

Decision of the President's Chamber of the Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen of 26 November 2018 on the determinations and rules in detail (award rules) and on the determinations and rules for conduct of the proceedings (auction rules) to award spectrum in the 2 GHz and 3.6 GHz bands.

- Reference: BK1-17/001 -

Germany is committed to becoming a world leader in the field of digital infrastructure and a leading market for 5G in Europe, with new-generation 5G technology set to encourage the development of innovative services and applications (Industry 4.0, autonomous driving, Internet of Things). Spectrum must be awarded at an early stage and in line with needs to enable Germany to forge ahead with this technological advancement.

The Chamber's objective is to ensure that consumers can benefit to the greatest possible extent from the socio-economic potential of the spectrum provided. In addition to enabling the use of frequencies for enhanced mobile broadband, new-generation 5G technology will, in particular, encourage the development of innovative services and applications such as automated driving, Industry 4.0 and telemedicine. To ensure that consumers gain maximum benefit in terms of selection, price and quality, however, spectrum must be made available for use at an early stage and in line with needs to enable the rollout of high-speed next-generation telecommunications networks.

The auctioning of spectrum provides planning and investment certainty and ensures that spectrum is made available for use on a timely basis. This should make the rollout of 5G technology in Germany fast, flexible and in line with demand.

On 14 May 2018, the President's Chamber of the Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen (hereinafter "Bundesnetzagentur") ordered that the assignment of spectrum for wireless access in the 2 GHz band (1,920 MHz – 1,980 MHz/2,110 MHz – 2,170 MHz) and in the 3.6 GHz band (3400 MHz – 3700 MHz) is to be preceded by award proceedings in the form of an auction ("Decision I and II" of 14 May 2018, Order 62/2018, Bundesnetzagentur Official Gazette 10/2018 of 30 May 2018, page 760 et seq).

Before the spectrum is auctioned off, the award conditions (Decision III) and auction rules (Decision IV) will be defined by the President's Chamber.

The award conditions contain the framework conditions for spectrum acquisition. Within these, the President's Chamber defines the key aspects of spectrum regulation in terms of coverage obligation, service provider regulation, roaming and rules for new entrants. The auction rules include technical determinations for conducting the auction.

On 13 July 2018, the President's Chamber held an oral hearing for interested parties on the regulatory aspects of the proceedings for the award of spectrum. Based on this, on 24 September 2018 the draft of a decision of the President's Chamber on the award conditions and auction rules was put out for consultation (Communication No 267/2018, Bundesnetzagentur Official Gazette No 19/2018 of 4 October 2018, page 1702 et seq).

The present decision of the President's Chamber essentially sets out the following framework conditions, following consultation of the interested parties:

Award conditions for better geographical coverage and modern industrial applications

The purpose of imposing coverage requirements is to ensure rapid network rollout, thus facilitating the achievement of the German government's broadband objectives, as set out in the coalition agreement. In the past, spectrum assignment has been subject to the fulfilment of certain requirements. On expiry of the respective deadlines, these obligations have been met by mobile network operators. Mobile network operators are currently

implementing their obligations with respect to the award of spectrum in 2015. By 31 December 2019, they must ensure broadband coverage with a transmission rate of 50 Mbit/s for 98% of households throughout Germany and at least 97% of households in the sector in each federal state.

As conditions imposed by the state, coverage requirements must take into account the principle of proportionality, ie they must not give rise to an unreasonable burden for private-sector undertakings in a market economy. In addition, coverage requirements must not be discriminatory, in particular not expose certain undertakings to the risk of market withdrawal.

The specific design of coverage requirements is subject to legal limits. As well as adhering to the principles of proportionality and non-discrimination, any rollout obligations must not have a disproportionate retroactive effect on existing rights. This relates to requirements affecting existing and protected spectrum usage rights acquired in previous award proceedings.

Taking into account the consultation and in compliance with the principle of proportionality, the following coverage obligations and associated quality parameters are being set:

- coverage with a transmission rate of at least 100 Mbit/s for at least 98% of households in each federal state by the end of 2022,
- coverage with a transmission rate of at least 100 Mbit/s and a maximum latency of 10 milliseconds (ms) for all German motorways by the end of 2022,
- coverage with a transmission rate of at least 100 Mbit/s and a maximum latency of 10 ms for all federal roads with connectivity function levels 0 or 1 by the end of 2022,
- coverage with a transmission rate of at least 100 Mbit/s and a maximum latency of 10 ms for all other federal roads by the end of 2024,
- coverage with a transmission rate of at least 50 Mbit/s for all state roads by the end of 2024,
- coverage with a transmission rate of at least 50 Mbit/s for seaports and the inland waterways core network by the end of 2024,
- coverage with a transmission rate of at least 100 Mbit/s for rail routes with more than 2,000 passengers daily by the end of 2022,
- coverage with a transmission rate of at least 50 Mbit/s for all other rail routes by the end of 2024,

and, by the end of 2022:

- operation of 1,000 "5G base stations", and
- operation of 500 base stations with a transmission rate of at least 100 Mbit/s in not-spots.

The following coverage obligations apply to new entrant entrants:

- coverage of at least 25% of households by the end of 2023, and
- coverage of at least 50% of households by the end of 2025.

New entrants purchasing spectrum in the 3.6 GHz band only must achieve:

- coverage of at least 25% of households by the end of 2025.

New entrants purchasing 3.6 GHz spectrum must:

- set up 1,000 “5G base stations”.

The coverage obligations with respect to the transport routes (federal and state roads, waterways and rail routes) allow coverage provided by other mobile network operators to count towards the target coverage. This and the enhanced possibilities for cooperation enable network operators to meet all the obligations not simply by rolling out their own physical network infrastructure. In particular the fact that coverage by other mobile network operators counts towards the target coverage allows operators to differentiate with regard to their network coverage and business models. The possibilities for cooperation allow unused spectrum to be leased and, in return, coverage to be achieved through roaming.

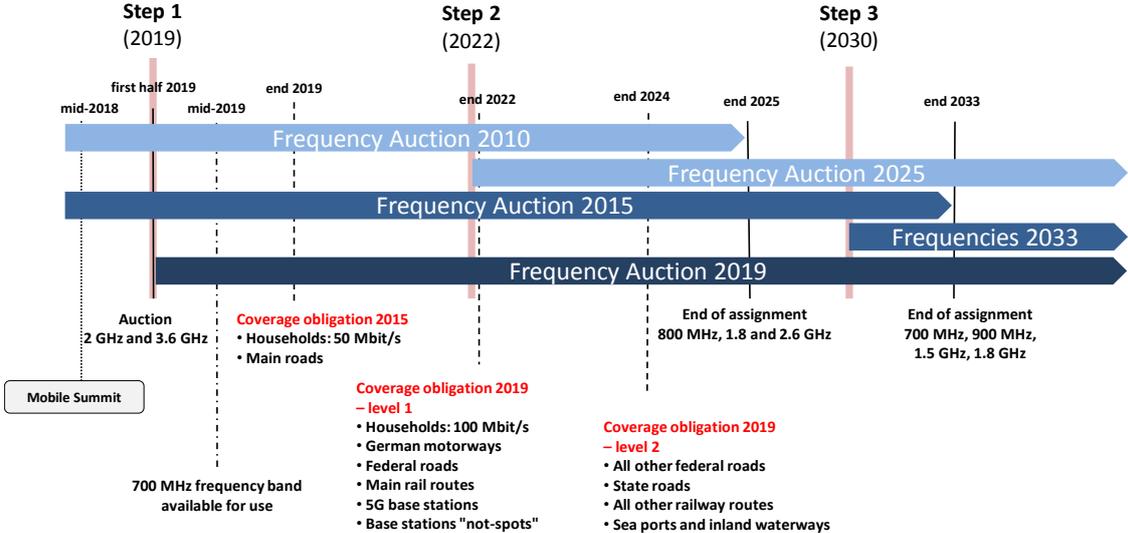
Further broadband rollout through future frequency awards

Further spectrum bands will be offered in future as the basis for new technological developments and better coverage. By the end of 2025, not only will further spectrum capacity have been made available, but rural area spectrum will also become available once again. The upcoming auction is therefore only a first step. With the future award of spectrum, the Bundesnetzagentur will seek to drive forward the advancement of high-speed mobile broadband networks in urban and rural areas.

The coverage obligations imposed in the current award proceedings will not definitively determine the coverage levels up to 2040. For spectrum to be provided in the medium term from 2025 and from 2033, coverage requirements will have to be redefined in a second and a third step. Preparations for these spectrum awards will begin around three years before the spectrum becomes available again (ie in 2022 and 2030), thus on a timely basis prior to the expiry of the respective spectrum usage rights, taking into account future, market-driven spectrum needs. The Bundesnetzagentur will base these obligations on further technological developments, taking into consideration the needs of consumers and the market. This applies with regard to both requirements (eg data rates) and the future coverage situation.

This includes the possibility of higher, needs-oriented requirements within the scope of the re-award of spectrum usage rights in the 800 MHz, 1.8 GHz and 2.6 GHz bands expiring in 2025. The same applies to assignments in the spectrum bands 700 MHz, 900 MHz, 1.5 GHz and 1.8 GHz expiring in 2033. Here, too, the Bundesnetzagentur can stipulate that any re-award is subject to higher, needs-oriented requirements. The Bundesnetzagentur plans to launch the corresponding preparatory consultations in 2022 and 2030 based on technological and market developments at that time in order to consolidate and enhance Germany's position as a market leader for 5G in the long term.

Germany as lead market for 5G



Further spectrum for local assignments

In addition to nationwide spectrum usage rights, the Bundesnetzagentur will make further spectrum in the 3700 MHz – 3800 MHz and 26 GHz bands available for local assignment. The Bundesnetzagentur's objective is to ensure that, even after the provision of a substantial part of the 3.6 GHz band for nationwide assignments, applicants can be awarded local assignments on a flexible and needs-oriented basis. This will mean that business models still in development can be implemented at a later date. This arrangement also takes account of the fact that some business models require frequencies for their own, autonomous telecommunications networks.

