

**Consultation
on the
700/1500/2100 MHz
Award Procedure**

NON BINDING TRANSLATION

Vienna, 20. Dezember 2018

Rundfunk und Telekom Regulierungs-GmbH (RTR-GmbH)

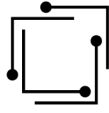
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1 Introduction

At the end of 2016, the regulatory authority published a Spectrum Release Plan together with the Federal Ministry of Transport, Innovation and Technology (BMVIT). This plan provides for the joint award of the 700 MHz, 1500 MHz (core band) and 2100 MHz bands. In the meantime, harmonised terms and conditions of use can also be expected for the extension bands within the 1500 MHz band. Some stakeholders have proposed that the extension bands—the awarding of which was planned for the period after 2020—should be included in the award procedure. The regulatory authority supports many of the arguments in favour of a joint award, in particular that only this can prevent a fragmentation of the band, which is detrimental to efficient use. The regulatory authority therefore plans to award the extension bands within the 1500 MHz range together with the core band.

These considerations are also subject to clarification of the legal uncertainty regarding the possible use of the 700 MHz band by mobile operators from mid-2020 onwards. If it is not possible to make the 700 MHz band usable for mobile services in a timely and legally secure manner, it would be conceivable—as already proposed in the Spectrum Release Plan—to conduct a single-band auction for the 2100 MHz band and to jointly award the 700 and 1500 MHz bands only at a later date. Both scenarios will, in principle, be taken into account in the present consultation.

The Telekom-Control Commission (hereinafter referred to as the TTK) is currently working on the assumption that the technical terms and conditions of use for the three frequency bands concerned will be available in the first quarter of 2019, and that a consultation on the tender conditions can therefore be carried out in the second quarter of 2019. The tender could thus take place in autumn 2019, with the auction then beginning in the first quarter of 2020. Nonetheless, in view of a number of uncertainties, the regulatory authority reserves the right to deviate from the plan; uncertainties include: when conditions of use become available, any possible restrictions on use, or changes to the legal framework (at the European or national level) that might oppose the plan.

RTR will (on behalf of the TTK) subsequently consult with the stakeholders on the key points of the award procedure. The consultation will involve the presentation of considerations and options relating to key issues. In addition to product and auction design, the regulatory authority wishes to address two areas in particular which are closely related to the most recent amendment to the Telecommunications Act 2003 (TKG 2003) (as amended by Federal Law Gazette (FLG) I No. 78/2018). The amendment places the regulatory objectives of the TKG 2003—and competition in particular—more clearly and explicitly at the centre of the auction procedure planning. At the same time revenue interests have been relegated even further to the background. The regulatory authority therefore carried out a competition analysis prior to the tender, on the basis of which measures to safeguard competition in the downstream markets can be derived for the coming years. The second area concerns the provision of modern mobile services, specifically 5G, to the Austrian population and to Austrian companies. Based on the federal government's

5G strategy, the regulatory authority has identified three central coverage targets to be responded to with appropriate coverage obligations.

Given the great economic importance of the aforementioned topics, the regulatory authority wishes to address with this consultation not only potential bidders, but also expressly invites all stakeholders and the interested public to submit statements.

Statements (in German or English) should be emailed by **20 February 2019** to tkfreq@rtr.at. Please use the cover sheet template (Appendix 1). Additionally, a list of the organisations/individuals that submitted statements for the consultation and consented to disclosure of the organisation/individual will be published. If requested, the complete individual statements will be published as well.

The TTK is considering holding a hearing as part of the consultation. This consultation is primarily aimed at potential bidders. In order to take part in the hearing, applicants must register with the regulatory authority by email (tkfreq@rtr.at) no later than **12.00 noon on 8 January 2019**.

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2 Award objectives

The TTK is focusing the award procedure on the objectives listed below:

- Objective 1: Legal certainty
- Objective 2: Ensure efficient utilisation of spectrum
- Objective 3: Safeguard/promote effective competition
- Objective 4: Promote coverage
- Objective 5: Promote innovation

Maximising auction revenue is expressly ruled out as an award objective, as is actively supporting new market entrants through actions such as reserving spectrum. To the extent relevant and feasible, the regulatory authority will base key design decisions on the objectives listed above.

Efficient frequency use is ensured where bidders are able to acquire spectrum to meet their individual needs, and where a frequency lot is assigned to the bidder who puts the highest value on that lot and submits the highest bid for it.¹ This requires a *product design* that matches the demands of potential users, ensures fair and equal participation of all users and allows competition for incremental spectrum. This needs to be complemented by an *auction design* suited to identifying the bidder with the highest valuation. The award procedure also needs to be designed so as to largely avoid any *unnecessary fragmentation* of spectrum within a single band. *Aggregation and substitution risks* are to be minimised in the auction through a suitable design. For example, bidders should be allowed to acquire larger frequency blocks for 5G. Exercising such an option should not be impaired by switching barriers or aggregation risks.

The significance of the third award objective (competition) for the design of the award procedure is underscored by the most recent amendment to the TKG 2003. The regulatory authority intends to safeguard competition on the downstream mobile telecommunications markets in the coming years by means of a suitable selection of instruments to safeguard competition. The aim here is not only to prevent an excess concentration of usage rights in the hands of a single network operator, but also to ensure that a sufficient number of effective providers (mobile network operators and MVNOs) will be active on the market after the auction.

The 700 MHz band may be the last coverage spectrum to be awarded for mobile services for some time. Therefore, and in order to take into account the ambitious 5G targets of the federal government and the European Commission, the TTK will place particular emphasis on ensuring the best possible coverage for the Austrian population and for Austrian companies. To achieve this goal, the regulatory authority plans to impose ambitious *coverage obligations*. On the one hand, the aim is to

¹ Cf. Art. 55 Telecommunications Act (TKG 2003) and ruling 2013/03/0149 of 4 December 2014 by the Austrian Administrative Court (complaint by a mobile network operator against the TTK decision of 19 November 2013, F 1/11-283)

achieve important coverage targets derived from national and European objectives in connection with 5G. On the other hand, these requirements should ensure that the spectrum is in fact used, and not hoarded for strategy reasons.

Following the publication of a position paper on infrastructure sharing and the awarding of the 3410 to 3800 MHz range, the TTK sees the awarding of the 700/1500/2100 MHz bands as making a significant additional contribution to the introduction of 5G in Austria. Through the timely and legally certain award of spectrum and a design focusing on award objectives, the regulatory authority is laying the groundwork for innovative efforts in the area of 5G.

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3 Frequency bands and frequency usage

The planned award procedure comprises the following spectrum:

- 700 MHz
- 1500 MHz
- 2100 MHz

Because the number of frequencies in these bands is ‘limited’, the regulatory authority is responsible for the spectrum award.

3.1 700 MHz band

The 700 MHz band consists of a paired frequency range of 2 x 30 MHz. The band is divided into six 5 MHz channels as shown in the figure and table below:

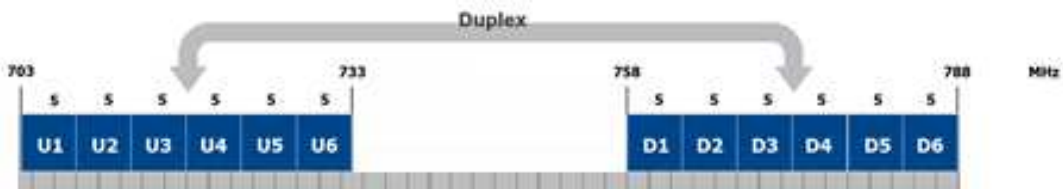


Figure 1: 700 MHz band (LTE band 28)

Table 1: List of frequency blocks in 700 MHz band

Frequency blocks in 700 MHz band	Uplink/MHz	Downlink/MHz
A1	703–708	758–763
A2	708–713	763–768
A3	713–718	768–773
A4	718–723	773–778
A5	723–728	778–783
A6	728–733	783–788

The frequency band is thus earmarked for paired usage (FDD).

This frequency band is currently licensed, until expiry, for terrestrial television, and has up to now comprised the DVB-T(2) channels 49 to 60.

The frequency band is part of LTE band 28 and NR band n28 (according to 3GPP TS 38.104).

The Frequency Utilisation Ordinance 2013 (FNV 2013, FLG II No. 63/2014 as amended) stipulates that the 700 MHz frequency band can be used for broadcasting services until 30 June 2020, but must be available for mobile telecommunications services from 1 July 2020. At present, however, there are still individual usage rights (operating permits) for DVB-T2 broadcasting systems that extend beyond 30 June 2020. These broadcasting systems, together with the expiry dates of the respective operating permits, are listed in an evaluation report from June 2018, commissioned by KOA.² Systems can be switched over (i.e. frequencies in the 700 MHz band can be decommissioned) depending on the system; systems may be shut down before 1 July 2020, or they may actually be operated until the specified date of expiry of the respective operating permit.

The number of locations still having a telecommunications licence that will be valid after 30 June 2020 can be assumed to be considerably smaller than that stated in the evaluation report mentioned above; this assumption is based on the regulatory authority's knowledge as derived mainly from the KOA decisions (as of 19 December 2018), which are published on the RTR website. These locations are shown in the table below.

Table 2: Locations having a telecommunications licence still valid after 30 June 2020

Programmes	Transmitter name	Channel	Broadcaster	Licence expiry date
MUXF	B Gleichenberg	50	ORS comm	2023-04-01
MUXF	Rechnitz	50	ORS comm	2023-04-01
MUXF	Klagenfurt 1	51	ORS comm	2023-04-01
MUXF	Spittal Drau 1	51	ORS comm	2023-04-01
MUXF	Viktring	51	ORS comm	2023-04-01

The existing usage rights for the broadcasting sector could stand in the way of legal certainty for mobile network operators to use these frequencies from mid-2020, as granting rights of use to mobile network providers prior to the expiry of broadcasting licences would constitute an intervention in existing rights of usage.

² Available (in German) at https://www.rtr.at/de/tk/Spectrum700MHz/700MHz_Gutachten_Reindl.pdf

With (policy-level) activities under way to ensure that all locations are available for mobile telecommunications as of mid-2020, a corresponding amendment to the KommAustria Act (KOG) entered into force on 1 December 2018, which allows for financial compensation to Österreichische Rundfunksender GmbH & Co KG (ORS) for freeing up the 700 MHz band ahead of schedule and by 30 June 2020 at the latest. However, it has not yet been conclusively clarified whether the TKK will have obtained reasonable assurance by the time of the tender regarding the entire 700 MHz band and its potential use for mobile services from mid-2020. There could also be a delay in switching over broadcasting locations in Austria, in particular due to problems unable to be ruled out with the frequency reassignments in neighbouring countries. The regulatory authority will have a clear picture of the situation only once the final version of the technical terms and conditions of use become available, which will be part of the tender documentation. This is expected for the first quarter of 2019.

The BMVIT has published a ‘national timetable’ for the 700 MHz band.³ This provides for the use of the 700 MHz band for terrestrial systems under the aforementioned harmonised technical conditions, beginning with 1 July 2020. According to the plan, it would appear that the agreements for cross-border spectrum coordination within the EU, which are required for such usage, have already been concluded.

Whatever the situation, any remaining broadcasting systems would restrict the use of the frequency band for mobile services, depending on the coverage area of the respective system. Under certain circumstances, this could have an impact on the product design and complexity of the design (cf. section 4).

3.2 1500 MHz band

The 1500 MHz band is presented in the following figure:

1427 MHz															1518 MHz				
1427	1432	1437	1442	1447	1452	1457	1462	1467	1472	1477	1482	1487	1492	1497	1502	1507	1512	1517	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
1432*	1437	1442	1447	1452	1457	1462	1467	1472	1477	1482	1487	1492	1497	1502	1507	1512	1517*	1518	
Downlink (base station transmit)																	Guard band		
90 MHz (18 blocks of 5 MHz)																	1 MHz		

*Block conditions and **Restricted power.

Figure: 1500 MHz band

The band consists of 5 MHz channels which are designated as downlinks (referred to as ‘supplementary downlinks’) and can therefore only be used together with another band.

This results in the following 5 MHz frequency channels:

³ Available (in German) at https://www.bmvit.gv.at/telekommunikation/fahrplan_700.html

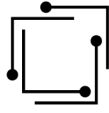


Table 3: List of frequency blocks in 1500 MHz band

5 MHz frequency blocks	Downlink/MHz
B00 (*)	1427–1432
B0 (*)	1432–1437
B1	1437–1442
B2	1442–1447
B3	1447–1452
B4	1452–1457
B5	1457–1462
B6	1462–1467
B7	1467–1472
B8	1472–1477
B9	1477–1482
B10	1482–1487
B11	1487–1492
B12	1492–1497
B13	1497–1502
B14	1502–1507
B15	1507–1512
B16	1512–1517

The blocks B00 and B0 at the lower edge of the band, which are marked with an asterisk (*), can be used not at all or only to a very limited extent due to the neighbouring passive band (1400-1427 MHz). The regulatory authority does not plan to offer these in the (principle stage of the) auction, but to award them to the winner of the neighbouring block (cf. section 4).

