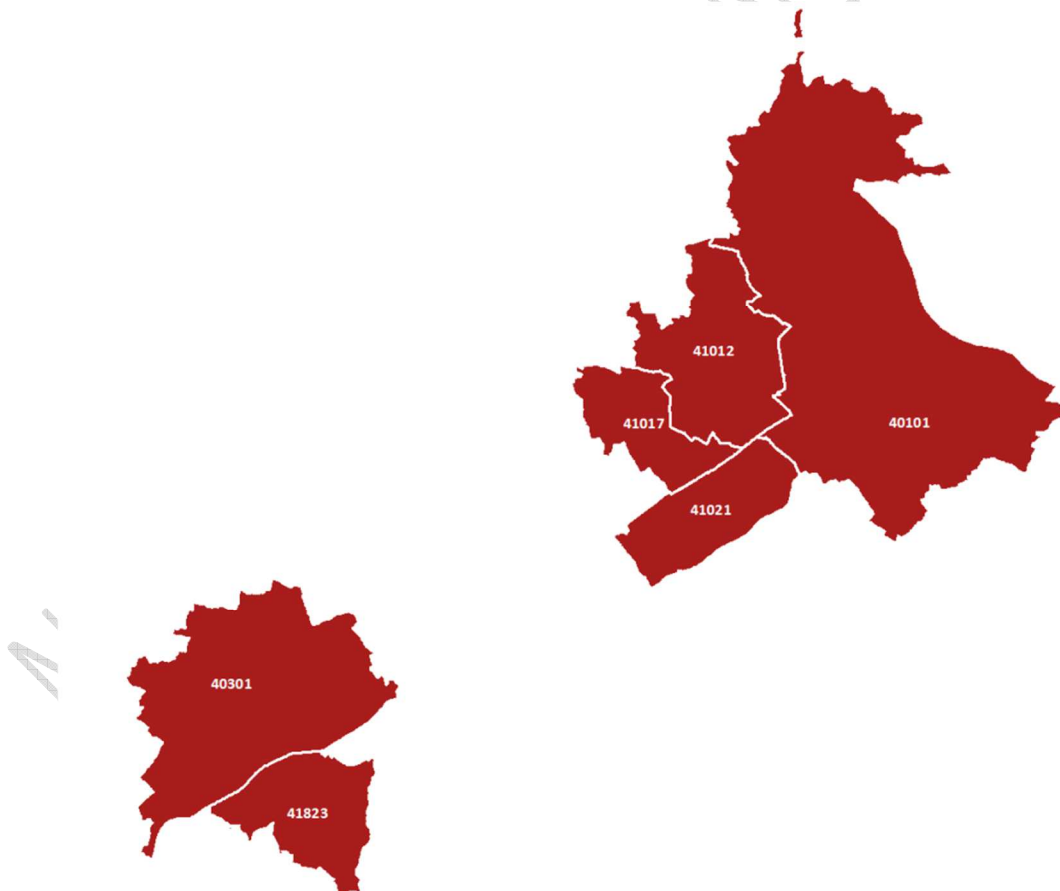


Figure 9: Urban region 2 – Linz and Wels and selected neighbouring municipalities

Urban region 3

Region	Province	Municipality ID	Municipality
A03u	Salzburg	50101	Salzburg
		50338	Wals-Siezenheim