The Bundesnetzagentur has held a public consultation on providing the band from 3400 MHz to 3800 MHz for MFCN(cf www.bundesnetzagentur.de/lokalesbreitband).

Maintaining and encouraging competition at the service level

Since the telecommunications market started to be liberalised in the early 1990s, the service providers have contributed to strengthening competition at the service level and thus to promoting consumer interests. The service provider obligation imposed in 2000, which is based on the licence obligations that applied in the 1990s, will end on 31 December 2020. The President's Chamber therefore believes that action is needed to maintain and encourage competition at the service level.

Assignment holders are required to engage in negotiations. The Bundesnetzagentur is therefore permitted, in the event of infringements of this requirement, to intervene in order to protect competition, ie by acting as an arbitrator.

Better coverage through infrastructure sharing and roaming

Infrastructure sharing and roaming can contribute to better mobile coverage. Spectrum assignment holders can, in compliance with competition and antitrust law, enter into cooperation agreements on joint, efficient network rollout ("burden sharing").

In the opinion of the President's Chamber, it is appropriate that, in the interest of ensuring better coverage in rural areas, infrastructure sharing is used for cost-efficient network rollout in those areas in which there has been no such rollout thus far and in which none is scheduled in the foreseeable future. Roaming can also contribute to better coverage in rural areas. Here, too, network operators are required to engage in negotiations.

Encouraging competition through new entrants

In the interest of encouraging competition, the Bundesnetzagentur expressly welcomes the participation of suitable new entrants in the auction process.

The President's Chamber therefore welcomes nationwide roaming for new entrants in particular, within the limits of competition and telecommunications law. Here, too, network operators are required to engage in negotiations.

In addition, an alternative, milder coverage obligation is established for new entrants. Participants will also be able to register a minimum essential spectrum package at the auction, meaning they will only receive and be obliged to pay for spectrum if they are able to purchase the minimum amount required for their business models.

Auction rules

The auction format is essentially the same as that used for the auctions in 2010 and 2015. Minimum bids are based on the economic value of spectrum, but also take into account, in particular, the cost burden of coverage requirements.

Schedule

The qualification procedure opens with publication of the Decision.

The auction is scheduled to begin in the first quarter of 2019.

Applications to qualify for the auction should be submitted in writing, in German, in one original and two copies, and electronically on a data carrier (in Word or PDF format), to

Bundesnetzagentur
Referat 212
Kennwort: Versteigerungsverfahren
Tulpenfeld 4
53113 Bonn
Germany

The closing date for applications is 3.00 pm on 25 January 2019.

**Decision of the President's Chamber of the Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen of 26 November 2018 on the determinations and rules in detail (award rules) and on the determinations and rules for conduct of the proceedings (auction rules) to award spectrum in the 2 GHz and 3.6 GHz bands for mobile/fixed communications networks (MFCN) for the provision of telecommunications services;
decision taken under sections 55(10), 61(3), (4) and (6), 132(1) and (3) TKG**

- Reference: BK1-17/001 -

Based on the President's Chamber's decision on the order for and choice of award proceedings (Decisions I and II; Order 62/2018, Bundesnetzagentur Official Gazette 10/2018 of 30 May 2018, page 760 et seq.), the Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen (hereinafter "Bundesnetzagentur"), through the President's Chamber and in consultation with the Advisory Council of the Bundesnetzagentur, hereby issues the following decisions under sections 55(10), 61(3), (4) and (6), 132(1) and (3) of the Telecommunications Act (TKG) on the award of spectrum for MFCN for the provision of telecommunications services in the 2 GHz and 3400 MHz – 3700 MHz bands and on the determinations and rules for conduct of the proceedings to award spectrum

III. Determination and rules of the award proceedings

III.1 Qualification requirements, section 61(3) second sentence para 1 TKG

1. The right to take part in the auction, given the minimum specialist and other requirements within the meaning of section 61(3) second sentence para 1 TKG, is not limited.
2. Undertakings may qualify once only. This also applies in respect of consortia. Undertakings that have merged under section 37 of the German Competition Act (GWB) are deemed to be one undertaking.
3. In their application, applicants must state how the requirements to qualify for the auction as set out in section 61(3) second sentence para 1 and subsection (4) TKG are met (for details of the application requirements, see Annex 1).
4. In their application for admission, applicants are entitled to request the minimum frequency requirements needed for their business model (minimum essential spectrum package).

Applicants requesting a minimum essential spectrum package but actively bidding for less during the auction will be eliminated from the entire proceedings.

Any minimum essential spectrum package requested is to be set out in the frequency usage concept.

5. The Bundesnetzagentur will state the particular bidding entitlements and agreed minimum essential spectrum package in the qualification notice. This specification of the minimum essential spectrum package is binding for the auction and will be reflected in the auction software for the particular bidder. The bidding entitlements will be given in lot ratings (cf subsection IV.3.8).
6. The qualification procedure opens with publication of this Decision on the Bundesnetzagentur's website.

Applications to qualify for the auction should be submitted in writing, in German, in one original and two copies, and electronically on a data carrier (in Word or PDF format), to

Bundesnetzagentur
Referat 212
Kennwort: Versteigerungsverfahren
Tulpenfeld 4
53113 Bonn
Germany

The closing date for applications is 3.00 pm on 25 January 2019.

III.2 Determining the frequency usage for which the spectrum to be assigned may be used in compliance with the Frequency Plan (section 61(3) second sentence para 2 TKG)

1. The frequencies to be assigned may be used for MFCN in compliance with the Frequency Plan.
2. Frequencies in the 2 GHz and 3400 MHz – 3700 MHz bands are available nationwide.

III.3 Basic spectrum package and bidding rights restrictions, sections 61(3) second sentence para 3 TKG, 61(4) in conjunction with section 61(2) first sentence TKG

1. A basic spectrum package, as referred to in section 61(3) second sentence para 3 TKG, will not be stipulated.
2. Bidding rights in the 2 GHz and 3400 MHz – 3700 MHz bands will not be restricted. No spectrum cap will be defined.

III.4 Frequency usage conditions, including the degree of coverage with frequency usage, section 61(3) second sentence para 4 TKG

1. The usage conditions in this Decision and in Annex 2 apply to frequency usages in the 2 GHz band. The provisional usage conditions in this Decision and in Annex 3 apply to frequency usages in the 3400 MHz – 3700 MHz band.

Assignees may diverge from these conditions if they have made mutual arrangements to this effect and divergence is without detriment to the frequency usage rights of third parties. The Bundesnetzagentur must be informed of this in writing beforehand.

The frequency usage conditions can be modified subsequently, particularly if this is necessary to secure efficient and interference-free use of frequencies or as a result of international harmonisation agreements.

2. The frequency assignments are valid until 31 December 2040.
3. Coverage obligation with respect to households

The assignment holder must, by 31 December 2022, achieve coverage of at least 98% of households in each federal state with a downlink transmission rate of at least 100 Mbit/s (megabits per second) per sector.

4. Coverage obligation with respect to German motorways

For German motorways, the assignment holder must, by 31 December 2022, achieve coverage with a downlink transmission rate of at least 100 Mbit/s per sector.

A latency of no more than 10 ms (milliseconds) between a terminal and the associated base station must be ensured.

5. Coverage obligation with respect to federal roads

For federal roads with connectivity function levels 0 or 1 (Annex 4), the assignment holder must, by 31 December 2022, achieve coverage with a downlink transmission rate of at least 100 Mbit/s per sector.

A latency of no more than 10 ms between a terminal and the associated base station must be ensured.

Coverage for the other federal roads must be achieved accordingly by 31 December 2024.

Assignment holders may enter into cooperation agreements and lease frequencies. Coverage achieved by other assignment holders counts towards the target coverage.

6. Coverage obligation with respect to state roads

For state roads, the assignment holder must, by 31 December 2024, achieve coverage with a downlink transmission rate of at least 50 Mbit/s per sector.

Assignment holders may enter into cooperation agreements and lease frequencies. Coverage achieved by other assignment holders counts towards the target coverage.

7. Coverage obligation with respect to waterways

For seaports and inland waterways of the federal core network (Annex 5), the assignment holder must, by 31 December 2024, achieve coverage with a downlink transmission rate of 50 Mbit/s per sector.

Assignment holders may enter into cooperation agreements and lease frequencies. Coverage achieved by other assignment holders counts towards the target coverage.

8. Coverage obligation with respect to rail routes with more than 2,000 passengers daily

For rail routes carrying more than 2,000 passengers daily (Annex 6), the assignment holder must, by 31 December 2022, achieve coverage with a downlink transmission rate of at least 100 Mbit/s per sector, taking into consideration cooperation with the operators of rail routes and railway undertakings.

Assignment holders may enter into cooperation agreements and lease frequencies. Coverage achieved by other assignment holders counts towards the target coverage.

9. Coverage obligation with respect to all other rail routes

For all other rail routes (Annex 7), the assignment holder must, by 31 December 2024, achieve coverage with a downlink transmission rate of at least 50 Mbit/s per sector, taking into consideration cooperation with the operators of rail routes and railway undertakings.

Assignment holders may enter into cooperation agreements and lease frequencies. Coverage achieved by other assignment holders counts towards the target coverage.

10. Coverage obligation with respect to not-spots

The assignment holder must, by 31 December 2022, put into operation 500 base stations with a transmission rate of at least 100 Mbit/s in previously defined not-spots.

In each federal state, coverage must be rolled out in accordance with the proportionate share of federal territory.

Assignment holders may enter into cooperation agreements and lease frequencies.

11. Coverage obligation with respect to 5G base stations

The assignment holder in the 3.6 GHz band must, by 31 December 2022, put into operation 1,000 base stations to be used for 5G applications. In each federal state, coverage must be rolled out in accordance with the proportionate share of federal territory.

12. Coverage obligation with respect to new entrants

New entrants must achieve coverage of at least 25% of households by 31 December 2023 and coverage of at least 50% by 31 December 2025.

If a new entrant purchases spectrum in the 3.6 GHz band only, however, a coverage of at least 25% of households must be achieved by 31 December 2025.

If a new entrant purchases spectrum in the 3.6 GHz band, it must put into operation 1,000 base stations to be used for 5G applications by 31 December 2022. In each federal state, coverage must be rolled out in accordance with the proportionate share of federal territory.