This means that a total of 80 MHz is available for use in the 1500 MHz band. Blocks B4 to B11 (1452–1492 MHz) fall within what is referred to as the 1500 MHz core band and thus form part of LTE band 32. By contrast, the newer LTE band 75 comprises all channels from B00 to B16 (core band + extension bands).

The 1500 MHz band currently comprises various local uses. These local uses (e.g. for telecontrol systems) must be protected by the future spectrum holder. In addition, the spectrum holder is free to enter into civil law agreements with the local user (e.g. migration of the existing system to another frequency band or replacement by a cable solution).

All frequency channels in the 1500 MHz band can be used upon notification of the assignment decision.

3.3 2100 MHz band

The 2100 MHz band can be used based on existing usage rights from 1 January 2021 (awarded in 2000) in accordance with the current award procedure.

The 2100 MHz band (LTE band 1) is presented in the figure below:

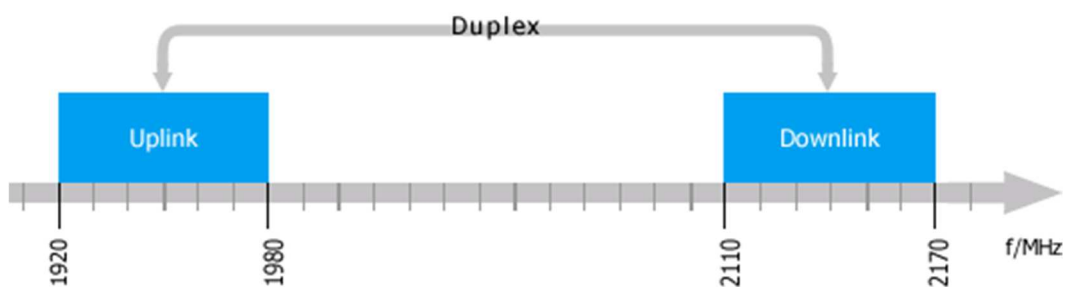


Figure 2: 2100 MHz band

The band comprises 2 x 60 MHz. Due to existing guard bands to neighbouring bands, the current award is based on channels less than 5 MHz in some cases. The regulatory authority is now planning to award 5 MHz blocks (that is, exactly 5.0 MHz), which results in the following list of blocks:

Table 4: List of frequency blocks in 2100 MHz band

Frequency blocks in 2100 MHz band	Uplink/MHz	Downlink/MHz
C1	1920–1925	2110–2115
C2	1925–1930	2115–2120
C3	1930–1935	2120–2125
C4	1935–1940	2125–2130
C5	1940–1945	2130–2135
C6	1945–1950	2135–2140
C7	1950–1955	2140–2145
C8	1955–1960	2145–2150
C9	1950–1965	2150–2155
C10	1965–1970	2155–2160
C11	1970–1975	2160–2165
C12	1975–1980	2165–2170

The frequency band is thus earmarked for paired usage (FDD).

3.4 Service and technology neutrality

The regulatory authority plans to award the spectrum in line with the principle of service and technology neutrality.

The technological neutrality of the bands to be awarded is specified in Commission Implementing Decisions as follows:

- 700 MHz band: Commission Implementing Decision (EU) 2016/687
- 1500 MHz band: Commission Implementing Decision (EU) 2015/750
- 2100 MHz band: Commission Implementing Decision 2012/688/EU

This means in detail that the spectrum can be used for 3G, 4G and 5G, for example, provided these technologies are used in keeping with the Commission Implementing Decision. By referring to what is termed a block edge mask (BEM), the Commission Implementing Decision attempts to describe permitted use in terms that as far as possible are independent of any one technology, while at the same time defining the necessary conditions allowing coexistence of neighbouring networks.

Service neutrality is achieved through specifying details of the services only to the extent required in order to achieve other regulatory objectives (for instance efficient frequency use). With this in mind, terms such as ‘broadband’ and ‘mobile telecommunications’, which are used in other contexts within the consultation paper, are to be interpreted broadly and serve to describe the particular use by referring to familiar types of use. Coverage obligations necessary as part of the award can in effect limit service neutrality, while nonetheless being required to ensure efficient frequency use.

3.5 Consultation questions

Question 3.1: Do you have any comments about the spectrum to be awarded?

Question 3.2: Do you share our opinion that the 1500 MHz range should be used for SDL (LTE band 75, NR band n75)? If not, why not? (Please give reasons for your answer); which concrete specifications (e.g. guard bands, synchronisation or duplex distances) would be necessary from your point of view?

4 Product design

4.1 Introduction

The following section presents options as to how the frequencies to be awarded should be offered in the auction (product design). For example, it must be clarified whether the spectra are to be auctioned as generic or specific lots, how large the lots should be, and to how many categories—if any—the generic lots should be assigned.

Product and auction design need to be simultaneously optimised due to the close interdependencies between these features. The further discussion in this section as well as the questions at the end of the section are therefore closely related to section 7, and in particular to the three auction models presented in this section:

- Model A: classic three-band auction
- Model B: model to achieve key award objectives
- Model C: 2100 MHz single-band auction

4.2 Geographical structuring

The spectra are awarded in the form of nationwide usage rights. No regional breakdown of the usage rights is planned.

4.3 Lot structure

‘Lots’ refers to the objects of the auction for which bidders can submit bids. Either abstract (generic) lots or specific lots can be awarded in the auction.

The awarding of specific lots has the clear disadvantage of being unable to ensure assignment of contiguous frequency ranges within a band if at the same time competition for incremental spectrum is enabled and thus the award objective of efficient frequency usage is to be met.

The regulatory authority therefore proposes—where possible—the initial auctioning of frequencies in a principle stage, with (narrow) generic lots across different product categories, and in the assignment stage the subsequent awarding of specific (and as far as possible contiguous) frequency blocks within a band, to the winners of spectrum from the principle stage.⁴

However, this model is limited where the terms and conditions of use of individual frequencies differ considerably from one another and the frequencies within one band vary considerably in value.

This could apply to the 700 MHz band under certain circumstances. Based on requirements of EU law, the band is to be freed up by mid-2020 if possible. Austria is

⁴ For the product categories, see section 4.4

also working on having the band freed up in time. However, it is not (yet) possible to estimate the kinds of restrictions on use and uncertainties that will prevail with regard to the remaining period of use (cf. section 3.1). Not only could this uncertainty have an influence on the value of individual frequencies, it could also fail to meet the condition requiring frequencies to be sufficiently homogeneous so to allow them to be awarded as generic lots in one category. From the perspective of the regulatory authority, the following options could help manage this uncertainty:

- A1) It is becoming clear that the differences in value arising from restrictions in the short term are not materially relevant in view of the very long periods of use. The lots can therefore be offered as generic lots. Certain value differences will be tolerated to enable a design which is less complex and which avoids band fragmentation.
- A2) Specific lots are offered in the auction. Depending on which and what number of blocks are affected, there may be a considerable risk that winners of frequencies in the 700 MHz range will have to be assigned non-contiguous blocks.
- A3) The frequencies will be made homogeneous and the periods of use of all blocks aligned with the “worst-case” conditions. This has the major disadvantage that coverage spectrum critical for the 5G rollout would lie ‘fallow’ for some time.
- A4) As proposed as a fallback option in the Spectrum Release Plan, the awarding of the 700 MHz band will be postponed until the periods of use for all frequencies can be definitively clarified (see Model C in section 7).

The regulatory authority has a clear preference for option A1) and does not view options A3) and A4) as currently relevant considering the estimated remaining periods of use for broadcasting services (see section 3.1). Yet, the regulatory authority would also like to hear in this context the opinion of potential bidders (cf. section 3.1).

In addition, the regulatory authority prefers to award narrow lots in order to allow competition for incremental spectrum and to enable a relatively fine-grained distribution of frequencies. If the granularity chosen is too coarse, in a tender with three bidders, for example, there is a risk of one successful bidder winning double the spectrum compared with the others.

The majority of the industry also prefers small lot sizes and flexibility with regard to the amount of spectrum demanded in the auction. This is clearly shown by the submissions received during the consultation on the Spectrum Release Plan and by the interviews conducted as part of the stakeholder meetings (see table below).

Table 5: Lot sizes preferred by the majority of the industry

Band	SRP consultation	Stakeholder meeting
700 MHz	–	2x5 MHz
1500 MHz	1x5 MHz	1x10 MHz
2100 MHz	2x5 MHz	2x5 MHz

One potential disadvantage associated with the awarding of small lot sizes is that of ‘aggregation risks’, unless such risks can be avoided through an appropriate auction format. Aggregation risks can be attributed to synergistic valuations of larger blocks or packages of lots (see DotEcon’s separate report on auction design). For example, a minimum number of lots may be required in order to use the frequencies efficiently. Synergistic valuations may also exist in relation to channel spacing for a specific technology (e.g. 20 MHz channels for LTE).

If synergistic valuations exist for several lots, bidders must be allowed to express such valuations in the auction through corresponding bids. Otherwise there is a risk of blocks being distributed inefficiently; individual blocks may also remain unsold. Depending on the synergies in the individual case and market conditions, combinatorial formats are better suited in this context than non-combinatorial formats. If aggregation risks cannot be addressed by selecting a suitable auction design, it is also possible to select lot sizes so as to incorporate the synergies. Blocks can for example be auctioned according to minimum spectrum portfolio. On the other hand, this has the disadvantage of the need to significantly limit bidding competition for incremental spectrum. This, in turn, can also be detrimental to the goal of efficiency. Thus, due to their close interdependency, product and auction design have to be optimised at the same time.⁵

The regulatory authority has addressed potential synergistic valuations, both during the consultation on the Spectrum Release Plan and at stakeholder meetings.⁶

⁵ See DotEcon’s separate report on auction design)

⁶ Cf. the results of the consultation on the Spectrum Release Plan, which can be viewed on the regulatory authority’s website

Table 6: Possible synergistic valuations (source: consultation and stakeholder meetings)

Band	SRP consultation	Interviews
700 MHz	2x10 MHz	2x10 / 2x20 MHz
1500 MHz	10 / 20 MHz	20 / 40 MHz
2100 MHz	2x15–2x20 MHz	2x10–2x20 MHz

The submissions of network operators suggest that synergistic valuations exist in all three bands—relative to the preferred, narrow lot sizes. Some statements refer primarily to the minimum spectrum portfolio. For example, it was argued that a minimum spectrum portfolio of 2x10 MHz in the 700 MHz band was necessary for the nationwide rollout of a 5G network. Smaller minimum spectrum portfolios were specified for new entrants.⁷ Other statements refer more to technical channel widths (for example, 20 or 40 MHz in the 1500 MHz band when used for LTE). The regulatory authority would like to put this topic forward for discussion once again before the final decision on the auction and product designs.

If generic lots are awarded, these must be compatible with the spectrum amount offered in the corresponding category (see section 4.4). The offer in the respective category must be an integer multiple of the lot size (cf. section 4.4).

⁷ Cf. the results of the consultation on the Spectrum Release Plan

Table 7: Lot sizes compatible with the offer in the categories (up to 20 MHz)

Band	Categories	Offer	Sizes of generic lots
700 MHz	1	2x30 MHz	2x5 MHz, 2x10 MHz
1500 MHz ^a	1	80 MHz	5 MHz, 10 MHz, 20 MHz
1500 MHz ^a	3	15 MHz 40 MHz 25 MHz	5 MHz, 15 MHz 5 MHz, 10 MHz, 20 MHz 5 MHz
1500 MHz	1	90 MHz	5 MHz, 10 MHz
1500 MHz	4	10 MHz 15 MHz 20 MHz 25 MHz	5 MHz
2100	1	2x60 MHz	2x5 MHz, 2x10 MHz, 2x20 MHz

^a Provided that the lower two fringe blocks are not offered in the principle stage.

In view of the above circumstances, the regulatory authority proposes the lot sizes for generic lots listed in the table below (“Preference: generic lots” column).

Table 8: Proposed lot sizes

Band	Preference: generic lots	Alternative: generic lots	Alternative: specific blocks / licences
700 MHz	2x5 MHz	2x10 MHz ^a	3 ^c
1500 MHz	1x10 MHz	1x5 MHz ^b 2x20 MHz ^a	If applicable, specific block for the 1427–1437/1437–1452 MHz range ^d
2100 MHz	2x5 MHz	2x10 MHz ^a 2x20 MHz ^a	–

^a If materially relevant, aggregation risks cannot be addressed by the auction design.

^b If the lot structure is not divisible by the offer in the respective category.

^c Frequencies are too heterogeneous to be assigned as generic lots.

^d The lower extension band of the 1500 MHz range may be offered as a specific block with or without the two blocks at the lower edge of the band.

Alternatively, wider generic lots or specific blocks could be awarded. Wider lots may be necessary if there are significant aggregation risks and these cannot be addressed by an appropriate auction design. Narrower lots may be required in the 1500 MHz band, for example, if more than one category is required due to value differences within individual bands. Given the uncertainties as to when the 700 MHz band will become available, it cannot be ruled out at present that this band will be awarded in specific blocks —possibly using Model B from section 7.

If extension and core bands in the 1500 MHz range are offered in different categories, it could prove advantageous at the auction to offer the lower extension band (1427–1437 MHz) in the form of a specific block (with or without the two blocks at the lower edge of the band, as applicable) in order to avoid a fragmented assignment of frequencies.