Table 14: Municipalities in urban region 3

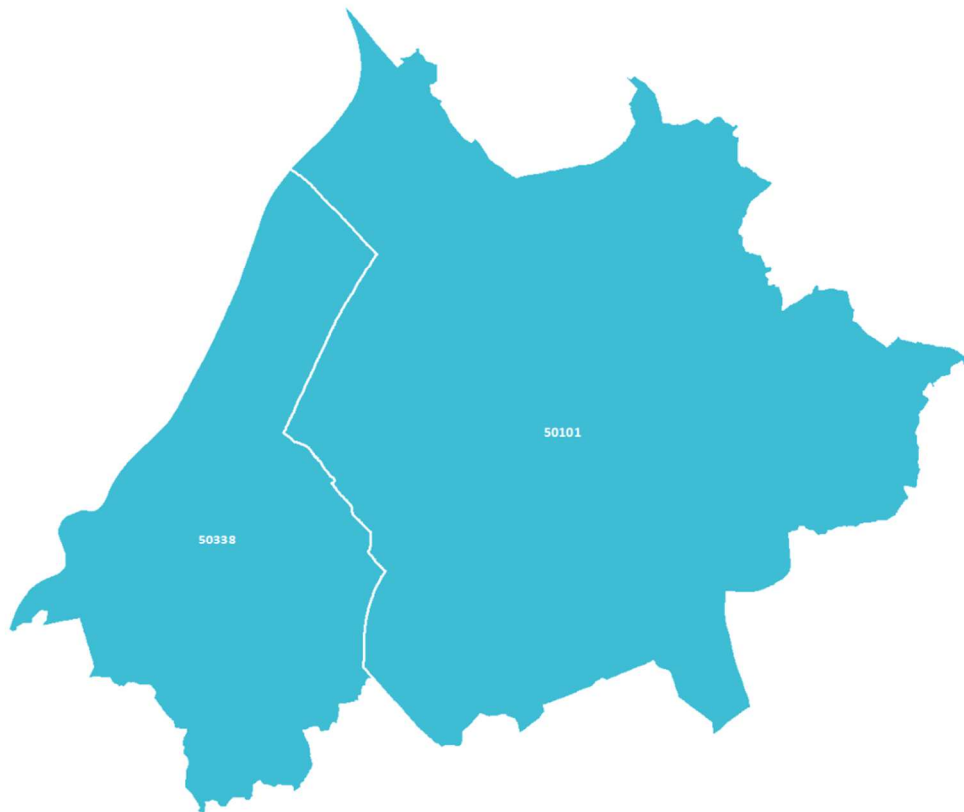


Figure 10: Urban region 3 – Salzburg and Wals-Siezenheim

Urban region 4

Region	Province	Municipality ID	Municipality
A04u	North Tyrol	70101	Innsbruck
		70346	Rum
	Vorarlberg	80207	Bregenz
		80215	Hard
		80220	Kennelbach
		80224	Lauterach
		80235	Schwarzach
		80240	Wolfurt
		80301	Dornbirn

Table 15: Municipalities in urban region 4

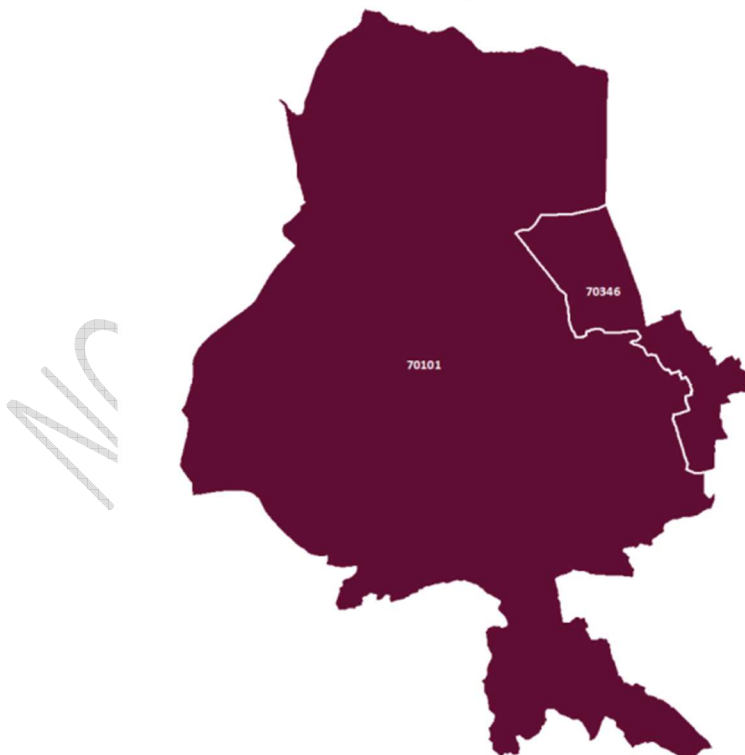


Figure 11: Urban region 4 – Innsbruck and Rum



Figure 12: Urban region 4 – Bregenz and selected neighbouring municipalities

Urban region 5

Region	Province	Municipality ID	Municipality
A05u	Carinthia	20101	Klagenfurt am Wörthersee
		20201	Villach

Table 16: Municipalities in urban region 5

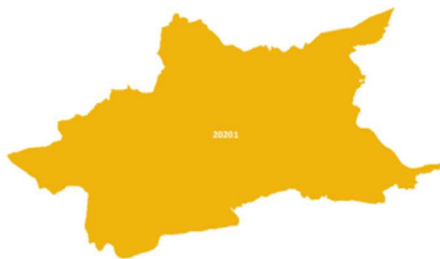


Figure 13: Urban region 5 – Villach and Klagenfurt

Urban region 6

Region	Province	Municipality ID	Municipality
A06u	Styria	60101	Graz
		60608	Feldkirchen bei Graz
		60669	Seiersberg-Pirka

Table 17: Municipalities in urban region 6



Figure 14: Urban region 6 – Graz and selected neighbouring municipalities

Rural regions 1 to 6

Rural regions	Scope (territory)
A01r	Vienna, Lower Austria and Burgenland except for the municipalities classified under region A01u
A02r	Upper Austria except for the municipalities classified under region A02u
A03r	Salzburg except for the municipalities classified under region A03u
A04r	North Tyrol and Vorarlberg except for the municipalities classified under region A04u
A05r	Carinthia except for the municipalities classified under region A05u
A06r	Styria except for the municipalities classified under region A06u

Table 18: Rural regions 1 to 6