13. At the request of the Bundesnetzagentur, the spectrum assignment holder must provide a written report on the progress of frequency usage and of network build and rollout and on the rollout plans.

14. A condition subsequent will be attached to the assignment of frequencies which, at the time of assignment, are the subject matter of an administrative law dispute beyond the scope of these award proceedings (Decisions I to IV), to the effect that assignment will be rescinded if the legal requirements are to be regarded as not given at the time of assignment as a result of the court's final decision.

15. Assignment holders must negotiate the shared use of radio capacities with suitable service providers. The negotiations should be non-discriminatory and

the capacities to be provided should not be restricted to certain services, radio technologies or applications.

16. Assignment holders must negotiate the local or regional leasing of spectrum in the 3400 MHz – 3700 MHz band with suitable parties. The negotiations should be non-discriminatory.
17. Upon request by other nationwide assignment holders, assignment holders must, in compliance with telecommunications and antitrust law, engage in negotiations on the shared use of existing nationwide networks (roaming) and about infrastructure sharing. The negotiations should be non-discriminatory.

III.5 Minimum bid, section 61(4) second sentence TKG

1. The minimum bid for a frequency block of 2 x 5 MHz (paired) in the 2 GHz band that is available from 2021 will be €5 million and €3.75 million for a frequency block that is available from 2026.
2. The minimum bid for a frequency block of 1 x 20 MHz (unpaired) in the 3400 MHz – 3420 MHz band will be €2 million. The minimum bid for a frequency block of 1 x 10 MHz (unpaired) in the 3420 MHz – 3700 MHz band will be €1.7 million.

IV. Auction rules

IV.1 General provisions

IV.1.1 Venue

The auction will be conducted in the physical presence of the bidders at the Bundesnetzagentur's Mainz office, Canisiusstraße 21, 55122 Mainz.

IV.1.2 Eligibility

Eligible to take part in the auction are applicants qualified under subsection IV.3.3 who have provided security for the bidding entitlements in accordance with subsection IV.1.3 and whose representatives have been authorised in accordance with subsection IV.2.2.

IV.1.3 Security

Qualified applicants must, not later than 14 days before the auction begins, pay a security deposit to an account to be specified by the Bundesnetzagentur. The security can also take the form of an unconditional, continuing, irrevocable, absolute bank guarantee for the amount of the security payable, issued by a domestic financial institution or a financial institution authorised as a customs and tax guarantor.

The security is €1.7 million per bidding entitlement (lot rating). The total is derived from the bidding entitlements in lot ratings (cf subsections IV.3.8 and III.5).

IV.1.4 Lots

The frequency blocks at 2 GHz and 3420 MHz – 3690 MHz will be auctioned in abstract blocks in terms of their spectral position.

Spectrum in the 2 GHz band will, in terms of its spectral position, be auctioned in twelve abstract blocks of 2 x 5 MHz (paired). Although the frequency blocks at 2 GHz will be assigned specific assignment periods, they will be auctioned in abstract blocks in terms of their spectral position. Eight of these blocks are available from 2021 and four of these blocks are available from 2026.

Spectrum in the 3400 MHz – 3420 MHz band will be auctioned in one specific block of 1 x 20 MHz (unpaired). Spectrum in the 3420 MHz – 3690 MHz band will be auctioned in twenty-seven abstract blocks of 1 x 10 MHz (unpaired). Spectrum in the 3690 MHz – 3700 MHz band will be auctioned in one specific block of 1 x 10 MHz (unpaired). It is not possible for a bidder to bid for both of the specific frequency blocks at the same time.

For details, see Annexes 8 and 9.

IV.1.5 Restrictions on bidding entitlements

Bidders are restricted in terms of their bidding entitlements with respect to the amount of spectrum for which bids can be submitted.

IV.2 Power of attorney and auction tutorial

IV.2.1 Power of attorney

Applicants must, by the auction tutorial date at the latest, confer a power of attorney on four to eight persons who will take part in the tutorial and will then be authorised to bid at the auction on behalf of their undertaking. A written declaration of power of attorney must be provided to the Bundesnetzagentur. During the auction, for each bidder at least two persons with power of attorney and authorised through having attended the tutorial must be present in the bidder's room.

IV.2.2 Auction tutorial

The persons with a power of attorney must take part in a tutorial before the auction is held. The aim of the tutorial is to give these persons instruction in the practical conduct of the auction, in particular in the electronic bidding procedure and the special software used.

The tutorial will be held at the Bundesnetzagentur's Mainz office. The tutorial date is to be close to the auction date.

At the end of the tutorial, the persons with power of attorney must provide the Bundesnetzagentur with a written declaration stating that they have understood the auction rules and the electronic bidding method. They must also undertake to comply with the rules.

Participation in the tutorial and the declaration specified in paragraph 3 are preconditions for participation in the auction.

Only the persons with power of attorney who have attended the tutorial are authorised to submit bids for the bidder. On the part of the bidders, only the authorised agents have access to their rooms (cf subsection IV.3.2).

IV.3 Conduct of the auction

IV.3.1 Form of auction

The auction will be held as an open, ascending, simultaneous multiround auction.

IV.3.2 Organisation

The auction will be held on Mondays to Fridays. It will begin at 8.00 am each day. The last auction round on each day will begin no later than 5.30 pm.

Each bidder will be provided with a separate room for communication with decision-makers and for making bids.

Any suspension of the auction will be announced by the auctioneer, who will also inform the bidders of the time at which the auction will be resumed.

The auction results will be publicly announced.

IV.3.3 Bidders

A bidder is an undertaking that has qualified to take part in the auction. Bidders will be represented by persons with powers of attorney and authorised agents.

IV.3.4 Bid submission

In each round, bidders can submit bids simultaneously and, subject to their bidding entitlements, are free to choose which blocks to bid for (cf subsections IV.1.5 and III.1.5).

Bids will be submitted electronically by means of special software.

IV.3.5 Valid bids

In the first round, the minimum valid bid is the minimum bid for a frequency block. In the subsequent rounds, the minimum valid bid is a bid that exceeds the current highest bid for a frequency block by the current minimum bid increment. If no valid bid was made for a frequency block in the previous rounds, the minimum valid bid will count as the minimum bid. If a highest bid in a round is withdrawn (cf subsection IV.3.11), the new minimum valid bid will be derived from the amount of the withdrawn highest bid plus the current minimum bid increment. The same applies if the highest bidder is excluded from the auction for actively bidding for less than its essential spectrum package, and no new valid bid for this block is submitted in that round.

In each round, the software will provide a list for each frequency block showing the valid bids from which bidders can choose their bid amount (click box bidding).

The following bid amounts from which bidders can choose are listed as follows:

- the minimum valid bid
- the minimum valid bid plus €10,000
- the minimum valid bid plus €20,000
- the minimum valid bid plus €50,000
- the minimum valid bid plus €100,000
- the minimum valid bid plus €200,000
- the minimum valid bid plus €500,000
- the minimum valid bid plus €1,000,000
- the minimum valid bid plus €2,000,000
- the minimum valid bid plus €5,000,000
- the minimum valid bid plus €10,000,000
- the minimum valid bid plus €20,000,000
- the minimum valid bid plus €50,000,000
- the minimum valid bid plus €100,000,000.

IV.3.6 Minimum bid increment

If there is a highest bid for a frequency block at the end of a round, the auctioneer will stipulate a minimum bid increment for it for the subsequent rounds.

The minimum bid increment is a particular (not minus) sum of money by which the highest valid bid in a round must increase as a minimum.

In the first stage, the minimum bid increment for the 2 GHz and 3.6 GHz bands is 10% of the designated highest bid. Depending on how the auction proceeds, the

minimum bid increment can be lowered step by step by the auctioneer for further stages to 5% and 2% of the designated highest bid (incremental stages).

Diverging from this, the auctioneer can stipulate a specific amount of money for individual frequency blocks as the minimum bid increment.

The auctioneer will notify bidders at the start of a round of the level of the particular minimum bid increment, rounded to the next whole multiple of €1,000.

IV.3.7 Highest bids

At the end of every round the highest bid for each frequency block will be identified by evaluating the round. The highest bid is the highest active bid for a frequency block at the end of a round. If identical highest valid amounts are bid for a frequency block, the bidder who submitted its bid first will be considered to have the highest bid. The applicable highest bid for a frequency block will be designated as such at the beginning of the next round.

IV.3.8 Lot ratings

Standardised numerical values are determined for every frequency block depending on the amount of spectrum (lot ratings).

A frequency block of 2 x 5 MHz (paired) in the 2 GHz band is given a lot rating of 1.

A frequency block of 1 x 10 MHz (unpaired) in the 3.6 GHz band is given a lot rating of 1 and the frequency block of 1 x 20 MHz (unpaired) in the 3400 MHz – 3420 MHz band is given a lot rating of 2 (cf Annex 9).

Bidding entitlements are given in lot ratings.

IV.3.9 Activity rules

A bidder's activity in a round is the sum of all the bidding entitlements in lot ratings exercised for frequency blocks for which the bidder has submitted an active bid.

An active bid for a block in a round is deemed given by a bidder when, at the beginning of the round, either the bidder holds the highest bid for the block – and does not withdraw it in the current round as set out in subsection IV.3.11 – or submits a valid bid as per subsection IV.3.5 for a block in the current round.

A bidder must exercise its bidding entitlements to a certain extent if it is not to lose any (minimum level of activity), unless it makes use of a waiver as provided for in subsection IV.3.10.

The auction is divided into three consecutive activity phases:

- activity phase 1 requires a minimum activity level of 65% of applicable bidding entitlements;
- activity phase 2 requires a minimum activity level of 80% of applicable bidding entitlements;
- activity phase 3 requires a minimum activity level of 100% of applicable bidding entitlements.

The auctioneer will decide when to move on to the next activity phase in accordance with the progress of the auction.

The minimum activity level determines the minimum activity a bidder has to engage in. Minimum activity is derived from the product of the number of the bidder's eligibility points and the minimum activity level in the particular activity phase, rounded up to the next highest whole number.