Model B is aimed at achieving key award objectives. In the first auction stage, this model is based on broader, preferably generic (but if necessary, specific) frequency blocks in the 700 MHz band and the restriction of bidding competition for incremental spectrum. In the view of the regulatory authority, it could be justified to exclude bidding competition if at the same time central award objectives (relating to coverage and competition) considered appropriate in relation to the value of the frequencies are pursued.

4.4 Product categories

Generic lots with similar characteristics will be offered in a single product category at the auction. A minimum of three product categories are required in the present auction: one for each band. If the frequencies within a band differ significantly in terms of value, they may have to be divided into several categories. However, this increases the complexity of the auction and the risk of fragmentation (cf. DotEcon's separate report on auction design).

In the view of the regulatory authority, the individual blocks in the 2100 MHz band are sufficiently homogeneous to be offered in a single product category.

The 1500 MHz band consists of the core band, the upper extension band and the lower extension band. The lower two blocks at the lower edge of the band are subject to strict usage restrictions (cf. section 3.2). The regulatory authority is of the opinion that these blocks should not be offered during the principle stage, but should instead be awarded to the winner of the adjacent block. It needs to be clarified whether the frequencies of the extension bands should be offered in separate categories. Participants in the stakeholder meetings expressed their preference for a single product category. At that time, however, the use of TDD was expected, whereas it is now assumed that SDL will be used. While technologies are already available for the core band, this is not the case for the extension bands. Whether this is materially relevant and should be taken into account in the product design is one of the questions that the regulatory authority wishes to put to this

consultation. The table below shows the possible options for creating product categories in the 1500 MHz band.

Table 9: Options for product categories in 1500 MHz band

Band	Number of categories	Frequency range
1500 MHz	1	Cat. 1: 1427–1517 MHz (90 MHz)
1500 MHz ^a	1	Cat. 1: 1437–1517 MHz (80 MHz)
1500 MHz	4	Cat. 1: 1427–1437 MHz (10 MHz) ^b Cat. 2: 1437–1452 MHz (15 MHz) ^b Cat. 3: 1452–1492 MHz (40 MHz) Cat. 4: 1492–1517 MHz (25 MHz)
1500 MHz ^a	3	Cat. 1: 1437–1452 MHz (15 MHz) ^b Cat. 2: 1452–1492 MHz (40 MHz) Cat. 3: 1492–1517 MHz (25 MHz)

^a The two blocks at the lower edge of the band will not be offered at the auction.

^b The lower part of the extension band could be offered at the auction even as a closed specific frequency range.

The options with more than one category exhibit the clear disadvantage that, under unfavourable circumstances, the fragmentation of the frequencies within the band must be accepted.

With regard to the 700 MHz band, a final assessment will only be possible once the terms and conditions of use as defined by the BMVIT are available. The regulatory authority is currently operating on the assumption that the blocks belonging to the 700 MHz band will be sufficiently homogeneous to be offered in the form of generic lots within a single product category. Depending on the terms and conditions of use, however, several categories may also be necessary, and specific blocks may have to be awarded.

Finally, the need to implement the TKK's award objectives may also make it necessary to create further product categories. The different coverage obligations associated with specific frequencies or categories of frequencies should be noted in this context (cf. DotEcon's separate report on auction design).

4.5 Options for product design

The following table summarises the options for all relevant parameters. The questions in the next chapter relate to these options. These options do not yet take into account the implementation of specific award objectives, such as coverage obligations which may be linked to specific frequencies. In the case of the 1500 MHz band, the regulatory authority assumes that the two blocks at the lower edge of the band will not be offered as separate lots at the auction but instead assigned to the winner of the neighbouring block.

Table 10: Options for product design

Option	Band (offer)	Categories	Lot structure
B1	700 MHz (2x30 MHz)	1	Generic / 2x5 MHz
B2	700 MHz (2x30 MHz)	3	Generic / 2x10 MHz
B3	700 MHz (2x30 MHz)	–	3 specific blocks (e.g. 2x10 MHz)
C1	1500 MHz (80 MHz) ^b	1	Generic / 1x10 MHz
C2	1500 MHz (80 MHz) ^b	1	Generic / 1x20 MHz
C3	1500 MHz (80 MHz) ^b	3	Generic / 1x5 MHz
C4	1500 MHz (80 MHz) ^b	3	1 specific block: 1437–1452 MHz Remainder: Generic / 1x5 MHz
D1	2100 MHz (2x60 MHz)	1	Generic / 2x5 MHz
D2	2100 MHz (2x60 MHz)	1	Generic / 2x10 MHz
D3	2100 MHz (2x60 MHz)	1	Generic / 2x20 MHz

^a The two blocks at the lower edge of the band would not be offered at the auction but instead awarded to the winner of the neighbouring block.

4.6 Consultation questions

Question 4.1: Do you share the view that in the 1500 MHz band the core band and extension bands should be awarded jointly? Please give reasons for your answer.

Question 4.2: How do you estimate the value differences within the 1500 MHz band? Are the value differences materially relevant for product design or can the blocks be awarded as generic lots in a single category? Do you agree to not awarding the two blocks at the lower edge of the band in the principle stage but instead to the winner of the neighbouring block? Give reasons for your answers.

Question 4.3: Do you agree with selecting option A1) in view of the possible uncertainties as to when the 700 MHz band will be freed up? If not, which option should be selected? Please give reasons for your answer.

Question 4.4: If the regulatory authority selects model A in section 7: Which product design option among B1 to D3 would you prefer? Give reasons for each answer.

Question 4.5: If the regulatory authority selects model B in section 7: Which product design option among B1 to D3 would you prefer? Give reasons for each answer.

Question 4.6: If the regulatory authority selects model C in section 7: Which option for the product design D1 to D3 would you prefer? Give reasons for each answer.

NON BINDING TRANSLATION

5 Coverage targets and coverage obligations

5.1 Introduction

The regulatory authority can set out minimum coverage obligations within the framework of frequency award procedures. These can be linked to different regulatory objectives. The two most fundamental ones are:

- ensuring efficient use of the frequencies (award objective 2);
- improving coverage of the population with mobile telecommunications services (award objective 4)

Imposing coverage obligations also entails potential risks and costs. Excessive coverage obligations can result in undesired effects:

- They can result in investments in infrastructure that are less than optimal from an economic point of view (such as inefficient replication of infrastructure or coverage in areas without corresponding demand).
- Due to the associated costs and risks, they can prevent network operators from being able to optimally cover their long-term spectrum requirements. In an extreme case, coverage obligations can be associated with such high costs that individual spectra are not accepted by the market.
- They can have negative impact on profitability, without any comparable social benefit.
- Imposing and especially verifying coverage obligations entails regulatory costs.
- Coverage obligations can potentially squeeze out specific provider groups and business models.

The regulatory authority views it as necessary to weigh advantages, disadvantages and risks when defining appropriate coverage obligations.

The regulatory authority wishes to implement a number of measures in order to find the right trade-off. Firstly, the regulatory authority will seek to align coverage obligations with political coverage objectives in order to reflect as far as possible society's vision of a modern communications infrastructure. Secondly, the national regulatory authority wishes to move away from the practice of requiring operators to always meet coverage obligations using their own radio network infrastructure. Widespread possibilities for infrastructure sharing should help to reduce the costs associated with meeting coverage obligations. Thirdly, the regulatory authority wishes to take appropriate measures—such as implementing an appropriate auction design—to ensure that the obligations are not excessive and can be distributed among several operators if necessary.

5.2 Ensuring efficient use of spectrum

The regulatory authority is required to ensure the efficient use of frequencies (cf. Art. 1 or Art. 55 TKG 2003). Coverage obligations are an important instrument for the achievement of this objective:

- By ensuring that the acquired spectrum is in fact used to a minimum degree (while otherwise threatening licence withdrawal)
- By increasing the costs associated with purely strategic spectrum acquisition, without any intention of use, thereby impeding spectrum hoarding

Both aspects support the objective of ensuring the efficient use of frequencies as a limited resource (award objective 2).

This presupposes, however, that the obligation is linked to the acquisition of the respective frequencies. In other words, the operator must fulfil the obligation using the frequencies in question, while the coverage provided using spectra from another band is not counted towards fulfilment of the 'band-specific' obligation. At the same time, an operator must have the flexibility to use frequencies only when necessary. Excessive band-specific obligations could be an impediment here. This, in turn, could lead to the inefficient replication of infrastructure.

In the multiband auction, the TTK required band-specific coverage of 25% of the population (outdoors) for all bands. For the regulatory authority, any coverage under nationwide licences that falls below this threshold raises the question of whether frequencies are being used efficiently within the meaning of Art. 55 TKG. The regulatory authority holds that falling below the 25% threshold would be justified only in the case of very high-frequency capacity bands with highly unfavourable propagation characteristics, or spectra for which it is highly uncertain whether terminal equipment will be available in future. In the present award procedure, this applies if at all to the 1500 MHz band.

The 2100 MHz band has been used by mobile network operators for almost 20 years; equipment and terminal devices for the varying mobile phone generations are available on the market. The current obligation in this band provides for coverage of 50% of the population. According to surveys conducted by the national regulatory authority, all three network operators in the 2100 MHz band currently offer coverage well above the 75% threshold. In the view of the regulatory authority, any reduction would not be in the interests of efficient frequency usage. For this reason, it seems justified that the band-specific coverage obligation should be based on previous requirements.

The 700 MHz band may be the last coverage spectrum to be awarded for several years. These frequencies are particularly well suited to providing nationwide coverage. For this reason, a higher band-specific coverage obligation appears justified. On the other hand, there are arguments against the rapid expansion of densely populated urban areas. The use of capacity spectrum can be more cost-efficient in these areas—at least in the short term—which can also be an advantage for consumers at the end of the day. The lack of availability of suitable locations represents a further argument against a very high level of coverage, as this could only be achieved by expanding urban areas.

Companies may have an incentive to purchase a larger spectrum amount within a band purely for strategic reasons, in order to curb competition in downstream markets. The best way to prevent this would be to introduce spectrum caps (cf. section 7.4). In addition, however, the coverage obligation can also be designed in such a way that the scope and quality of the service to be provided increases in line with the spectrum amount (e.g. higher transmission rates).

With this in mind, the regulatory authority considers it expedient to impose the following band-specific coverage obligations for broadband services (see tables below).

Table 11: Band-specific obligations for existing mobile network operators

Band	Band-specific obligation
700 MHz	<ul style="list-style-type: none"> • 25% population coverage (outdoors) • To be met for the first time as of 31 December 2021 • Broadband services at 10 Mbps DL and 2 Mbps UL from an assignment of 2x10 MHz and larger
1500 MHz	<ul style="list-style-type: none"> • 5–10% population coverage (outdoors) or equivalent number of locations • To be met for the first time as of 31 December 2025 • Broadband services at 10 Mbps DL for an assignment of 20 MHz • Potential secondary use by alternative users
2100 MHz	<ul style="list-style-type: none"> • 50% population coverage (outdoors) • To be met for the first time as of 31 December 2021 • Broadband services at 10 Mbps DL and 2 Mbps UL for an assignment of 2x10 MHz

Table 12: Band-specific obligations for new entrants

Band	Possible options
700 MHz	<ul style="list-style-type: none"> • 25% population coverage (outdoors) • To be met for the first time as of 31 December 2023 • Broadband services at 10 Mbps DL and 2 Mbps UL for an assignment of 2x10 MHz
1500 MHz	<ul style="list-style-type: none"> • 5–10% population coverage (outdoors) or equivalent number of locations • To be met for the first time as of 31 December 2025 • Broadband services at 10 Mbps DL for an assignment of 20 MHz • Potential secondary use by alternative users
2100 MHz	<ul style="list-style-type: none"> • 25% population coverage (outdoors) • To be met for the first time as of 31 December 2023 • Broadband services at 10 Mbps DL and 2 Mbps UL for an assignment of 2x10 MHz

In addition to the level of coverage, quality requirements must also be specified. The regulatory authority proposes the following quality requirements:

- **Service:** Broadband service at 10 Mbps for downlink traffic and 2 Mbps for uplink traffic (except for the 1500 MHz band), so that a specified measuring point (and thus the corresponding residents) can be considered to have coverage. This transmission rate applies to an awarded package of 2x10 MHz or 1x20 MHz. An equivalent data transmission rate is being considered for other packages (e.g. 5 Mbps for downlink traffic and 1 Mbps for uplink traffic for 2x5 MHz).
- **Availability:** Due to the low level of coverage, no special regulations or tolerance thresholds are required. Only measuring points that give a positive result are counted. It is not necessary to repeat the measurement.

5.3 Achievement of coverage targets

5.3.1 Introduction

Coverage obligations are an important tool in the achievement of regulatory and political coverage targets and help to ensure a supply of mobile telecommunications services potentially going beyond the level that network operators would offer as a result of competition.

The latest amendment to Art. 55 TKG 2003 places the TKG's regulatory objectives more clearly and explicitly at the centre of the planning of auction procedures. One of these objectives is to create a modern communications infrastructure matching the highest standards. This implies achieving central coverage targets defined in policies.

In line with this, the TTK has identified improved coverage of the population with mobile telecommunications services as a central award objective and has defined the following sub-objectives:

- Meeting coverage targets that take into account **telecommunications policy objectives and 5G developments** while being economically viable
- Improved coverage in areas where coverage is **not ensured by the market**
- Preventing strategic frequency purchases (spectrum hoarding)

Consequently, the present award is closely linked to the 5G strategy of the Austrian Federal Government and other relevant objectives and legal requirements at EU level (including the 5G Action Plan, the harmonisation decision on the 700 MHz band, and the multiannual radio spectrum policy programme). The 5G Action Plan, specifically, provides for the following:

- **All urban areas** as well as **all major terrestrial transport paths** should be provided with **uninterrupted** 5G coverage, in other words, using fifth-generation wireless communication systems.
- As an interim goal, at least one major city in each Member State should be '5G-enabled' on a commercial basis by 2020.

Decision (EU) 2017/899 on the use of the 470–790 MHz frequency band in the Union provides for the following:

- Taking account of the **speed and quality objectives** defined in the multiannual radio spectrum policy programme (**30 Mbps for all citizens**)
- Coverage in pre-defined **national priority areas**, e.g. **along major terrestrial transport paths**

The 5G strategy of the Austrian Federal Government, in turn, specifies the availability of 5G services on all **main transport links by the end of 2023** and the goal of **near universal 5G availability by the end of 2025**.

Many regulatory authorities and national regulatory authorities responsible for frequency allocation make coverage targets and national and European requirements the focus of 5G awards.⁸ 5G coverage and coverage obligations have also been part of the work programme of the Body of European Regulators for Electronic Communications (BEREC).⁹

In light of these requirements relating to policy and regulatory strategy, the regulatory authority has identified the following coverage targets and priorities:

- Motorways and priority roads
- Inhabited areas (outdoors)
- Households with insufficient internet access (indoors)

In the following three sections, the regulatory authority discusses how to frame these coverage targets in operational terms and develops options for implementing the targets within the framework of coverage obligations.

The regulatory authority takes the view that certain coverage obligations should be assigned to all winners of spectrum, while in the case of more extensive obligations it is more efficient from an economic point of view to select a single operator to meet the coverage obligation. Such more extensive obligations are associated with significantly higher rollout costs: the economies of scale are significant and oppose the mandatory replication of infrastructure. In addition, it may not be possible to achieve all the desired coverage targets. This can occur, for example, where the costs of expansion to meet the obligation exceed the value of the frequencies. If the obligation is closely linked to the spectrum, there is a risk that the spectrum offer will not be accepted. This, in turn, is at odds with the goal of efficiency.

⁸ See, for example, the award procedures in Denmark, Sweden or the UK.

⁹ See the BEREC reports: “BEREC report on practices on spectrum authorization, award procedures and on coverage obligations with a view to considering their suitability to 5G” and “BEREC and RSPG joint report on facilitating mobile connectivity in ‘challenge areas’” Can be viewed at: <https://berec.europa.eu>

In such a case, however, an appropriate auction design makes it possible to determine the actual level of coverage that will be achieved by the auction. This may even be preferable. If, for example, it is difficult for the regulatory authority to estimate the actual costs of supplementary coverage, it would be highly desirable to separately assign coverage obligations, while specifying not only who is to meet the obligations but also to what extent these are economically viable (provided that such a procedure is sufficiently competitive). Alternatively (or in addition), the costs of the extended obligations could be estimated on the basis of a simulation model in order to define the scope of the requirements. Within the context of preparing for the award procedure, the regulatory authority commissioned Real Wireless to develop a model for estimating the costs of coverage obligations. That model was the subject of a consultation with Austrian mobile network operators. The model can be adapted in line with specific coverage targets.

As these considerations show, there is a close relationship between the coverage obligations and the auction design. This is discussed in more detail in section 7 and in even greater detail in the separate DotEcon report on auction design.¹⁰

The coverage obligations presented below are closely aligned with the three coverage targets already mentioned. Coverage obligations that all operators must fulfil are referred to as 5G basic coverage obligations, while those that need only be fulfilled by one company are referred to as extended coverage obligations. Extended coverage obligations do not all necessarily have to be met by a single mobile network operator—they can also be distributed among several operators.¹¹ The extent to which the extended obligations can be distributed among several mobile network operators depends, however, on the auction design. If, for example, extended coverage is linked to a single coverage block—as in the case of the 2013 Multiband Auction—then the requirement cannot be distributed among several operators. On the other hand, a procurement auction with coverage lots offers significantly more flexibility. Such an auction would even make it possible to disaggregate the extended obligations discussed below in order to create more possibilities for distribution among different operators. The question of how to distribute the (disaggregated) obligations may be particularly relevant for coverage targets 2 and 3 (e.g. forming groups of municipalities). This may involve a trade-off between cost efficiency and competition. While it may be advantageous in terms of cost efficiency for a single operator to fulfil all the extended coverage obligations, in the long term it may be

¹⁰ See in particular the section under “Assignment of coverage obligations” in the DotEcon report.

¹¹ This does not affect the question of infrastructure sharing. Operator A, who accepts an extended obligation, may—to the extent permitted—enter into cooperation with other operators in order to fulfil that obligation. Conversely, operator A may make the coverage provided within the scope of fulfilling the obligation available to other operators where this is permissible. However, only operator A is obligated to provide the coverage.

more advantageous in terms of competition to distribute the coverage obligations over several award procedures and thus avoid too much coverage asymmetry.¹²

In accordance with the legal framework, the frequencies in question are to be awarded on a service and technology-neutral basis (cf. section 3.4 or Art. 54 TKG 2003). As a result, the regulatory authority is unable to prescribe a technology standard (e.g. 5G). Nevertheless, obligations can be imposed relating to the services to be provided which promote the use of the most efficient technology. In the medium term, the regulatory authority believes that this will be 5G in most frequency bands.

The option to share infrastructure and thus reduce costs can represent an important building block in achieving the ambitious coverage targets. In 2018 the regulatory authority published a revised position paper on infrastructure sharing. This paper defined a liberal framework for the joint rollout of infrastructure. The regulatory authority wishes to open up far-reaching opportunities for cooperation, particularly in areas where market forces do not ensure coverage (e.g. in sparsely populated rural areas) (cf. section 6.4).

5.3.2 Motorways and priority roads

The coverage of important transport routes is the focus of both national and European 5G and broadband strategies. The 5G Action Plan therefore envisages uninterrupted 5G coverage along all major road links; the 5G strategy of the Austrian Federal Government provides for the availability of 5G services along all main transport links by the end of 2023. From the point of view of the regulatory authority, this should create the infrastructure for future automation processes (keyword: autonomous driving).

The regulatory authority has derived two coverage targets from the specifications:

- Broadband service coverage for motorways and priority roads (motorways and other limited-access highways, and category B and L regional roads) that is as continuous as possible (i.e. with as little interruption as possible) within moving vehicles (in-car coverage)
- Near universal outdoor coverage of motorways and priority roads with low data transmission rates for stationary communication in emergencies

The regulatory authority has attempted to estimate the current coverage of traffic routes on the basis of operator data as well as using a simulation model calculated by an external contractor. In a study carried out by Real Wireless using spectrum below

¹² This is particularly relevant in the longer term with regard to several award procedures. It is highly likely that it would always be the same operator that would meet the obligation in the most cost-effective way, which would result in an increase in asymmetry from one award procedure to another.

1 GHz, all mobile network operators showed coverage values of significantly more than 80% for motorways and priority roads.¹³

The regulatory authority wishes to submit the following proposals for framing in operational terms the “Motorways and priority roads” coverage target, for the purpose of discussion with industry and the interested public:

Table 13: 5G basic coverage obligations along roads

Coverage area	5G basic coverage along roads
Motorways and other limited-access highways ¹⁴	<p>95% of carriageways, ramps and exits, rest areas and parking lots to be covered with 10 Mbps for downlink and 1 Mbps for uplink traffic (while on the move, in-car)</p> <p>95% of carriageways, ramps and exits, rest areas and parking lots to be covered with 1 Mbps for downlink and 0.5 Mbps for uplink traffic (stationary, outdoors)</p>
Category B and L regional roads ¹⁵	<p>90% of carriageways to be covered with 10 Mbps for downlink and 1 Mbps for uplink traffic (while on the move, in-car)</p> <p>90% of carriageways to be covered with 1 Mbps for downlink and 0.5 Mbps for uplink traffic (stationary, outdoors)</p>

The obligations proposed here as part of 5G basic coverage along roads are to be fulfilled by every winner of 700 MHz frequencies. However, the regulatory authority is also considering assigning these coverage obligations to operators who only bid for frequencies in the 2100 MHz frequency range.

The obligations in the following table represent the regulatory authority’s proposal for extended coverage along roads.

¹³ The coverage of MNOs was simulated on the basis of the existing infrastructure (locations) and the use of 800 MHz frequencies.

¹⁴ All roads with the designation A or S (e.g. A1 or S6)

¹⁵ All roads with the designation B or L (e.g. B17 or L121)

Table 14: Coverage obligations for extended coverage along roads

Coverage area	Extended coverage along roads
Motorways and other limited-access highways	<p>98% of carriageways, ramps and exits, rest areas and parking lots to be covered with 10 Mbps for downlink and 1 Mbps for uplink traffic (while on the move, in-car)</p> <p>98% of carriageways, ramps and exits, rest areas and parking lots to be covered with 1 Mbps for downlink and 0.5 Mbps for uplink traffic (stationary, outdoors)</p>
Category B and L regional roads	<p>95% of carriageways to be covered with 10 Mbps for downlink and 1 Mbps for uplink traffic (while on the move, in-car)</p> <p>95% of carriageways to be covered with 1 Mbps for downlink and 0.5 Mbps for uplink traffic (stationary, outdoors)</p>

In certain areas, extended coverage along roads can only be provided by one mobile network operator. For such coverage obligations to be met, a winner must be selected in the auction who accepts the respective coverage obligations. Depending on the auction design selected, it might also be conceivable to disaggregate the extended obligation (e.g. regionally); this might, for example, allow different areas to be covered by different operators.

5.3.3 Inhabited areas

The 5G strategy of the Austrian Federal Government envisages near nationwide availability of 5G by 2025. The 5G Action Plan provides for 5G coverage of all urban areas.

The regulatory authority does not consider nationwide availability in the broadest sense (i.e. 100% nationwide coverage) to be economically feasible or expedient. The regulatory authority has commissioned an external contractor to develop a simulation model for estimating the costs of providing widespread broadband coverage in Austria. The costs increase exponentially in proportion to coverage area. Such investments would be disproportionate to the value of the frequencies.

The regulatory authority therefore concludes that the target of wide area coverage must be limited to those areas with the highest concentrations of people (inhabited areas). This is first and foremost the permanent settlement area (roughly 39% of Austria's territory), which comprises both habitable and settled areas. The population not only lives in this area, but also does most of its travelling here; i.e. coverage is aimed primarily at the outdoor area. The regulatory authority believes

that—in line with the goals of the 5G Action Plan—the winners of frequencies should largely supply the permanent settlement area of cities (90–95% of coverage). In addition, each winner of frequencies should achieve broadband service coverage of 98% of the population (outdoors), as is now common in the EU.

To prevent rural areas from falling significantly behind in terms of coverage, the regulatory authority proposes a comparable obligation for municipalities; however, this should be provided by a sole operator for each municipality (extended coverage obligation). The data available to the regulatory authority provide only partial information on current coverage compared with the above standards. On the basis of coverage data from the network operators, the regulatory authority estimates that this obligation may affect several hundred municipalities.

In addition to the permanent settlement area, there are also other areas in which people live and move (e.g. hiking trails, cycle paths, forest roads etc.). The regulatory authority does not have any reliable information which would allow it to systematically delimit areas in which a sufficient number of people move, and on the basis of which a coverage obligation might be justified based on cost-benefit considerations. The following two coverage obligations could be considered, however:

- Widespread coverage (e.g. 90% of Austria's territory) at a very low data transmission rate to enable communication in an emergency
- A coverage obligation based on the area around traffic routes (e.g. 500 metres to both the right and left of traffic routes)

Following the conceptual outline of a subdivision into 5G basic coverage and extended coverage, the following breakdown is proposed:

- 5G basic coverage of inhabited areas relates to the permanent settlement area comprising all state capitals, cities with the district authority offices and municipalities with more than 10,000 residents.
5G basic coverage additionally comprises coverage of 98% of the population throughout Austria.
- The extended coverage obligations apply to the permanent settlement area comprising other municipalities as well as—where applicable—inhabited areas outside the permanent settlement area.

The regulatory authority wishes to submit the following proposals for framing in operational terms the coverage target for inhabited areas, for the purpose of discussion with the industry and the interested public:

Table 15: 5G basic coverage obligations for inhabited areas

Coverage area	5G basic coverage of inhabited areas
Permanent settlement area comprising state capitals, cities with district authority offices and municipalities with more than 10,000 residents	90% to 95% of the permanent settlement area to be covered with a data transmission rate of 30 Mbps for downlink and 3 Mbps for uplink traffic (outdoors)
Territory of Austria	98% of the resident population (pop coverage) to be covered with a data transmission rate of 30 Mbps for downlink and 3 Mbps for uplink traffic (outdoors)

The obligations proposed here as part of 5G basic coverage of inhabited areas are to be fulfilled by every winner of 700 MHz frequencies. However, the regulatory authority is also considering assigning these coverage obligations to operators who only bid for frequencies in the 2100 MHz frequency range.