A bidder keeps its full bidding entitlement for the next round if it has complied with or surpassed the minimum activity level in the current round.

If a bidder falls below the applicable minimum activity level and does not use a waiver (cf subsection IV.3.10), its bidding entitlement will be determined anew for the next round:

- in activity phase 1 by multiplying its activity level (sum of the lot ratings for frequency blocks for which an active bid has been submitted) by 100/65;
- in activity phase 2 by multiplying its activity level (sum of the lot ratings for frequency blocks for which an active bid has been submitted) by 100/80;
- in activity phase 3 by multiplying its activity level (sum of the lot ratings for frequency blocks for which an active bid has been submitted) by 100/100;

A bidder not submitting a new valid bid in a round for any frequency block, not holding a highest bid and not using a waiver (active or passive) as provided for in subsection IV.3.10 will be eliminated from the auction.

Notwithstanding this activity rule, a bidder must at any rate exercise its bidding entitlements to match the extent of the minimum essential spectrum package it has specified (cf subsection III.1.5). If fewer bidding entitlements are exercised than the minimum essential spectrum package agreed, the bidder will lose all its bidding entitlements and will be eliminated from the auction, provided it has not used any waivers (active or passive) as specified in subsection IV.3.10.

IV.3.10 Waivers

Each bidder will be given five waivers that it can use in five different rounds. Using a waiver means that no bidding entitlements will be lost in the particular round (cf subsection IV.3.9).

A distinction is made between active and passive use of waivers.

Active use of a waiver is made by activating a command to this effect in the software (active waiver).

There are two ways of doing so:

1. A bidder can either sit out a whole round, ie not submit a valid bid and not withdraw a bid in the particular round. In this case, it does not lose any bidding entitlements.
2. Alternatively, it can submit valid bids and/or withdraw bids and – as long as it remains below the required minimum activity level – can avoid its bidding entitlements being reduced by active use of the waiver.

If the bidder engages in less than the minimum activity level and exercises bidding entitlements to match its minimum essential spectrum package, it can explicitly do without using a waiver. In this case, it will lose bidding entitlements (cf subsection IV.3.9).

The use of such a waiver is not available to a bidder with an agreed minimum essential spectrum package if it has not exercised bidding entitlements to match its minimum essential spectrum package.

A passive waiver, by contrast, is automatically effected by the software when the bidder allows time to elapse in a round without submitting a valid bid or withdrawing a bid and the bidder falls below the minimum activity level with its highest bids (cf subsection IV.3.9). A passive waiver has no effect on the termination rule (cf subsection IV.3.16).

IV.3.11 Withdrawal of highest bids

Every bidder is entitled to withdraw, in part or in full, the highest bids it holds. There are no restrictions on the number of bids that can be withdrawn. A bidder can also submit new valid bids in the same round with the entitlements that have been released.

A bidder is not permitted to withdraw a bid if the bid submitted falls below its agreed minimum essential spectrum package in the particular round.

Withdrawal of a bid does not have any effect on the termination rule of the auction (cf subsection IV.3.16). If a bidder withdraws one or more bids in the last activity phase and none of the bidders submits a new valid bid or uses an active waiver, the auction will end.

A bidder withdrawing a bid is obliged to pay if no new valid bid is made for the frequency block in question in the course of the first stage of the auction. In this case, the bidder will be obliged to pay a sum equivalent to the bid it has withdrawn.

If the frequency block is awarded in a second stage, the price bid for the block will be deducted from the amount the withdrawing bidder has to pay. If the price for the particular frequency block in the second stage is higher than or the same as its highest bid in the first stage of the auction, the withdrawing bidder is not obliged to pay.

IV.3.12 Time of a round, completion of a round, discontinuation of a round and suspension of the auction

At the beginning of the auction, the time for a round in which bids can be submitted is 60 minutes. In the course of the auction, the auctioneer can set a different time before the start of a round, after due consideration of the circumstances.

There will be an automatic reminder ten minutes before the round expires.

A round is completed after the bids from all the bidders have been received by the auctioneer or after expiry of the specified time period for the submission of bids. A round is closed after evaluation by the auctioneer.

The auctioneer may discontinue a round not yet completed if there is a technical defect in the equipment needed for conducting the auction or if other reasons jeopardise proper conduct of the auction. In this case, the auction will resume with the result of the previous round.

Each bidder will be given one opportunity to request the auctioneer to suspend the auction. Upon request, it can also be suspended during a round. The request must be declared for record with the auctioneer. The auction will then be continued at 1.00 pm on the next working day.

Bidders will be notified of the reason for and length of any suspension of the auction.

IV.3.13 Provision of information to bidders

The auctioneer will give every bidder the following information at the start of a round:

- the current round
- the current activity phase (cf subsection IV.3.9)

- the duration of the round (cf subsection IV.3.12)
- the highest bid and the highest bidder for each frequency block (cf subsection IV.3.7)
- the minimum valid bid and the minimum bid increment for each frequency block (cf subsections IV.3.5 and IV.3.6)
- a click box list from which bidders can select the amount of their bid (cf subsection IV.3.5)
- the extent of their current bidding entitlements (in lot ratings) and their minimum activity level in the current round (cf subsection IV.3.9)
- the number of waivers remaining (cf subsection IV.3.10)
- the names of the bidders eliminated or excluded.

At the close of every round, the auctioneer will inform every bidder of the current highest bid for each frequency block and the active bids of all the bidders and their identity. This information will also be transmitted electronically to the authorised agents in the bidder's room for further processing.

IV.3.14 Exclusion of bidders/collusion

Any bidders working together before or during the auction to influence the course or the result of the auction (collusion) may be excluded from taking part in the entire proceedings. Bidders may also be excluded from taking part as a result of irregular behaviour or hindering the proper conduct of the auction.

An excluded bidder is obliged to pay if a highest bid it held at the time of exclusion is not outbid in the course of the auction by a new valid bid. In this case, it has to pay the amount of its highest bid. If the frequency block is awarded in the second stage of the auction (cf subsection IV.3.18) to another bidder, the bid price for the block will be deducted from the amount to be paid by the excluded bidder. If the price for the particular frequency block in the second stage is higher than or the same as its highest bid in the first stage of the auction, the excluded bidder is not obliged to pay.

The frequency block will not be awarded to the excluded bidder.

If collusive or irregular behaviour is established only after the auction has closed, award and/or frequency assignment can be revoked. A highest bidder will remain bound by its bid to pay. It will also have to meet its payment obligation for withdrawing its bids (cf subsection IV.3.11). Payments made will not be refunded.

IV.3.15 Elimination from the auction

A bidder will be eliminated from the auction if it has no more bidding entitlements (cf subsection IV.3.9) or has been excluded (cf subsection IV.3.14).

IV.3.16 End of the auction (termination rule)

The auction will end if no valid bid has been made in the last activity phase for any frequency block and none of the bidders has used an active waiver. The final result of the auction will be announced by the auctioneer.

If, in an earlier activity phase of the auction, no valid bid has been submitted in a round and none of the bidders has used an active waiver and if all the bidding entitlements are bound by highest bids, it is up to the auctioneer to continue the auction by taking it into the next activity phase or to end it directly.

The auction can also end through discontinuation. The auctioneer may discontinue the auction if there is a technical defect in the equipment needed for conducting the auction, if bidders collude, or if other reasons jeopardise the proper conduct of the auction. In this case, the Bundesnetzagentur will set a date for a new auction.

IV.3.17 Award

The bidder holding the highest bid for a frequency block at the end of the auction will be awarded the block. Bidders with an agreed minimum essential spectrum package will be awarded the spectrum only if they have won at least their minimum essential package.

The award price will be equal to the highest bid submitted by the particular bidder. The award notice will be presented after the auction.

A frequency block for which

- a) there is no valid bid at the end of the auction,
- b) no new valid bid was submitted after a bid was withdrawn,
- c) award was denied, or
- d) there is a bid, but the highest bidder failed to acquire its agreed minimum essential spectrum package,

will not be awarded in the auction.

IV.3.18 Second stage of the auction

If frequency blocks have not been awarded at the close of the first stage of the auction (cf subsection IV.3.17), the President's Chamber will take a decision on whether, and if so, when these blocks should be auctioned in full or in part in a

second stage. Provided that it is appropriate to do so, the following arrangements will apply as a general rule:

The same minimum bids for the frequency blocks as in the first stage will apply in the second stage.

For the second stage of the auction the same rules will generally apply as for the first stage, with the following exceptions:

- Only bidders that have been awarded one or more frequency blocks in the first stage will be eligible to take part.
- The maximum number of bidding entitlements in the second stage will be derived from the difference between the number of bidding entitlements established as a result of the application and the entitlements successfully exercised in the first stage. Bidders may also submit bids for frequency blocks for which they withdrew a bid in the first stage.
- Bid withdrawal is not possible.
- A minimum essential spectrum package cannot be requested.

IV.4 Auction close

IV.4.1 Obligation to pay

The bidder awarded a frequency block at the close of the auction must pay the amount of its highest bid.

A bidder that has withdrawn a current highest bid must likewise pay the amount of this highest bid if no new valid bid is made for the frequency block in question in the course of the first stage of the auction. If the frequency block is awarded in the second stage of the auction, the bid price for the block will be deducted from the amount to be paid by the withdrawing bidder (cf subsection IV.3.11).

The award notice will be presented together with the notice of the amount payable, against acknowledgement of receipt.

Payment of the award price less any security deposited as a sum of money (cf subsection IV.1.3) is due within sixty-five banking days of the auction and is payable to the account specified by the Bundesnetzagentur.

In derogation of this, payment of the award price for frequency blocks in the 2 GHz band that are available from 2026 is due by 30 June 2024 at the latest.

Compliance with the respective deadline is determined by the time at which the sum is credited to the account (value date). The debtor will automatically default after the deadline has expired if payment is not made. There does not need to be a reminder.

Interest will be charged during the period of default on the award price less any security deposited as a sum of money. The rate of interest for the year will be five percentage points above the base rate as per section 247 of the German Civil Code (BGB).

The security will likewise be deducted if there are other payment obligations under the auction rules.

The security will not earn interest. Bidders not awarded a frequency block and having no other payment obligations will have their security deposit refunded without delay after the close of the entire auction proceedings. The surety bonds will be returned after receipt of payment or the final instalment.

IV.4.2 Allotment of the abstract frequency blocks won

The spectral position of the abstract frequency blocks purchased by the bidders in the 2 GHz and 3.6 GHz bands will be allotted after the auction. The blocks will be allotted in an objective, transparent and non-discriminatory procedure in accordance with the following rules:

1. If a successful bidder wins a specific frequency block and further abstract frequency blocks in a frequency band, the blocks will be allotted as contiguous spectrum.
2. The successful bidders will have the opportunity to agree amongst themselves, within a period of one month of the close of the auction, the spectral position of their blocks in the particular frequency band.
3. If agreement between the successful bidders is not reached within this period, the Bundesnetzagentur can – taking into consideration the aspect of assigning contiguous spectrum, existing usages and any stated preferences – allot the abstract blocks won.
4. If the abstract blocks won cannot be allotted after the auction in accordance with the principles of subsection 2, they will be allotted by lot.

IV.4.3 Reassignment of existing assignments

For the purposes of allotting and assigning contiguous spectrum, existing nationwide spectrum usage rights at 2 GHz and 3.6 GHz can be reassigned.

RATIONALE

- 1 The following considerations and grounds prompted the Chamber to decide the award and auction rules for awarding spectrum in the 2 GHz and 3400 MHz – 3700 MHz bands for MFCN.

Current situation

- 2 The decision on the award conditions and the auction rules is based on the following steps:

Steps

- 3 The steps and responses – provided they do not contain any trade or business secrets – can be viewed on the Bundesnetzagentur website (www.bundesnetzagentur.de/mobilesbreitband).

"Frequenz-Kompass"

- 4 With its "Frequenz-Kompass" document of 15 July 2016, the Bundesnetzagentur provided an overview of the approach in the area of spectrum management and identified corresponding fields of regulatory activity for the rollout of digital infrastructures (Communication No 1032/2016, Bundesnetzagentur Official Gazette No 14/2016 of 27 July 2016, page 1714 et seq). All interested parties had the opportunity to respond.

Points of Orientation

- 5 With regard to the responses to the "Frequenz-Kompass", the Bundesnetzagentur on 20 December 2016 launched a public consultation on its document "Points of Orientation for the provision of spectrum for the rollout of digital infrastructures" (Communication No 1703/2016, Bundesnetzagentur Official Gazette No 24/2016 of 21 December 2016, page 4483 et seq).
- 6 The Points of Orientation addressed the frequencies suited to and envisaged for the rollout of 5G infrastructures. In particular, the following frequencies were identified for this purpose: 700 MHz (centre gap), 2 GHz (UMTS spectrum), 3400 MHz – 3800 MHz, 26 GHz and 28 GHz. They also addressed whether regulations that benefit service providers/MVNOs and new entrants could be necessary.

Key Elements and demand identification

- 7 On 27 June 2017, the Bundesnetzagentur published the document "Key Elements for the rollout of digital infrastructures and identification of demand for nationwide assignments in the 2 GHz and 3.6 GHz bands" (Communication No 484/2017, Bundesnetzagentur Official Gazette No 13/2017 of 12 July 2017, page 2726 et seq). This paper set out, as the basis for consultation, the initial framework conditions for a procedure for the provision of spectrum (details of the consultation can be found in Administrative Order No 62/2018, Bundesnetzagentur Official Gazette No 10/2018 of 30 May 2018, page 760 et seq). In so doing, the Bundesnetzagentur prompted the start of the process to make key 5G spectrum available.

- 8 Interested companies were able to comment on the paper and register their demand for spectrum.

Draft decision on the order for and choice of proceedings

- 9 On the basis of the responses to the Key Elements paper and the demand for spectrum registered, the Bundesnetzagentur drew up a draft decision of the President's Chamber on the order for and choice of award proceedings, which it submitted for public consultation (Communication No 35/2018, Bundesnetzagentur Official Gazette No 3/2018 of 7 February 2018, page 329 et seq). Responses could be submitted until 28 February 2018.

Decision on the order for and choice of proceedings

- 10 On the basis of the responses received, the decision of the President's Chamber on the order for and choice of proceedings for the award of spectrum in the 2 GHz and 3400 MHz – 3700 MHz bands for MFCN was published on 14 May 2018 (Order No 62/2018, Bundesnetzagentur Official Gazette No 10/2018 of 30 May 2018, page 760 et seq).

Oral hearing of the President's Chamber

- 11 On 13 July 2018 the President's Chamber held an oral hearing on key regulatory aspects of the proceedings for the award of spectrum from the 2 GHz and 3.6 GHz bands. Accordingly, interested parties were given the opportunity to add their opinions in writing.
- 12 The hearing addressed aspects of the decisions on the order for and choice of proceedings (Decisions I and II), in particular the combined provision of 2 GHz spectrum, the provision of 100 MHz in the 3700 MHz – 3800 MHz band for local and regional assignments, and the availability of the 3.6 GHz band with respect to existing unlimited wireless local loop assignments.
- 13 The hearing also expanded on aspects of the decisions on the award conditions and the auction rules (Decisions III and IV), in particular with respect to the coverage obligation, the service provider regulation, the interests of new entrants, and interactions with the application process for local and regional assignments in the 3700 MHz – 3800 MHz band.

Draft consultation document

- 14 On 24 September 2018, the draft of a decision of the President's Chamber on the award conditions and auction rules was put out for consultation (Communication No 267/2018, Bundesnetzagentur Official Gazette No 19/2018 of 4 October 2018, page 1702 et seq). More than 50 responses were received.

Detailed reasoning

Re III Determination and rules of the award proceedings

Re III.1 Qualification requirements, section 61(3) second sentence para 1 TKG

Re III.1.1 No restriction on participation

The Chamber has ruled as follows:

- 15 In principle, anyone and any undertaking can apply for admission to the auction proceedings. The Chamber does not feel it necessary to place any restrictions on participation provided the undertakings meet the minimum requirements.

Re III.1.2 Competitive independence

The following comments were made:

- 16 Mobile network operators responding stated that the principle of competitive independence should be applied without exception. The principle, based on the Bundesnetzagentur's long-standing administrative practice, prohibited undertakings from being active as network operators and service providers at the same time. The planned exemptions and aids to entry for new market entrants were too far-reaching. The principle of competitive independence also had to apply in future to operators of any public local or regional networks. In addition, a relaxation of the principle would stifle any incentive for further infrastructure competition: if a network operator were able to access third-party networks as a service provider in economically unattractive areas, there would no longer be any incentive for the network operator to roll out its own infrastructure in not-spots.
- 17 One respondent was in favour of clear exemptions from the principle of competitive independence for new entrants. It had to be possible for new entrants to be active as both network operators and service providers if they were unable to migrate their customers, for instance for legal or economic reasons. There should therefore be an explicit provision allowing a new entrant to act as a mobile network operator, conclude a permanent national roaming and/or infrastructure sharing agreement with an existing mobile operator, and act as a mobile virtual network operator (MVNO)/service provider at one and the same time. There would be no risk of an adverse effect on competition since new entrants would have a strong economic interest due to economies of scale in rolling out and using their own networks to the greatest possible extent.

The Chamber has ruled as follows:

- 18 If insufficient spectrum is available to cover all assignment demands, current standard regulatory practice is to assign spectrum to undertakings that are independent from a competition standpoint. The regulatory objective of safeguarding fair, fully functioning competition (section 2(2) para 2 TKG) requires the assignment holders/network operators to be competitively independent from one another. This rules out the possibility of multiple applications being filed. As such, the applicant must confirm in its application for admission that there are no grounds for concern under the GWB.
- 19 In the event that spectrum is acquired by service providers or MVNOs, the Chamber draws attention to the following:
- 20 In principle, it is not possible that a mobile network operator is at the same time also a service provider for another network operator (cf part C, subsection 2 UMTS/IMT-2000 licences). This is based on the stipulation that only competitively independent

- undertakings will be admitted to the respective spectrum award proceedings (principle of competitive independence).
- 21 A key aim of this principle is to promote sustainable competitive markets (section 2(2) para 2 TKG). If a mobile network operator offers both its own products and products based on a rival network, this could have a negative effect on the intensity of competition. The same would also apply in principle to a service provider acquiring spectrum and setting up a proprietary network as a new entrant while also continuing to act as a service provider for one or more mobile network operators in parallel.
 - 22 However, a reduction in the intensity of competition is not a concern in every case. Simply participating in the auction or acquiring spectrum usage rights does not violate the principle of competitive independence.
 - 23 Further, a nuanced view of the relevant product and geographic market has already been taken in connection with the UMTS/IMT-2000 licences mentioned above. It is thus conceivable that services based on a rival network will be offered in addition to the provider's own services if they are not materially comparable and thus do not compete with one another.
 - 24 If the available mobile services acquired as capacity are similar in nature, it is conceivable, at least for the interim period, that in individual cases an undertaking acquiring spectrum usage rights would also act as a service provider for another network operator. This would give the new entrant the opportunity to establish its own mobile network in the interim and migrate existing customers to this network. In addition, it would ensure that the new entrant's existing customers receive uninterrupted service from the service provider.
 - 25 The Chamber, having evaluated the controversial responses, is still holding firm in its belief that the principle of competitive independence cannot stand in the way of a potential new entrant that is already active as a service provider participating in the award proceedings. In view of the intended purpose of the principle of competitive independence, the Chamber considers the risk of a new entrant abusing its dual position to be extremely low. The aim of enabling new players to enter the market is specifically to promote competition in the mobile market and is therefore consistent with the aims of the principle of competitive independence.
 - 26 Regarding comments that relaxing this principle would stifle any incentive for infrastructure competition and take away the incentive for new entrants to roll out their own infrastructure, the Chamber wishes to draw attention to the following: The Chamber is convinced that it would be in a new entrant's economic interest alone to gradually roll out its own network infrastructure and use it to provide coverage for its customers at the earliest possible opportunity and to the greatest possible extent, and that a new entrant would rather provide coverage with its own network than as a service provider. Thus the principle does not carry the risk of a temporary dual position being abused. The Bundesnetzagentur will decide in individual cases, keeping the regulatory objectives in mind, on the framework conditions for a temporary dual position.
 - 27 It is important to note, in particular with respect to a company acting as both an operator and a service provider, that there would not necessarily be a connection between the old customers served by the company as a service provider using a competitor's network and the new customers served by the company as a new entrant using its own network.
 - 28 In the case of roaming agreements, by contrast, there is generally a connection, since the customers use a competitor's network when they leave the new entrant's own network. Whether and over which period this is permitted would be the subject of negotiations between new entrants and assignment holders (subsection III.4III.4.17) in compliance with antitrust and telecommunications law.