Table 16: Obligations for extended coverage of inhabited areas

Coverage area	Extended coverage of inhabited areas
Permanent settlement area is all municipalities not included in 5G basic coverage	90% to 95% of the permanent settlement area to be covered with a data transmission rate of 30 Mbps for downlink and 3 Mbps for uplink traffic (outdoors), with this coverage to be provided in all municipalities
Inhabited areas outside of the permanent settlement area	Either a widespread coverage obligation (e.g. 90%) or coverage of the immediate area around traffic routes (e.g. 500 m) at a data transmission rate of 1 Mbps for downlink and 0.5 Mbps for uplink traffic (stationary, outdoors)

Extended coverage of inhabited areas could only be provided by an MNO. However, depending on the auction design selected, it would be conceivable to divide the municipality into several groups in order to distribute the obligation among different operators. In particular on the question of coverage outside of permanent settlement areas, the regulatory authority wishes to obtain the opinion of the interested public. What are the coverage objectives and areas that you view as important in this context?

5.3.4 Households with insufficient internet access

To ensure the nationwide availability of broadband services, it is essential to also address households whose broadband service coverage is not ensured by the market (third coverage objective).

Based on the data available, the regulatory authority estimates that up to 26,000 households currently do not have adequate internet access supporting at least 10 Mbps for downlink traffic, i.e. neither wireless broadband access (indoors) nor fixed broadband access. The regulatory authority wishes to address a (substantial) proportion of these households under the third coverage target.

The Real Wireless simulation model has shown that providing conventional mobile services coverage in the indoor area (from without) to more than 95% of the population is not economically feasible—among other things due to the effect of building attenuation. A conventional indoor obligation—such as that chosen for the multiband auction, for example—would therefore not be suitable for reaching the households concerned. For this reason, to supply the remaining households with broadband, the regulatory authority proposes a model that has already been used with success in Sweden and is under discussion for use in Denmark’s upcoming spectrum award. The network operator who accepts the obligation must ensure that selected households (requiring service) receive adequate internet access, whereas the connection does not necessarily have to be made via a conventional mobile services connection. Instead, there are several options available to the operator when it comes to fulfilling the requirement:

- Expansion of the mobile network so that the relevant household has access to the corresponding data transmission rate indoors
- Connection of the relevant household via outdoor customer premises equipment (CPE); depending on the model, customers may need to install the outdoor CPE themselves, or the installation may need to be carried out by the operator
- Connection via a point-to-(multi-)point system—this can also be carried out via a third-party provider if necessary
- Connection by means of wired broadband

The regulatory authority recognises several ways of identifying households with corresponding needs. One possible option would be as follows: on the basis of the data available to it, the regulatory authority makes a preselection of municipalities which, for example, have a particularly large number of unserved households. Those municipalities are included in the coverage obligation set out in the tender documentation. After taking into account an appropriate rollout period following the auction, households in those municipalities can register their demand (over a period of five years). Following appropriate verification (that the household in question definitely does not have adequate internet access), the network operator must provide these households with a data transmission rate of 10 Mbps for downlink and 1 Mbps for uplink traffic.

Depending on the auction design selected, the entire obligation can either be directed towards a single operator or distributed among different coverage areas so that several mobile operators can assume the coverage obligation.

5.3.5 Summary

The regulatory authority is attempting to meet to a large extent the coverage targets set by the Austrian Federal Government and the European Union by imposing relevant coverage obligations. A distinction is made between 5G basic coverage and extended coverage.

5G basic coverage

The coverage obligations discussed here are to be met by all operators bidding for frequencies within the 700 MHz frequency range. Expanding this to include operators bidding for only 2100 MHz frequencies is envisaged.

Extended coverage

The coverage obligations discussed here are to be fulfilled by a sole operator for a specific location or area.

The following table gives a further overview of how the coverage obligations discussed are to be framed in operational terms:

Coverage obligations within the framework of 5G basic coverage:

Table 17: Coverage obligations relating to 5G basic coverage

Coverage target	Obligation
Traffic routes	<p>5G basic coverage along roads</p> <p>Extensive coverage of motorways and other limited access highways and regional roads (B + L), inside moving vehicles, at data transmission rates of 10 Mbps for downlink and 1 Mbps for uplink traffic</p> <p>Extensive stationary coverage of motorways and other limited access highways and regional roads (B + L) outdoors, at data transmission rates of 1 Mbps for downlink and 0.5 Mbps for uplink traffic</p>
Inhabited areas	<p>5G basic coverage of inhabited areas</p> <p>90–95% coverage of the permanent settlement area, comprising state capitals, cities with district authority offices and municipalities with more than 10,000 residents, at 30 Mbps for downlink and 3 Mbps for uplink traffic</p> <p>98% nationwide pop coverage at 30 Mbps for downlink and 3 Mbps for uplink traffic</p>

Coverage obligations within the framework of extended obligations:

Table 18: Coverage obligations relating to the extended obligation

Coverage target	Obligation
Traffic routes	<p>Extended coverage along roads</p> <p>Virtually uninterrupted coverage of motorways and other limited-access highways and regional roads (B + L), inside moving vehicles, at data transmission rates of 10 Mbps for downlink and 1 Mbps for uplink traffic</p> <p>Virtually uninterrupted stationary coverage of motorways and other limited-access highways and regional roads (B + L) outdoors, at data transmission rates of 1 Mbps for downlink and 0.5 Mbps for uplink traffic</p>
Inhabited areas	<p>Extended coverage of inhabited areas</p> <p>90% to 95% coverage of the permanent settlement area across all municipalities at a data transmission rate of 30 Mbps for downlink and 3 Mbps for uplink traffic</p> <p>A widespread coverage obligation (e.g. 90%) extending beyond the permanent settlement area or coverage of the immediate area around traffic routes (e.g. 500 m to the right and left) at a data transmission rate of 1 Mbps for downlink and 0.5 Mbps for uplink traffic (stationary, outdoors)</p>
Households with insufficient internet access	<p>Unserved households in selected municipalities which have declared their need are to be supplied at a data transmission rate of 10 Mbps for downlink and 1 Mbps for uplink traffic (indoors)</p> <p>Various options are available to fulfil this obligation</p>

The extended coverage obligations stem from the ambitious 5G political targets. Two important questions arise in relation to the implementation of the extended coverage obligations: firstly, the question of cost. Uncertainties regarding cost and scope in relation to economic feasibility can be addressed either by means of a further cost analysis or by implementing in the auction a design that is suitable for defining the scope of the obligation. Beforehand, the regulatory authority wishes to obtain the opinion of industry. Secondly, the question arises as to how finely the extended obligations should be distributed among the operators, or whether all extended obligations should be met by a single operator. We would refer here once again to the above comments on the trade-off between cost efficiency and long-term competition. Both questions have an impact on auction design. By means of the following questions, the regulatory authority aims to achieve greater clarity on these issues.

5.3.6 Quality criteria and verification

The regulatory authority is aware that the required data transmission rate cannot be provided at all of the required locations at all times. It is therefore necessary to define criteria with regard to service quality and availability, in order to ensure that service is provided at a standard acceptable to the end user and that the end user can expect, with a high degree of probability, to be able to use the service at the required data transmission rate. These specifications are, in turn, closely related to verification of the coverage obligations. In this context, it is also important to mention one of the key focal areas of BEREC in 2018.¹⁶

The regulatory authority wishes to obtain proposals from the industry on this point.

¹⁶ Cf. the BEREC report “Common Position on information to consumers on mobile coverage”. Can be viewed at: <https://berec.europa.eu>

5.4 Consultation questions

Question 5.1: What is your opinion of the band-specific obligations for ensuring the use of frequencies? Please give reasons for your answer.

Question 5.2: What is your opinion of the coverage targets from a political, legal and economic point of view? Please give reasons for your answer.

Question 5.3: What is your opinion of the 5G basic coverage obligation? Which changes would you propose, if any? Please give reasons for your answer.

Question 5.4: What is your opinion of the extended coverage obligations? Which changes would you propose, if any? Suggest potential coverage targets and areas outside of the permanent settlement area. Please give reasons for your answer.

Question 5.5: What is your opinion of the costs of the extended coverage obligations? Should the scope of the extended coverage obligations be specified at the time of auction? Please give reasons for your answer.

Question 5.6: Is it desirable for the extended coverage obligations to be distributed among several operators, or should a single operator be selected to be responsible for meeting all extended coverage obligations? Should the extended obligations be disaggregated (e.g. for northern, southern, eastern and western Austria)? Please give reasons for your answer.

Question 5.7: What is your opinion of the regulatory authority's proposal for addressing the third coverage target, in particular as this relates to the procedures outlined above? The regulatory authority invites all respondents to the consultation to submit alternative proposals. Please give reasons for your answer.

Question 5.8: What possibilities do you see for including the required data transmission rates in the obligations? Which quality requirements should be defined (e.g. with regard to the availability of services)? How might these best be framed in operational terms? How should compliance with obligations be verified? Please give reasons for your answer.

6 Other conditions of use

6.1 Period of use

In setting the validity period for rights of frequency use, the TKK pursues a number of objectives. A specific example is that all spectrum usage rights within one band should expire at the same time (to allow the introduction of new technologies, and similar considerations).

Alongside this consideration, the regulatory authority assumes that an auction will be held in regular intervals (roughly every five years) to allow adaptation of capacities as well as new market entries and to be able to accommodate possible changes in technology. The licence period for all bands should be set between 20 and 25 years, depending on when the rights for other frequencies expire. In any event, no renewal option will be granted—as nonetheless provided for at European level through the Directive establishing the European Electronic Communications Code (EECC) in the case of shorter licence terms (although the Directive is unlikely to have been transposed into national law by the time of this award). Combining area and capacity spectrum in a single award is also generally considered worthwhile. Moreover, combination with substitutes is a goal in every auction.

Licences to use the other mobile bands have been granted for the periods listed below (and included in the tender for the 3410 to 3800 MHz range):

- 2.6 GHz until 31 December 2026
- 450 MHz until 31 December 2029
- 800 MHz until 31 December 2029
- 900 MHz and 1800 MHz until 31 December 2034
- 3410 to 3800 MHz (based on tender documentation—not yet assigned) until 31 December 2039

The concrete proposal for the periods of use for the 700, 1500 and 2100 MHz bands is therefore as follows:

- End of term for frequencies in the 700 and 1500 MHz range: **31 December 2042** (roughly 20.5 years—depending on the exact date of service of the award decision)
- End of term for frequencies in the 2100 MHz range: **31 December 2044** (24 years)

6.2 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.

The frequency assignment fees are specified in the Telecommunications Fee Ordinance (*Telekommunikationsgebührenverordnung, TKGV*). Where reasons exist, 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 frequencies. The most recent amendment to the TKG 2003 in December 2018 included the following sentence: “In this case, the minimum bid may not exceed 50% of the lower limit of the market value as determined in accordance with the previous sentence.”

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 (explanatory comments on Art. 55 Par. 4).

Basing the fee on the TKGV would result in a minimum bid of EUR 11,134,800 for the frequency usage rights currently to be awarded; RTR interprets the current provision on the minimum bid such that, were the regulatory authority to deviate from the fees specified in the TKGV, the following steps would be necessary to determine the minimum bid:

- Determination of a range based on the estimated market value (if one were to base this calculation on the “actual market value”, it would not be possible to determine a lower limit and there would be no point to the newly added amendment to the TKG)
- Determination of the ‘lower limit’ of this range and fixing the minimum bid at 50% of this lower limit

According to the explanatory comments, the regulatory authority should—at a minimum—orient itself on national and international benchmarks; the legislation does not specify the national and international reference values to be used or how the reference values are to be taken into account. For example, no statement is made as to which statistical indicator (mean value, median, X% percentile) to choose. The mean value is generally used on the basis of MHz/pop prices. Where the quality of the reference values permits, a regression model can also be used to determine the market value. In addition, it is also possible to conduct a business case analysis.

From the perspective of the regulatory authority, the following estimated and reference values might be considered:

- The average value (or other statistical indicator, where applicable) from national awards of comparable frequency ranges, whereby the widespread approach of subdivision into low bands (700 MHz, 800 MHz and 900 MHz), mid bands (1800 MHz, 2100 MHz) and high bands (2.6 GHz, 3.4-3.8 GHz) could be followed. Consequently, all national awards of spectrum below 1 GHz (900 MHz and 800 MHz awards) would be relevant for the 700 MHz spectrum, while those in the 2100 MHz and 1800 MHz bands would be relevant for the 2100 MHz spectrum. There are no suitable national reference values for the 1500 MHz range, as this frequency range can only be used as SDL spectrum and there is considerable uncertainty regarding how long equipment and terminal devices will be available for the entire frequency range.
- The average value (or other statistical indicators) from selected international awards of relevant bands or comparable frequency ranges. It would be necessary here to assess in each individual case which awards in other countries are sufficiently relevant to be included in the statistics. Countries would be excluded which, for example, set frequency licence fees on an administrative basis and award rights of use by means of a comparative selection procedure. In addition, the respective national conditions may have to be taken into account (e.g. valuation using purchasing power parities). The timing of the auction must also be taken into account, and in particular any potential differences which could arise as a result of the technology used after the award.
- Where the data permit, an econometric model can be generated which allows the market value to be described on the basis of a number of explanatory variables (e.g. time of award, band or number of MNOs).
- Determination of the value of the frequencies (e.g. business case analysis). The opportunity costs can be determined on this basis.¹⁷

The TKK would have to determine the lower limit of the estimated market value on the basis of these estimates and then set the minimum bid at 50% of this lower limit.