- 29 Contrary to the view of some respondents, the Chamber believes that allowing service providers to acquire their own spectrum and roll out their own networks will specifically create an incentive for them to invest in their own infrastructure so as to enhance value creation and assume their own commercial risks. Without a transitional arrangement, the principle of competitive independence would appear prohibitive from the perspective of service providers and would prevent service providers from participating in the award proceedings in the first place.
- 30 Regarding the concerns of individual respondents about a relaxation of the principle of competitive independence, the Chamber would like to emphasise the fact that it is holding firm with the principle in all other respects. Regarding the concerns of various network operators about a lack of incentives to provide multiple coverage in not-spots, the Chamber believes that cooperation leading to coverage in not-spots is essentially to be welcomed

Re III.1.3 Requirements for admission to the auction

The following comments were made:

- 31 It was said that sufficient time should be allowed to structure and correct applications for admission. A period of at least twelve weeks was seen as appropriate. In particular, new entrants that had to draw up an application for the first time needed a sufficient period of time to prepare and submit applications.
- 32 In addition, it is assumed that only the fact that an applicant has qualified for admission to the auction proceedings – but no information from the application for admission – will be publicly disclosed.

The Chamber has ruled as follows:

- 33 Undertakings will be admitted to the auction upon application as per section 61(4) third sentence TKG.
- 34 There are no restrictions in place regarding who is entitled to take part in the auction proceedings. The Chamber draws attention to the fact that new entrants also have the opportunity to take part in the auction. In view of this, the Chamber has included in its decision regulations that apply exclusively to new entrants (such as different coverage obligations). The Chamber felt it was in the interests of small and medium-sized enterprises (cf section 61(4) TKG) to have different regulations in place.
- 35 However, the entitlement to apply only constitutes a notional possibility of participation. Actual participation in the auction proceedings is subject in each case to admission by the Bundesnetzagentur, which is granted in a separate decision (qualification notice), section 61(4) fourth sentence TKG. In the application for admission, the applicant must include details and evidence of compliance with the provisions of section 61(3) second sentence TKG and the existing requirements laid down in section 55(5) TKG.
- 36 Applicants have a duty to demonstrate more than the personal characteristics of reliability, financial capacity and specialist knowledge within the meaning of section 61(3) second sentence para 1 TKG. In accordance with section 55(5) first sentence para 4 TKG, the applicant must ensure the efficient and interference-free use of spectrum in line with the conditions of assignment. Every applicant must submit a frequency usage concept detailing how it plans to safeguard the efficient use of spectrum. The frequency usage concept must be clear, conclusive and in particular include details about technical planning with respect to the specific business model and service concept. These requirements apply to existing network operators and new entrants alike.

- 37 In order to meet the minimum specialist and other requirements for admission to the auction proceedings within the meaning of section 61(3) second sentence para 1 TKG, the applicant must provide details and evidence (cf details in Annex 1):
- that it meets the legal conditions for assignment within the meaning of section 55(4) and (5) TKG;
 - that it can safeguard the efficient and interference-free deployment of spectrum as per section 55(5) first sentence para 4 TKG;
 - that it has access to the financial resources necessary to purchase the spectrum at auction and to pay for establishing and rolling out the network;
 - that it genuinely intends to bid; and
 - details of the investment and ownership structures at its company and where relevant its parent company.
- 38 In order to keep the general public informed and in particular give auction participants the necessary transparency, the Bundesnetzagentur will publicly disclose which bidders have qualified for admission to the auction proceedings and, subsequently, which bidders have been awarded spectrum. No other information from the applications for admission will be disclosed.
- 39 Regarding the response calling for a period of twelve weeks for the submission of applications for admission, the Chamber wishes to draw attention to the following: the period from consultation with the Advisory Council of the Bundesnetzagentur to 25 January 2019 is reasonable; here, it should also be remembered that the decision on the award in the form of an auction was announced on 14 May 2018.

Re III.1.4 Individual minimum spectrum requirement

The following comments were made:

- 40 It was noted that determining an individual minimum spectrum requirement would create scope for abusive tactical bidding, for instance so as to drive prices upwards without having any actual interest in the relevant spectrum. In this context, there were calls for the bidders' individual minimum spectrum requirements to be strictly examined for plausibility and for the amounts of spectrum accepted as the individual minimum spectrum requirements to be as small as possible.
- 41 Other respondents said that it was essential for new entrants to be able to interlink the two available frequency bands when stating their individual minimum requirements. The assignment of the minimum amount of spectrum required at 3.6 GHz would, for example, be contingent on the assignment to the new entrant of the minimum spectrum required at 2 GHz.
- 42 There were calls for all the bidders to be informed at the beginning of the auction of the minimum spectrum requirements registered. This information was necessary in order to be able to correctly interpret the existing excess demand and thus achieve efficient auction results.

The Chamber has ruled as follows:

- 43 Applicants are entitled to request an individual minimum spectrum requirement that reflects the absolute minimum required on spectrum efficiency and economic grounds in order to operate their business model (known as the minimum essential spectrum package).
- 44 The Chamber has decided not to administratively stipulate a basic spectrum package (cf subsection III.3.1). However, where a bidder requires a basic minimum of spectrum for its business model that is greater than the smallest unit up for auction of 2 x 5 MHz (paired) in the 2 GHz band or 1 x 10 MHz (unpaired) in the 3.6 GHz band,

- the bidder can register a total minimum essential spectrum package for both frequency bands in its application.
- 45 The Chamber has not followed the suggestion that applicants should be able to register separate minimum spectrum packages for the 2 GHz and 3.6 GHz bands. The Chamber believes that, firstly, registering separate packages could decrease the chances for new entrants to acquire spectrum. In this case, a bidder would have to bid for its minimum spectrum package for both frequency bands in each round in order not to be eliminated from the auction.
- 46 Requesting a minimum essential spectrum package for both frequency bands together allows the spectrum to be divided flexibly between the two bands. It can be assumed that frequency blocks comprising the same amount of spectrum are, to a certain degree, substitutes, irrespective of the frequency band. The auction design allows bidders to switch in the auction between such blocks, irrespective of the band. It is up to the bidders to decide on which bands to bid.
- 47 Secondly, registering separate minimum spectrum packages for the 2 GHz and 3.6 GHz bands could also create incentives for abusive bidding strategies.
- 48 The minimum essential spectrum package must be detailed clearly and conclusively in the frequency usage concept. The Chamber will examine the minimum essential spectrum package requested by the applicant in its frequency usage concepts, as called for by respondents. The Chamber understands the minimum essential spectrum package to be the amount of spectrum needed to operate a technically and commercially viable network. In light of the potential scope for abusive bidding strategies given large minimum essential spectrum packages, only one plausibly justified package with a limited amount of spectrum can be determined. The Chamber will therefore apply a strict benchmark. The qualification notice stipulates the minimum essential spectrum package determined for an applicant.
- 49 Here, the Chamber would like to point out that it will not follow the call to publish the minimum essential spectrum packages determined. These constitute trade or business secrets that cannot be published.
- 50 Where a minimum essential spectrum package has been determined, at the end of the auction the bidder will only be awarded the frequency blocks for which it holds the highest bids provided they correspond in total to at least the minimum essential spectrum package stipulated. This method ensures that a bidder does not receive less spectrum than the minimum required to operate its business model.
- 51 Further, during the auction bidders must bid on frequency blocks that correspond at least to the minimum essential spectrum package they have declared. Applicants bidding for less who have not exercised a waiver (active or passive) lose all bidding entitlements and will be eliminated from the entire proceedings (cf Activity rules, subsection IV.3.9).
- 52 The Chamber does not see the need to set guidelines in advance regarding the scope of the minimum essential spectrum package. The spectrum currently available for assignment can be used to offer a broad range of telecommunications services, thus it is inappropriate to specify a uniform arbitrary minimum package of spectrum greater than the smallest unit up for auction of 2 x 5 MHz (paired) in the 2 GHz band or 1 x 10 MHz (unpaired) in the 3.6 GHz band to apply to all conceivable business models.

Re III.1.5 Qualification notice

The Chamber has ruled as follows:

- 53 Admission to the auction proceedings requires a separate decision by the President's Chamber in accordance with section 132(3) in conjunction with section 55(10) and section 61(4) fourth sentence TKG (qualification notice).
- 54 The qualification notice constitutes confirmation that the applicant complies with the provisions of section 61(3) second sentence para 1 TKG and the existing requirements laid down in section 55(5) TKG regarding admission to the auction, sets out the scope of the minimum essential spectrum package, and determines bidding entitlements (in lot ratings) (cf subsection IV.3.8). The determinations in the qualification notice are binding for the auction. The minimum essential spectrum package determined and the maximum bidding entitlements in each case are entered into the auction software in advance. Bidding entitlements are only granted provided an applicant clearly and conclusively states in its application how it intends to use the spectrum efficiently under its business model.

Re III.1.6 Opening of the qualification procedure

The following comments were made:

- 55 Only the fact that an applicant has qualified for admission to the auction, but no information from or about the application for admission, will be publicly disclosed.

The Chamber has ruled as follows:

- 56 The proceedings for qualification to take part in the auction will open with the publication of this decision on the Bundesnetzagentur website. The decision will also be published in the Bundesnetzagentur Official Gazette. The qualification procedure precedes the auction. Compliance with the legal requirements for admission to the auction (cf Annex 1) is ascertained during the qualification procedure. The decision to admit an applicant to the auction proceedings is taken by the President's Chamber in accordance with section 132(3) in conjunction with section 55(10) and section 61(4) fourth sentence TKG.
- 57 Applications for admission to the auction can be submitted from the date of publication of this decision until 3.00 pm on 25 January 2019.
- 58 In the application, applicants must consent to their admission to the auction being made public as well as the publication of any decision to award spectrum to the applicant. No other information from the applications for admission will be disclosed.

Re III.2 Determining the frequency usage for which the spectrum to be assigned may be used in compliance with the Frequency Plan (section 61(3) second sentence para 2 TKG)

Re III.2.1 Intended use of spectrum

The following comments were made:

- 59 Some respondents said that the intended use of the spectrum, which includes linking infrastructure and in-house use (eg Industry 4.0), was not covered by the Frequency Plan.
- 60 Other respondents welcomed the technology neutrality. The switch to new technologies such as 5G would take place in line with demand. Migrating too swiftly would result in many customers becoming inaccessible because they would not yet have suitable terminal equipment. Respondents also addressed the issue of sharing/using PMSE spectrum.

The Chamber has ruled as follows:

- 61 In compliance with the Frequency Plan, the frequencies to be assigned in the 2 GHz and 3400 MHz – 3700 MHz bands may be used for MFCN.
- 62 The General section of the Frequency Plan describes MFCN as follows:
"This frequency usage serves to connect terminal equipment to wireless networks via fixed base stations. This is usually for the purpose of providing telecommunications services."
- 63 This usage designation allows the spectrum to be used on a technology- and service-neutral basis without restriction (cf section 1 TKG). There are no restrictions on the technologies that may be used.
- 64 Regarding the comments that linking infrastructure and in-house use (eg Industry 4.0) were not covered by the designation for MFCN in the Frequency Plan, the Chamber wishes to draw attention to the following:
- 65 Alongside wireless connections for subscribers, the frequencies can also be used for linking infrastructure or for other applications, such as in-house networks. This puts the foundations in place for deploying spectrum in the 2 GHz and 3400 MHz – 3700 MHz bands flexibly for 5G services, such as Industry 4.0 applications, as soon as the technology is available.
- 66 In view of the principle of technology and service neutrality, in-house use – such as for Industry 4.0 – is also covered by the definition of MFCN.
- 67 The Frequency Plan accommodates this principle by structuring individual stipulations as flexibly as possible. The current Frequency Plan (page 4) contains the following:
"An example is the use of spectrum for MFCN. The technology-neutral designation will enable the deployment of different technologies and systems without restriction to particular standards. Further, frequency usage is structured so broadly that, within the scope of the allocations in the Frequency Ordinance (FreqV), it covers all services consisting in, or having as their principal feature, the conveyance of signals by means of telecommunications networks. The allocation for mobile services can be used for mobile, nomadic or fixed applications provided the stipulated mobile service parameters are complied with. The frequency usage designated for MFCN connects terminal equipment to wireless networks via fixed base stations. This is usually for the purpose of providing telecommunications services. Other applications outside of telecommunications services are also possible, such as in-house applications or infrastructure applications."
- 68 The broad designation for MFCN enables mobile, nomadic and fixed applications to be realised in compliance with the frequency usage conditions. This allows assignment holders to realise all applications in the scope of their respective business models, provided that the coverage obligation is met.
- 69 Regarding the responses pointing out that migrating too swiftly would result in many customers becoming inaccessible because they would not yet have suitable terminal equipment, the Chamber wishes to draw attention to the following:
- 70 Introducing 5G-capable terminal equipment is interrelated with providing the frequency band and defining the award conditions. These provide stable framework conditions for the swift introduction of 5G. The introduction of 5G-capable terminal equipment will be driven by the specific demands from network operators and consumers on a needs-oriented basis. The Chamber assumes that there will be a fluid transition from current mobile technologies to 5G, since 5G is based on and builds on these current technologies.

- 71 In this context, the Chamber wishes to draw attention to the fact that the relevant technologies and terminal equipment will still be in development when the bands are made available. The Chamber assumes, however, that it will be possible to offer commercial 5G services as early as 2020.
- 72 Regarding the responses concerning the (shared) use of PMSE spectrum, the Chamber wishes to draw attention to the comments relating to subsection III.4.16 (Shared use).

Re III.2.2 Nationwide use

The following comments were made:

- 73 It was said that availability of the spectrum for nationwide use was a prerequisite for the efficient use of frequencies and efficient network planning.
- 74 By contrast, an alternative model was proposed: in a first step, spectrum for a certain number (divisible by three) of "pioneer regions" in rural areas throughout the country would be auctioned, with the network operator in each region being able to use the full bandwidth of 300 MHz (3400 MHz – 3700 MHz). In a second step, spectrum for the urban and semi-urban regions could be auctioned following the usual procedure. Nationwide use of the spectrum purchased in each "pioneer region" could be claimed from 2025, provided that the coverage obligation had been met in the region.

The Chamber has ruled as follows:

- 75 Spectrum in the 2 GHz and 3400 MHz – 3700 MHz bands will be made available for nationwide use.
- 76 The nationwide provision of 2 GHz spectrum is in line with the existing frequency management strategy. The 2 GHz (paired) band has proved to be suitable for use by nationwide providers to deliver efficient consumer coverage. As such, the assignments in this band have all been nationwide to date.
- 77 The provision of 3.6 GHz spectrum for nationwide assignments is intended to provide regulatory support for the introduction of high-speed 5G systems and the rollout of high-speed telecommunications networks (cf President's Chamber decision of 14 May 2018, Order No 62/2018, Bundesnetzagentur Official Gazette No 10/2018 of 30 May 2018, margin no 126 et seq). The physical propagation characteristics of 3.6 GHz make it particularly suited to regional deployment. However, assigning it nationwide ensures that the same frequencies are available nationwide to assignment holders for rolling out 5G networks in line with demand. This promotes the efficient use of spectrum (section 2(2) para 7 TKG) by nationwide assignment holders since it prevents, for example, the need to coordinate with other users. It also makes network planning easier.
- 78 The provision of the 3400 MHz – 3700 MHz band for nationwide assignments offers planning certainty for nationwide 5G rollout, and thus supports the regulatory objective of expediting the rollout of high-speed next-generation telecommunications networks (section 2(2) para 5 TKG).
- 79 Large bandwidths for 5G are available particularly in the 3.6 GHz band. This advantage can be exploited to the greatest possible extent if large contiguous bandwidths are available for nationwide use and compliance with separation distances is not required.
- 80 The fast and flexible rollout of 5G using 3.6 GHz spectrum is also promoted in the interests of users and consumers (section 2(2) para 1 TKG). The rapid rollout of high-speed 5G infrastructure lays the foundations to enable the development and use by consumers of future innovative applications in areas such as smart cities and smart health. The Bundesnetzagentur anticipates that additional local 5G networks will also be rolled out for such applications and has thus decided to make spectrum in the

3700 MHz – 3800 MHz band available for local assignments. However, nationwide assignment holders should be able to use the 3.6 GHz pioneer band freely so as to enable innovative services to penetrate the national market at an early stage.

- 81 The Bundesnetzagentur's objective is to ensure efficient and interference-free spectrum use (section 2(2) para 7 TKG).
- 82 Its decision to assign 3.6 GHz spectrum both nationwide as well as locally does not mitigate the requirement to use spectrum flexibly and efficiently. Nationwide assignment of this spectrum for MFCN will enable the build and rollout of networks delivering innovative mobile broadband in rural as well as urban areas.
- 83 Regarding the alternative model proposing that spectrum for rural regions be auctioned in a first step and that for urban and semi-urban regions in subsequent steps, the Chamber wishes to draw attention to the following:
- 84 The alternative model is not as equally suited as the provision of spectrum for nationwide use is to ensuring the regulatory objectives of the Telecommunications Act. The model would result in "insular" regional and local networks whose coordination would require a considerable amount of effort and large guard bands. This is contrary to the regulatory objective of efficient and interference-free frequency usage.
- 85 Awarding spectrum first to "pioneer regions" and then to urban and semi-urban regions would make coordination considerably more difficult and would therefore not be consistent with delivering 5G on a needs-oriented basis. Network operators would not be able to deploy their spectrum usage rights freely throughout the country. Moreover, nationwide assignment requires less coordination than locally or regionally differentiated assignment.
- 86 However, use of spectrum in the 3400 MHz – 3700 MHz band can be shared by other users temporarily where not deployed by a nationwide assignment holder (cf subsection III.4.16). Conversely, the draft application process for the 3700 MHz – 3800 MHz band gives nationwide assignment holders the option for temporary shared use of frequencies in the 3400 MHz – 3700 MHz band.

Re III.3 Basic spectrum package and restriction of bidding rights, section 61(3) second sentence para 3 TKG, section 61(4) in conjunction with section 61(2) first sentence TKG

Re III.3.1 Basic spectrum package

The following comments were made:

- 87 Some respondents called for a basic spectrum package to be stipulated, or for all the participants in the auction to be given the chance to purchase the frequency blocks they require. There was a call to reserve spectrum for new entrants.
- 88 It was said that the possibility to request a minimum essential spectrum package was not a suitable substitute for the stipulation of a basic spectrum package. Depending on how the auction proceeds, the minimum essential spectrum package could lead to a bidder being eliminated if the bidder's bids fell below a certain level. A basic spectrum package, by contrast, would guarantee that all bidders would continue to be able to supply their customers with suitable mobile services.

The Chamber has ruled as follows:

- 89 A basic spectrum package will not be stipulated. In accordance with section 61(3) second sentence para 3 TKG, prior to carrying out award proceedings the Chamber specifies a basic spectrum package that reflects the minimum amount required for commencement of the telecommunications service, where necessary.