With regard to determining the lower limit of the estimated market value, the regulatory authority first wishes to gather industry opinion, and then to propose specific values as part of the consultation on the tender conditions and auction rules.

¹⁷ The EECC, for example, considers opportunity costs as a measure for setting reserve prices (see Art. 42 EECC).

6.3 Secondary use

The TKG 2003, as amended in December 2018, provides for the possibility of secondary use of frequencies. Accordingly, the regulatory authority may provide for the possibility, where the licensee does not utilise frequencies, to make such spectrum available (temporarily) to a secondary user in certain areas.

The regulatory authority sees little potential for this rule to be applied in the case of the frequencies in question. The 700 MHz and 2100 MHz bands are expected to be used across large parts of Austria. At most, it might be possible to apply the rule on secondary use in the 1500 MHz range.

6.4 Infrastructure sharing

In 2018 the TKK published a position paper on infrastructure sharing.¹⁸ Corresponding conditions were included in the tender terms and conditions for the 3.4–3.8 GHz award in order to safeguard infrastructure competition and enable competitors to gain access to non-replicable infrastructure where necessary.¹⁹

- To safeguard infrastructure competition, core network sharing and active sharing outdoors²⁰ are prohibited in Vienna, Graz and Linz. This is intended to ensure a minimum level of infrastructure competition.
- There is an exemption for cooperation with entrants. A company is considered an entrant if it owns less than 10% of the awarded mobile telecommunications spectrum. There is also an exception if the active elements of the access network cannot be replicated—sharing is then still possible for those and only those elements.
- Access to non-replicable infrastructure must be granted for outdoor areas in Vienna, Graz and Linz where an exemption to the prohibition on active sharing applies, and for indoors throughout Austria where the infrastructure is non-replicable. The prerequisite for the access obligation is the joint use of the active elements by more than one MNO (i.e. no entrants as defined above).
- The tender documentation outlines the relevant reporting and information obligations that MNOs have towards the regulatory authority.

¹⁸ <https://www.rtr.at/de/tk/TKKPositionInfrShare2018>

¹⁹ Tender Document, Section 3.7, available at https://www.rtr.at/de/tk/5G-Auction-Tender-Documents/Ausschreibungsunterlage_3_4_-_3_8_GHz_ohne_Anhaenge_DE.pdf

²⁰ The corresponding definitions of the core network and of active elements of the access network can be found in the tender documentation.

The regulatory authority is considering adopting these rules with the following amendments:

- Firstly, the spectrum used as the basis of the definition of ‘entrant’ should also include the 700, 1500 and 3600 MHz bands; i.e. the denominator used for calculating the 10% share should include all bands.
- Secondly, in line with Article 61 (4) of the recently adopted Code,²¹ there will also be a general access obligation for non-replicable infrastructure.²²
- Thirdly, an exception to the prohibition on active sharing is also to be added for cases of legacy cooperation.

With regard to the coverage obligation, the regulatory authority is contemplating—in line with the considerations in the position paper on infrastructure sharing—prohibiting active sharing only for band-specific coverage obligations, in order to ensure efficient use and prevent hoarding (see section 5.2). Furthermore, the regulatory authority is considering not excluding active sharing for the additional coverage obligations (both 5G basic coverage and extended coverage obligations).

6.5 Consultation questions

Question 6.1: Do you agree with the planned period of use? If no, what period of use would you propose? Please give reasons for your proposal.

Question 6.2: What is your opinion of the proposals for estimating the market value? Do you have any alternative proposals? Please give reasons for your answer. Please also provide specific values.

Question 6.3: Do you consider the 700 MHz, 1500 MHz and 2100 MHz frequency ranges suitable for potential secondary use? Please give reasons for your answer.

Question 6.4: The rules on infrastructure sharing refer to the same definitions as for the 3.4–3.8 GHz award. In your view, do these definitions require any adaptations (passive elements, active elements including active antennas as defined there, or core network)?

Question 6.5: Do you have any other suggestions regarding the intended rules for infrastructure sharing?

²¹ Directive of the European Parliament and of the Council establishing the European Electronic Communications Code

²² In the 3.4–3.8 GHz award, the sharing of at least two MNOs was a prerequisite for the access obligation. This requirement is to be revoked, meaning there is to be an access obligation even where only one company uses the non-replicable infrastructure.

7 Auction design

7.1 Simultaneous auction or sequential auctions

With regard to the 700/1500/2100 MHz frequency ranges currently to be awarded, the Spectrum Release Plan includes only the award of the core band (1452–1492 MHz), but not the extension bands (1427–1452 MHz and 1492–1517 MHz) in the 1500 MHz range. One further reason for bundling the bands at the time related to complexity (to not have too many categories with generic lots).

Some stakeholders have now proposed that the extension bands should be included in the award procedure, although originally planned for the period after 2020. The regulatory authority agrees with many of the arguments in favour of a joint award. In particular, the regulatory authority agrees that only a joint award can prevent fragmentation of the band, which would be detrimental to efficient use. The regulatory authority therefore plans to award the extension bands together with the core band, provided that the technical terms and conditions of use are available in good time and no weighty arguments against a joint award are put forward in the consultation.

Including the extension bands in the award process could, however, increase the complexity of the design. Potential value differences among the different ranges within the 1500 MHz band may require more than one product category that includes generic lots (cf. section 4.4). Additional rules and special bidding restrictions may be required to prevent fragmentation of the band. A similar problem may arise with the 700 MHz band (cf. sections 3.1 and 4). Certain issues have not yet been conclusively resolved, including the sub-ranges within the band that will be freed up by mid-2020 and any usage restrictions that may apply beyond mid-2020, as well as the impact these restrictions might have on the value of the spectrum. A further factor which could increase design complexity is the need to consider coverage obligations. The DotEcon report on auction design describes mechanisms allowing coverage obligations to be taken into account in auction design. In addition to coverage, safeguarding competition is a key secondary TTK award objective that may have an impact on design (cf. section 5).

One way of reducing complexity is to offer spectrum in separate auctions (or stages; see the DotEcon report on auction design). Award by sequential auctions restricts the option of switching between different frequency ranges during an auction; this does not, however, necessarily have to be disadvantageous if the frequencies can be potentially considered distant substitutes and there are no other compelling reasons to hold a simultaneous auction—such as strong synergistic valuations.

Owing to SDL use of the 1500 MHz band, this band can only be used in combination with another frequency band, and it was argued in the consultation on the Spectrum Release Plan and in the stakeholder meetings that sharing this band with a band below 1 GHz would bring significant efficiency benefits. Thus, complementary value

interdependencies potentially exist, so that various mobile network operators could be exposed to significant aggregation risks in the auction.

The specific complementary relationship between the 1500 MHz band and the 700 MHz band can either be taken into account in the auction design (if the two bands are auctioned off simultaneously) or the 700 MHz band can be put to auctioned before the 1500 MHz band (cf. Model B in section 7). In any event, the regulatory authority will not auction off the 1500 MHz band before the 700 MHz band.

As explained in section 3.1, there continues to be uncertainty as to whether the 700 MHz band will be available without restriction for mobile telecommunications use from mid-2020 onwards. In the event of an unacceptably high legal risk in relation to the band being free up or a disproportionately long residual period of use, the regulatory authority proposed in the Spectrum Release Plan to initially award only the time-critical 2100 MHz band (Model C in section 7) and the other ranges at a later date. Based on the estimated remaining period of broadcasting use, the regulatory authority does not currently assume any need for this option.

7.2 Auction formats

The regulatory authority commissioned DotEcon with preparing an auction design for the pending award procedure. The separate report prepared by DotEcon contains a description of the auction procedures used internationally and a discussion of the pros and cons of these formats.

When selecting an appropriate auction format, the TTK must consider not only the suitability of the individual formats for achieving the award objectives but also the most recent amendment to the TKG.

7.3 Implementation of coverage obligations

The TKK has set as one of its central award objectives to achieve the coverage targets (related to 5G) defined in telecommunications policy. A broad discussion of these objectives as well as proposals for the coverage obligations can be found in section 5. The obligations are broken down as follows:

- 5G basic coverage obligation to be met by every provider awarded 700 MHz spectrum (and possibly 2100 MHz spectrum)
- Extended coverage obligations to be fulfilled (at one location/within one area) by a single operator to be selected

The 5G basic coverage obligation may be tied to the acquisition of the corresponding spectrum. The extended coverage obligations are associated with higher costs and thus with a greater risk that the frequencies might not be accepted because of the requirements. In addition, economies of scale are a clear argument against requiring the replication of infrastructure in the areas concerned. For such coverage obligations to be met, a winner must be selected in the auction who accepts the respective coverage obligations. Various instruments are available to achieve this.

The DotEcon report discusses and proposes the following instruments for taking coverage obligations into account in the auction design:

The respective coverage obligations may be linked to the acquisition of specific frequency blocks (though not necessarily with specified frequencies) that are auctioned off together with the blocks not falling under the coverage obligations. The costs associated with the fulfilment of the obligations would then be reflected in the reduced prices for those blocks.

One further option is to tie to a single frequency block all additional coverage obligations, i.e. supplementary coverage for roads, inhabited areas within and outside of municipalities as well as broadband coverage for households which are currently unserved. This block may need to comprise a large bandwidth in order to ensure that the costs of meeting the requirements do not exceed the value of the spectrum. This would ultimately mean that all additional obligations would be met by a single operator.

However, seeing that the coverage obligations vary, it would also be possible to tie them to different frequency blocks. This would make possible an outcome in any case whereby the various obligations would be met by different operators. Were a provider to be interested in meeting several obligations, that party would have to purchase several frequency blocks (possibly more than actually desired) and, depending on the spectrum caps in place, it may not be possible for a single operator to fulfil all obligations.

Decoupling coverage obligations from frequency blocks offers greater flexibility in this respect and allows, where appropriate, a further disaggregation of coverage

obligations, creating in turn more possibilities for distribution among various operators. In addition, such decoupling eliminates the risk of spectrum remaining unsold due to highly demanding coverage obligations. This outcome would clearly give rise to problems in achieving the efficiency objective.²³ It is, of course, also possible that not all coverage targets set by the regulatory authority will be reached, and that the level of additional coverage actually achieved will be determined during the auction itself. This does not necessarily have to be a problem, however; it can be desirable. If, for example, it is difficult for the regulatory authority to estimate the actual costs of supplementary coverage, it would be highly desirable to separately assign coverage obligations, while specifying not only who is to meet the obligations but also to what extent these are economically viable (provided that such a procedure is sufficiently competitive).

As explained in the DotEcon report, there are various options for such decoupling (such as the Danish model of obtaining an exemption from otherwise applicable obligations, or to offer coverage obligations at negative prices together with the frequency blocks). A crucial question in this case is then whether coverage obligations and frequency blocks should be auctioned off together or whether it is appropriate to distribute them over the various stages of a bidding procedure (i.e. a model in which spectrum is awarded first and bidders are then allowed to reduce their payment obligations by bidding for additional obligations).

As discussed in the DotEcon report, the decision on the form in which coverage obligations are awarded has an impact on the auction format, as additional lot categories may be required or combinatorial procedures may be necessary in order to avoid any aggregation risks relating to coverage obligations and the spectrum acquired.

²³ It should be noted here that such a risk exists even where the coverage obligations could easily be met by a single company but no other bidder is capable of doing so alone. In this case, an operator capable of meeting the obligations may try, by bidding for spectrum not subject to obligations, to crowd another bidder out of the competition who is unable to bid for such a block.

7.4 Measures safeguarding competition

7.4.1 Introduction

One of the main objectives of the TKK in awarding the spectrum is to ensure and encourage effective competition. To achieve this, the instruments listed below are available to the TKK:

- Spectrum caps can be used to prevent a network operator or a group of network operators from acquiring too much spectrum and therefore a dominant position. Spectrum caps can be defined for individual bands and for groups of bands (for example for all frequency bands). By defining very narrow caps, spectrum can be implicitly reserved.
- Spectrum can be implicitly reserved by means of competition constraints (spectrum floors), ensuring that a minimum number of network operators have a minimum spectrum portfolio. This concept can only be implemented in auction designs, such as the combinatorial clock auction (CCA), which include a method for identifying winners, while also requiring standard minimum spectrum portfolios to be defined for each (type of) network operator.
- The TKK also has the option of explicitly reserving (or setting aside) spectrum for certain groups of network operators (for example new entrants or very small operators). Reserving spectrum is a measure with far-reaching impact and is justified only where a corresponding lack of competition exists.
- Reserving spectrum can be supplemented by additional measures to support new entrants, potentially compensating for the disadvantages of entering the market at a later date (entry assistance). Such include obliging existing network operators to provide new entrants with temporary access to their networks, especially in rural areas (i.e. national roaming, site-sharing or other measures).
- In addition, wholesale access may be imposed as an obligation in order to ensure effective competition in the award process. Such a far-reaching measure is justified only where a corresponding lack of competition is to be expected.

The market analysis provided in the Appendix on Measures Safeguarding Competition describes current competition in the markets for mobile services and private customer broadband products, and in particular the role of MVNOs and the mandatory wholesale offer. In choosing measures to ensure competition, prime consideration is given to potential competition challenges. The regulatory authority has identified three potential competition challenges with relevance for the present award procedure:

- Fewer than three actual competitors on the mobile telecommunications market
- Excessively asymmetric spectrum assignment
- Competition deficit on the retail markets, considering the mandatory wholesale offer arising from the H3A merger and the demand-side power of MVNOs

The first two potential competition problems could directly materialise during the auction. These will therefore be analysed first.

The regulatory authority bases its assessment of spectrum assignment on the usual criteria relating to economic competition:

- Is one company (unilaterally) or are several companies jointly (through coordinated action) capable of limiting competition through a strategic purchase of spectrum in the auction?
- Do (unilateral or coordinated) incentives exist for the company or companies to pursue such a strategic purchase? Do the expected gains exceed the costs?
- Would such a strategic spectrum purchase have a negative impact on effective competition in the retail market?

The third potential competition challenge involves a potential competition deficit in the retail markets, considering the compulsory wholesale offer arising from the H3A merger and the demand-side power of MVNOs. This challenge is investigated as follows: first, retail competition is analysed in the segments of mobile services and private customer broadband products. The respective risks of tacit collusion are then discussed. Finally, the demand-side power of MVNOs and the incentives and expected behaviour of MNOs on the wholesale market following the expiry of the current mandatory wholesale offer by H3A are discussed.

7.4.2 Industry input

The regulatory authority has already discussed the topic of measures safeguarding competition as part of the consultation on the Spectrum Release Plan.²⁴ The table below gives an overview of the spectrum caps proposed by the consultation participants. The narrowest and widest spectrum caps are given for each band or band group. These caps range from 26% to 67%. Under certain conditions, consultation participants advise against limiting the amount of spectrum a bidder may purchase at all. However, these proposals tend to be closely linked to cross-band caps (e.g. 700 MHz band) or to the use of alternative measures to safeguard competition (such as spectrum floors). Some of the narrower caps may be attributable to strategic motives rather than competition considerations (for instance the narrow caps for mobile network operators in the 3400–3800 MHz range).

Table 19 Spectrum caps proposed by participants in the SRP consultation

700 MHz (2 x 30 MHz)	800 MHz (2 x 30 MHz)	900 MHz (2 x 30 MHz)	1500 MHz (40 MHz) ^b	1800 MHz (2 x 75 MHz)	2100 MHz (2 x 60 MHz)	2600 MHz (2 x 70 MHz + 50 MHz)	3400-3600 MHz (190 MHz) ^b	3600-3700 MHz (100 MHz) ^b	3700-3800 MHz (100 MHz) ^b	Maximum spectrum assignment from-to (in %) ^a
X										66%–100%
			X							50%–100%
					X					66%–100% ^a
										100%
						X				40%
							X			53%–100% ^d
								X	X	50%–100% ^d
X	X	X								40%–67%
X	X	X	X	X	X	X				43%
X	X	X	X	X	X	X	X	X	X	42%
X	X	X		X	X					37%–67%

²⁴ Cf. the results of the consultation on the Spectrum Release Plan

700 MHz (2 x 30 MHz)	800 MHz (2 x 30 MHz)	900 MHz (2 x 30 MHz)	1500 MHz (40 MHz) ^b	1800 MHz (2 x 75 MHz)	2100 MHz (2 x 60 MHz)	2600 MHz (2 x 70 MHz + 50 MHz)	3400-3600 MHz (190 MHz) ^b	3600-3700 MHz (100 MHz) ^b	3700-3800 MHz (100 MHz) ^b	Maximum spectrum assignment from-to (in %) ^a
X	X	X		X	X	X				39%–67%
X	X	X		X	X	X	X			0% ^c –67%
X					X					56%–67%
X					X		X			0% ^c –67%
			X	X	X					40%
						X	X	X	X	40%
							X	X	X	26%–100% ^d

^a The absence of a cap can be seen in connection with a floor of 2x15 MHz.

^b Only the core band was available at the time of the consultation.

^c Stems from the requirement that mobile telecommunication companies should not be able to acquire spectrum in the 3400–3600 MHz range.

^d The 100% threshold results among other things from the proposal to set caps only if demand in the auction is low.

^a All percentages are rounded up.

For the sake of completeness, it should be noted that the implementation of individual proposals would result in various potential demand-side parties being excluded from purchasing spectrum in certain bands. For example, a 40% cap in the sub-1 GHz band would prevent A1 from acquiring frequencies in the 700 MHz band.

Two participants in the Spectrum Release Plan consultation proposed a spectrum floor (implicitly reserved minimum spectrum portfolio) of 2x15 MHz for the 2100 MHz band. This proposal was based on the substantial business risk entailed in spectrum loss within this range, the disproportionate effort involved in substituting 2100 MHz spectra with frequencies from other ranges, and the protection of existing infrastructure in general. It is argued that the entire network topology would have to be changed and end-user terminal equipment replaced if an existing operator were to lose these spectra, as no substitute frequencies from a similar frequency range (e.g. 1800 MHz) would be offered. One participant suggests that a minimum spectrum portfolio of 2x15 MHz should be specified only for operators of networks which are critical for infrastructure competition.

The following competition-relevant arguments are examples of those put forward at the stakeholder meetings with existing MNOs:

- Various topics relating to competition issues were discussed: coverage, indoor coverage, capacity, service continuity. While coverage and indoor coverage are closely associated with the 700 MHz band, the question of service continuity relates primarily to the 2100 MHz band.
- It was also argued that competitive imbalances would be created, in particular by the uneven distribution of sub-1 GHz spectrum.
- One participant pointed to A1's dominant spectrum position (1800 and 800 MHz channels) and the resulting quality advantages (in indoor coverage and rural areas).
- In the context of business continuity in the 2100 MHz band, it was pointed out that investments in other bands should be avoided. To ensure this, each existing operator should receive a minimum spectrum portfolio. Some participants were unable to suggest a minimum, while others stated 2x10 or 2x15 MHz as the minimum required for business continuity. A floor of 2x15 MHz or reserved spectrum was proposed in this context.
- One participant suggested a two-thirds upper limit for the purchase of spectrum within a band as a reasonable upper limit.
- A cap of 45% and a cap of 50% were put forward for the range below 1 GHz. One participant suggested a 50% cap for the 1500, 1800 and 2100 MHz bands.
- Several participants proposed a minimum of 2x10 MHz as efficient for the 700 MHz band.

7.4.3 First draft of measures to safeguard competition

On the basis of the analysis in the Appendix, the regulatory authority is considering the following measures relating to spectrum assignment in order to safeguard competition:

- Firstly, a minimum of three network operators should have 2x40 MHz in the 700, 800, 900, 1800 and 2100 MHz bands. Based on existing assignments, this means that A1 and TMA may jointly purchase a maximum of 2x75 MHz of the available 2x90 MHz in the 700 and 2100 MHz bands.
- Secondly, no operator should hold more than 50% and thus a maximum of 2x45 MHz in the bands best suited for wide area coverage and deep indoor coverage within buildings. This means that A1 would be limited to 2x10 MHz and TMA to 2x20 MHz in the 700 MHz band.
- Thirdly, no operator should hold more than 43% or a maximum of 230 MHz or 2x115 MHz in the 700, 800, 900, 1500, 1800 and 2100 MHz bands (a total of 2x230 + 80 MHz). Based on existing assignments, A1 could acquire a maximum of 2x45 MHz or 90 MHz, while TMA could acquire a maximum of 2x70 MHz or 140 MHz.
- In line with the proposals put forward by two network operators, the regulatory authority is also considering the possibility of introducing band-specific caps at two thirds of the respective band.

Changes or additional measures to safeguard competition may also result from the overall distribution of mobile telecommunications spectrum—and thus depend on the outcome of the 3.4–3.8 GHz award procedure.

Specific implementation of these measures to safeguard competition will depend on the respective auction format. As explained in the DotEcon report on auction design (“Options for safeguarding competition” section), various instruments exist for safeguarding competition (spectrum caps, spectrum reservation, outcome constraints, floors etc.). The instruments are suitable for addressing potential competition problems to varying degrees. Moreover, the auction model and the instruments available are closely related. Spectrum caps are a rather crude instrument for safeguarding the minimum portfolio but can be used in any format. Other instruments are only available for certain auction formats.

A potential competition deficit in the retail markets exists, considering the mandatory wholesale offer arising from the H3A merger as well as the demand-side power of MVNOs. Here the regulatory authority sees a risk of insufficient competitive pressure from MVNOs and tacit collusion among the three MNOs. The regulatory authority is therefore considering making MNOs commit to a wholesale offer.

Several options are available for imposing such an obligation. The first option is to tie the mandatory wholesale offer to all packages in specified bands (see DotEcon's separate report on auction design).

In a manner similar to the extended coverage obligations, the second option is to tie a specific package to a wholesale obligation, assigning this obligation to only one company if it acquires the package. In this case, the MNO would voluntarily commit to the wholesale offer by purchasing the package. An MNO only has an incentive to purchase such a package if in doing so the MNO immediately acquires a correspondingly high benefit. The package would therefore have to be suitably attractive otherwise. One possibility would be a lower coverage obligation, which would allow an MNO greater flexibility with regard to network rollout and thus substantial cost savings.

7.4.4 Requirements for measures safeguarding competition

Because of potentially constituting intervention in users' freedom to acquire spectrum, measures safeguarding competition have to meet the following requirements:

- The measure must be **effective**. This means the measure must be suitable for remedying current challenges to competition or hindering potential challenges, which can be caused, for example, by overly strong concentration of frequency usage rights.
- The measure must represent the **mildest form of intervention**. The measure must not intervene more than is absolutely necessary, and if several measures are possible, then the one that is the least invasive must be chosen.
- The measure must be **proportionate** and trigger no unjustified, detrimental effects for individual network operators. Disproportionately tight caps, for example, can mean that a network operator is exposed to unreasonable growth barriers—owing to too little spectrum—or unjustified restrictions in quality competition. Measures are also not proportionate if they result in unsold lots or a disproportionate expense for the authority or the bidders (due to an overly complex design for example). Measures that are effective and represent the mildest form of intervention are essentially considered proportionate.

The regulatory authority will focus on these requirements when identifying suitable measures.

7.5 Potential models for the auction design

The regulatory authority considers it useful to more fully structuring the discussion surrounding appropriate design. This is based on recognition of the close interdependencies between the award goals and product and auction design, the large number of relevant and in some cases uncertain factors (such as availability of the 700 MHz band) influencing the award, as well as the need to simultaneously optimise both product and auction design.

The regulatory authority proposes three potential basic models for aligning the consultation and the questions:

- Model A: ‘classic three-band auction’
- Model B: ‘model to achieve key award objectives’
- Model C: ‘single band auction 2100 MHz’

7.5.1 Model A: ‘classic three-band auction’

Model A is based on proven practice. The 700 MHz, 1500 MHz and 2100 MHz bands would be auctioned off in a three-band auction (not necessarily simultaneously, but as part of the present auction procedure). The product design would be selected so as to allow competition for incremental spectrum, and would thus fulfil award objective 2 (efficient use of spectrum; preferably, the flexible packaging options B1, C1 and D1 described in section 4 would be selected). Nevertheless, the design should address the specific circumstances and risks, such as differences in the value of frequencies within a band and possible aggregation risks (e.g. minimum spectrum portfolio; cf. the discussion in section 4). In addition, the design would need to be consistent with the TKK’s award objectives, in particular those relating to coverage and competition (cf. the discussions in sections 5 and 7.4).

In order to avoid spectrum fragmentation, the auction would be divided into a principle stage and an assignment stage. During the principle stage, generic lots would be allocated to different categories. In the assignment stage, the winners of generic lots could submit bids for specific assignment options involving contiguous blocks within a band or category. In a possible third stage, companies could be selected to take over the extended coverage obligations.

The following specific design requirements have been defined:

- Any materially relevant value differences existing between the core band and extension bands within the 1500 MHz band should be taken into account. If the value differences make it necessary to divide the lots into several categories, the question arises as to whether fragmentation of the band should be accepted or avoided (as far as possible) through the use of bidding restrictions. In the latter case, auction formats with considerable barriers to switching, for example, are to be eliminated. In addition, the question arises as to how the auction should deal with the two blocks at the lower edge of the band. The regulatory authority currently believes that these blocks should not be offered during the principal stage but instead awarded to the winner of the neighbouring block.
- Depending on the subsequent process of freeing up the 700 MHz band, any temporary usage restrictions are to be taken into account.
- The auction design must make it possible to address the potential competition challenges identified in the market analysis in Appendix 2.
- The design must be suited to taking into account the coverage targets defined by the national regulatory authority. This applies in particular to the extended coverage obligations to be fulfilled by a single operator.
- Depending on the product design, materially relevant aggregation risks must be taken into account in the auction design.

In particular, the regulatory authority wishes to obtain consultation input on the following topics (see the questions at the end of this section):

- Which product design should be chosen (cf. the corresponding question in section 4)?
- Which auction design should be chosen? Should individual ranges be auctioned off sequentially if necessary?
- Which measures to safeguard competition should be chosen?
- How should the extended coverage obligations be implemented in the auction?

7.5.2 Model B: ‘model to achieve key award objectives’

Model B is largely based on the TKK’s award goals and the specifics of the award procedure. Of central importance in particular are the objectives relating to coverage and competition (and the possibility of distributing fulfilment among several operators). In addition, the design ensures that a winner of 700 MHz spectrum is awarded the minimum spectrum portfolio necessary for nationwide rollout, without necessarily having to implement a combinatorial procedure. Finally, the design would also be suitable for taking into account any value differences arising from freeing up the 700 MHz band or from the complexity resulting from defining separate categories within the 1500 MHz band (cf. DotEcon’s report on auction design).

According to this model, the first stage forgoes competition for incremental spectrum within the 700 MHz band in favour of obligations aimed at achieving higher-level award objectives. From the regulatory authority’s point of view, this is justified only if the obligations are proportionate to the value of the spectra.

The model calls for four stages (see also the figure below):

Stage 1:

In the first stage, three generic lots with 2x10 MHz would be offered in the 700 MHz band. Each bidder could purchase only one lot. In the event of any significant value differences within the 700 MHz band, individual lots could also be awarded as specific lots. Each winner of a lot would be required to meet the 5G basic coverage obligation. In addition, specific additional obligations would be attached to each lot. Provided the competition obligation is not imposed on all winners, this requirement would be linked to one lot, the extended coverage obligation for roads would be linked to a second lot, and the extended coverage obligation for the settlement area would be linked to a third lot. It would also be conceivable to include parts of the third coverage target. The winners of the lots would undertake to fulfil the respective obligations (cf. sections 5 and 7.4). If individual lots could not be assigned in this stage, the frequencies concerned would be offered in the second stage together with spectrum from the 1500 MHz and 2100 MHz bands. In any event, the frequencies would retain the 5G basic obligations and retain or be exempt from the additional obligation as appropriate.

Stage 2:

In the second stage, the available spectrum from the 1500 MHz and 2100 MHz frequency ranges, along with any spectrum from the 700 MHz range unable to be successfully awarded in the first stage, would be offered in the form of generic lots and where possible across different categories. In this stage there would be competition for incremental spectrum, including any unsold frequencies in the 700 MHz band. Bidders would have the option of purchasing additional spectrum. Measures to safeguard competition would ensure that none of the potential competition challenges materialise after the auction (cf. section 7.4).

Stage 3:

In the third stage, the winners of generic lots from the first two stages would be assigned specific and as far as possible contiguous frequency blocks. The winners from the first two stages would be allowed to submit bids for specific assignment options consistent with the spectrum won in the first two stages.

Stage 4:

Following completion of the frequency auction, a procurement auction would take place in the fourth stage. Here a (still to be determined) number of coverage lots would be awarded that relate to the second and third coverage targets (coverage of inhabited areas outside the permanent settlement area and coverage of households with inadequate internet access). This stage would be optional, with its scope depending on the outcome of the principle stage.

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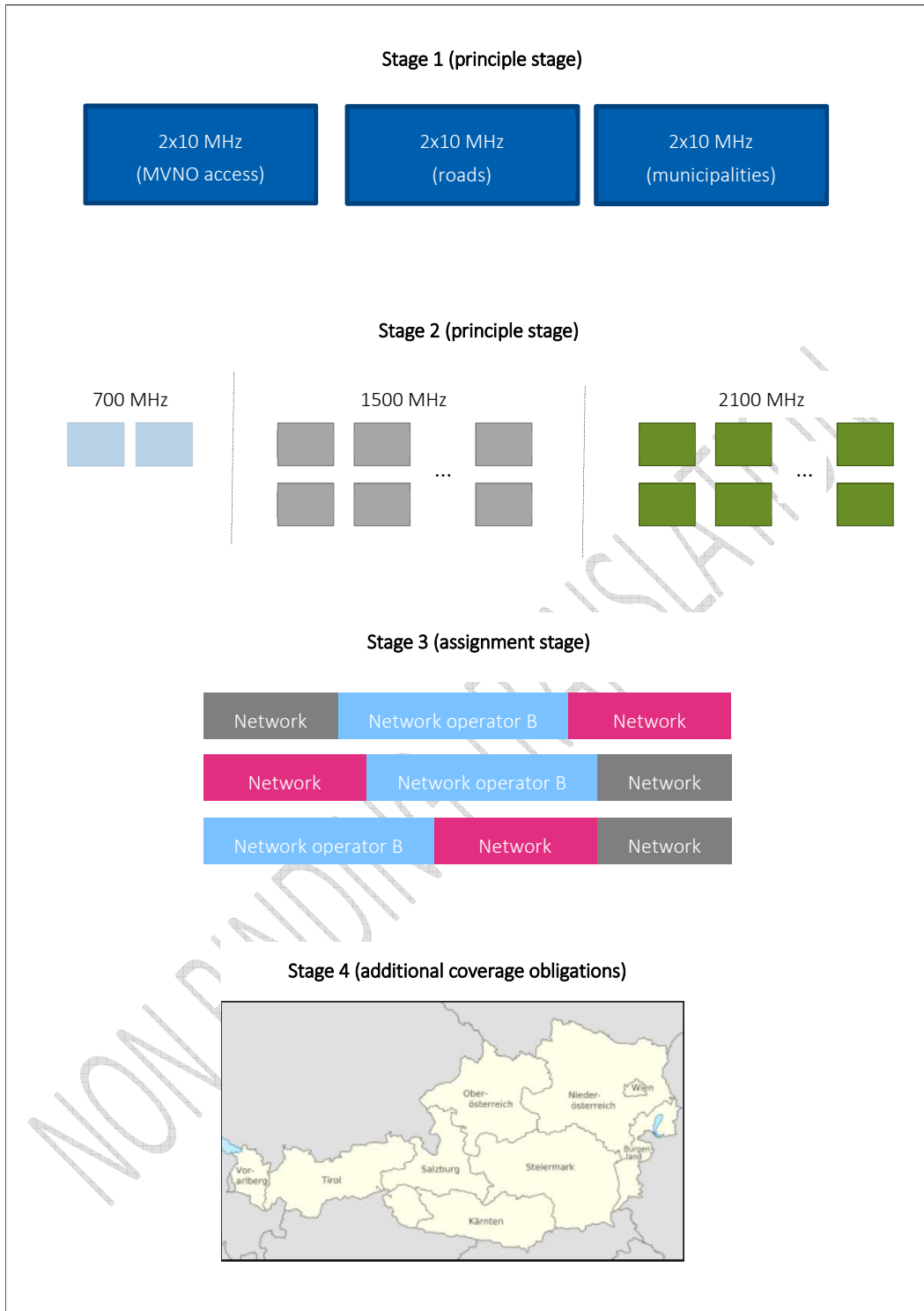


Figure 3: Auction Model B

The regulatory authority would like to obtain consultation input on this model, in particular with regard to the following topics (see the specific questions at the end of this section):

- How do you judge the model? What are the pros and cons of the model?
- Which product design should be chosen in stage 2 (cf. the corresponding question in section 4)?
- Which auction design should be chosen for the individual stages?
- Which measures to safeguard competition should be chosen in stage 2?

7.5.3 Model C: 'single band auction 2100 MHz'

Model C provides for the awarding of frequencies in the 2100 MHz band in an award procedure that is separate from the other two bands. The regulatory authority has proposed this model in the Spectrum Release Plan, in the event that legal certainty over when the 700 MHz band will be freed up cannot be achieved soon. The regulatory authority is currently working on the assumption that this option will not be necessary but does not wish to reject it completely until it is clearly determined when the band will be freed up. Consequently, the following section also contains two consultation questions relating to this model.

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7.6 Consultation questions

Question 7.1: Which model do you consider suitable for assigning the additional coverage obligations, and why? From your point of view, how important is it to allow the additional obligations to be distributed among various operators? What in your view are the advantages and disadvantages of a single operator fulfilling the additional obligations?

Question 7.2: If the assignment of coverage obligations is not linked to specific frequency blocks, how important do you think it is that spectra and coverage obligations are assigned simultaneously? From your point of view, what are the advantages and disadvantages of a sequential award?

Question 7.3: Do you agree with the regulatory authority's evaluation concerning potential competition challenges in relation to spectrum assignment and the measures to safeguard competition currently under consideration? In particular, are the minimum spectrum portfolio and the caps defined too narrowly or too broadly? Please base your assessments on appropriate arguments and provide facts and figures to support them. Please note that implementation of the measures to safeguard competition depends on the specific auction design (see the relevant questions below).

Question 7.4: Do you agree with the recognised risk of tacit collusion over mobile services and broadband products for private customers? In your answer, please distinguish between the market for mobile services and broadband products for private customers. Explain why you consider tacit collusion to be relevant or irrelevant, while presenting for your position business arguments (focus points, individual incentive, transparency, sanctioning or external competitive pressure) and referring to facts and figures to support your arguments.

Question 7.5: How do you foresee future demand-side power of MVNOs—in particular after the expiry of mandatory MVNO access? What incentives are there for MNOs to grant such access to MVNOs, allowing MVNOs to exert effective competitive pressure? What elements, if any, must a future wholesale offer for MVNOs contain in order to allow sufficient competitive pressure to develop in both markets? What changes, if any, must be made to the 2012 wholesale offer to ensure the effective competitiveness of MVNOs? In particular, what form of wholesale price indexing, if any, should be applied?

Question 7.6: According to one option, the regulatory authority is considering linking a wholesale offer to a package that can be purchased on a voluntary basis, and which should therefore be particularly attractive. What would make such a package particularly attractive from your point of view? What conditions would have a particular impact on attractiveness? Please describe the relevant impact; use facts and figures to support your arguments where possible.

Question 7.7: Do you prefer Model A or Model B? Which model would you reject? Provide specific reasons for why you prefer or reject a specific model.

Question 7.8: Which auction design do you prefer for Model A? Which auction formats would be acceptable, and which would not? What specific factors should the

design take into account? In the event that (significantly) more than three categories are required, should the principal stage be spread over several stages? Please give reasons for your answer.

Question 7.9: Which mechanisms should be used in Model A to address the identified competition challenges? Include specific suggestions, e.g. for spectrum caps. Please give reasons for your answer.

Question 7.10: How should the extended coverage obligations in Model A be implemented? Which mechanisms should be used? Which should not be used? Please give reasons for your answer.

Question 7.11: What is your opinion of Model B? What are the pros and cons? Please give reasons for your answer.

Question 7.12: Which auction design do you prefer for the individual stages of Model B? Which auction formats would be acceptable, and which would not? What specific factors should the design take into account? Please give reasons for your answer.

Question 7.13: Which mechanisms should be used in Model B stage 2 to address the identified competition challenges? Include specific suggestions, e.g. for spectrum caps. Please give reasons for your answer.

Question 7.14: Which auction design do you prefer for Model C? Which auction formats would be acceptable, and which would not? What specific factors should the design take into account? Please give reasons for your answer.

Question 7.15: Which mechanisms should be used in Model C to address the identified competition challenges? Include specific suggestions, e.g. for spectrum caps. Please give reasons for your answer.

8 Statements

Statements (in German or English) need to be emailed by **20 February 2019** to :

tkfreq@rtr.at

Please use the cover sheet below.

The regulatory authority will publish a list of the organisations/individuals that submitted statements for the consultation and consented to disclosure of the organisation/individual.

If requested, the complete individual statements will be published as well.

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APPENDIX 1

Consultation
on the 700/1500/2100 MHz
Award Procedure

Cover Sheet

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Cover sheet – statement for the consultation on spectrum award in the 700, 1500 and 2100 MHz bands

General information

Statement submitted by:

Represented by (if applicable):

Postal address:

E-mail address:

Confidentiality

Please indicate what may be published:

Organisation / company / individual

statement

RTR will publish a summary (without naming organisations or individuals) of all the statements received. An additional list will be published indicating the organisations/individuals that submitted statements for the consultation and consented to disclosure of the organisation/individual or company.

Declaration

I hereby confirm that this communication is a formal statement within the framework of the current consultation and that the statement may be published by RTR subject to any confidentiality requests indicated above. When submitting the statement by email, any standard email texts concerning the confidentiality or disclosure of email content (including any attachments) will not be considered relevant for publication by RTR.

Name:

Signature:

APPENDIX 2

Consultation
on the 700/1500/2100 MHz
Award Procedure

Measures Safeguarding
Competition

The Appendix on measures safeguarding competition
is available to be downloaded
as a separate document

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APPENDIX 3

Consultation
on the 700/1500/2100 MHz
Award Procedure

Auction design

The DotEcon report on auction design
is available to be downloaded
as a separate document

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