- 90 It is not necessary to specify a basic spectrum package in this case. The spectrum currently available for award can be used to offer a broad range of telecommunications services, thus it is not possible to specify a uniform arbitrary minimum package of spectrum greater than the smallest unit up for auction of 2 x 5 MHz (paired) in the 2 GHz band or 1 x 10 MHz (unpaired) in the 3.6 GHz band to apply to all conceivable business models.
- 91 The spectrum to be awarded is being made available for MFCN. This is compatible with a diverse range of business models. In addition, a bidder who requires a basic spectrum package that is larger than the smallest unit up for auction in order to operate its business model can register this as its individual minimum spectrum requirement (minimum essential spectrum package). This minimum essential spectrum package will then correspond to an individual basic spectrum package.
- 92 During the auction, it will be ensured that a bidder will only receive the spectrum being bid upon if the total number of frequency blocks acquired corresponds at least to the minimum essential spectrum package stipulated.
- 93 Furthermore, the Chamber takes the view that its decision not to stipulate a basic spectrum package gives bidders maximum flexibility in the auction.
- 94 With respect to the interests of potential new entrants, the Chamber also draws attention to the following:
- 95 In the interests of promoting competition, the Chamber welcomes the participation of new entrants in the auction proceedings. However, from established administrative practice the Chamber believes that, following consideration of the regulatory objectives, the implementation of different frequency access conditions for new entrants – for example by specifying a specific basic spectrum package or by earmarking frequency blocks – is neither appropriate nor does it ultimately serve to promote competition.
- 96 In principle, new entrants willing to invest also have the opportunity to acquire the spectrum required for their business planning.
- 97 Nevertheless, the President's Chamber recognises the interests of new entrants not only by offering the option to request a minimum essential spectrum package (cf subsection III.1.4), but also by specifying a different coverage obligation (cf subsection III.4.12), enabling infrastructure sharing, and imposing an obligation to negotiate on roaming (cf subsection III.4.17). These measures can help to make market entry easier for potential new entrants. In this context, the Chamber has also considered the circumstances for new entrants in this case with respect to the voluntary commitments made by Telefónica as part of the merger of Telefónica and E-Plus (cf Directorate-General for Competition, Decision M.7018 of 2 July 2014, Official Journal of the European Union of 13 March 2015, no 2015/C 086/07).

Re III.3.2 Restriction of bidding rights

The following comments were made:

- 98 There were calls for bidding rights to be limited by setting spectrum caps for the individual frequency bands. In view of the scarcity identified, there were doubts that it was largely rational for bidders to only bid on the spectrum they actually needed. There were concerns that bidders could be squeezed out by adding a "squeezing out" value (eg oligopoly return) to the rational technical value of the spectrum in the bids. Competitors could be squeezed out simply if one bidder purchased more spectrum than others and was thus able, for instance, to offer enhanced products. In light of the content of Report A from CEPT to the European Commission, measures should be taken to ensure that each network operator will be able to acquire at least 50 MHz in the 3.6 GHz band.

- 99 Some respondents called for spectrum caps of 2 x 10 MHz for the 2 GHz band and 80 MHz for the 3.6 GHz band.
- 100 Others called for combined spectrum caps comprising 2 x 50 MHz at 2 GHz, including existing usage rights at 1.8 GHz, and 150 MHz at 2 GHz and 3.6 GHz.

The Chamber has ruled as follows:

- 101 No restriction will be placed on the amount of 2 GHz and 3.6 GHz spectrum on which each bidder may bid (spectrum cap). The Chamber mainly based its decision on the following considerations:
- 102 In principle, the Chamber believes that limiting the bidding rights of each bidder could be a suitable way to make it easier for interested parties to acquire spectrum for their respective business models. However, the Chamber assumes that sufficient 2 GHz and 3.6 GHz spectrum is available to cater for all individual spectrum requirements.
- 103 The Chamber feels it is not necessary to set a general spectrum cap. With regard to the demand reduction effect, the likelihood of a bidder being squeezed out is considered to be low since a large number of frequency blocks will be made available in this procedure. If a bidder were to submit inflated bids with the aim of squeezing out a competitor, this would increase the price of all frequency blocks required by the bidder as the overall price level in the auction would climb. A rising price level is likely to reduce the bidder's demand for spectrum. The more frequency blocks available overall and the more of these the bidder intends to win, the stronger this effect becomes.
- 104 In general, the procedural mechanisms of an open simultaneous multiround ascending auction tend to promote the economically appropriate distribution of spectrum usage rights since it is largely rational for bidders to only bid on the usage rights they actually need.
- 105 Setting spectrum caps, as requested by some respondents, could lead to certain business models being ruled out even before the auction. Setting spectrum caps is therefore only appropriate if the auction results are otherwise likely to be inefficient. In light of the number of frequency blocks available in both the 2 GHz and the 3.6 GHz band, the Chamber believes this is not the case. Previous auctions have shown that, even without spectrum caps being set, the mechanisms – in particular the demand reduction effect – of the underlying auction design proved to be effective given a large number of frequency blocks. The Chamber is therefore holding firm with its belief and is not limiting the amount of spectrum that each bidder can acquire.

Re III.4 Frequency usage conditions, section 61(3) second sentence para 4 TKG

- 106 In accordance with section 61(3) second sentence para 4 TKG, prior to award proceedings the Chamber determines the frequency usage conditions, including the degree of coverage with the frequency usage and the time limit for achieving such coverage. These frequency usage conditions cover the technical requirements and the type and scope (eg location in the frequency band, size of the blocks) of the spectrum to be assigned.

Re III.4.1 Frequency usage conditions

The following comments were made:

- 107 With respect to 2 GHz mobile satellite service (MSS), there was criticism of the decision not to stipulate the 300 kHz guard band without having carried out any technical studies. This was not compatible with Commission Implementing Decision 2012/688/EU. The licence conditions should include a requirement to guarantee protection. It was also necessary to clearly define the protection measures.

- 108 With respect to the use of OFDM technology for 2 GHz MSS, it was pointed out that only the complementary ground components of the European Aviation Network (EAN) were based on OFDM. The MSS terminals received the geostationary MSS satellite emissions, however, and would be susceptible to interference from mobile base stations. This would cause problems for MSS terminals when aircraft were on the ground at airports.
- 109 Furthermore, protection for FSS sites was welcomed. However, clarity was needed regarding the grounds on which a mobile network operator would be able to object to a newly coordinated usage, irrespective of the actual use of the frequency concerned. Finally, the concern was raised that new ground stations in the 3600 MHz – 3700 MHz would not be protected.
- 110 There was a call for information at an early stage on plans regarding the IMT-2000 TDD spectrum below 1920 MHz.
- 111 One respondent called for protection for satellite applications (EESS, SRS and SOS) in the 2200 MHz – 2290 MHz band.
- 112 It was said that the coordination radius of 20 km to protect the satellite monitoring station in Leeheim and earth stations in the 3400 MHz – 3600 MHz band and the protection requirement for the Geodetic Observatory Wettzell (GOW) were too far-reaching. In addition, details of the future parameters and limits should be published before the award proceedings.
- 113 The protection requirements for the observatory were so drastic that the sense of rolling out 5G in entire regions was called into question. It was also doubted that the economic effects of 5G had been weighed against the specific or abstract benefit of the GOW for the general public. It was questioned whether an observatory that primarily observes radiated power in various frequency bands was actually a frequency usage that warranted protection within the meaning of the Frequency Plan. Moreover, it was said that determining the technical parameters for such a large protection zone, in conjunction with recommending the conclusion of operator arrangements, was the least suitable approach.
- 114 Furthermore, earth stations, exploration services and observatories hindered mobile planning and the fast rollout of new mobile technology. There was also a call for further information on the form of coordination, the actual coordination process and the exact coordinates.
- 115 It was suggested that operators should be informed at an early stage of the coordinates of the military radar systems and that the separation distance for radars below 3400 MHz as well should be examined.
- 116 It was said that the protection for the radio monitoring stations operated by the Bundesnetzagentur's radio monitoring and inspection service hindered the fast rollout of new mobile technology. There was also a call to increase the limit, since the field strength of 90 dB μ V/m was too low.
- 117 Some respondents pointed out that the current procedure for setting MFCN parameters for coordination in the 3.4 GHz – 3.7 GHz band was not suitable. The procedure should therefore be modified, and flexible and practice-oriented changes made to the assignment procedure.
- 118 It was to be welcomed that mobile rollout was to take sufficient account of correctional facility sites. However, suppressing mobile communications was the responsibility of the judicial system.
- 119 It was also suggested that the frequency usage conditions for synchronisation should be set out in more detail.

The Chamber has ruled as follows:

- 120 The frequency usage conditions are determined in each case on the basis of international recommendations and decisions.
- 121 The relevant CEPT reports and European Commission decisions form the basis for deploying the spectrum available in a manner that is efficient and interference-free, including across national borders. As such, the frequency usage conditions can be modified subsequently, particularly if this is necessary to secure efficient and interference-free use of frequencies or as a result of international harmonisation agreements.
- 122 The usage conditions in Annexes 2 and 3 for 2 GHz and 3400 MHz – 3700 MHz spectrum also aim to safeguard the interference-free coexistence of different applications in adjacent frequency bands. This is of particular relevance when determining site-related frequency usage parameters for base stations.
- 123 The Bundesnetzagentur specifies block edge masks (BEM) as part of the frequency usage conditions. These are usually part of European CEPT decisions and binding European Commission Implementing Decisions. These masks relate to the borders of the assigned spectrum. The block edge masks describe both permissible in-block emissions and out-of-block emissions. These regulatory requirements aim to reduce the likelihood of harmful interference occurring between adjacent networks.
- 124 Assignment holders may depart from these conditions if they have made mutual arrangements (known as operator arrangements) to this effect and departure is without detriment to the frequency usage rights of third parties. This gives assignment holders a high degree of flexibility when using spectrum for specific applications. In order to ensure the rapid and proper resolution of faults, the Bundesnetzagentur must be informed of this in writing.
- 125 With out-of-block emissions, a distinction is made between general and specific requirements. Since the minimum requirements are defined via the block edge masks, additional local or regional measures may be necessary to enable coexistence with other spectrum users. This must then be assessed taking the exact locations and prevailing local or regional framework conditions into consideration when determining site-related frequency usage parameters.
- 126 The onus is on the operator to decide how it restricts out-of-block emissions (eg by using special filter technology) in its frequency block. As a result, there is no need to apply a general restriction on radiated power for base stations.
- 127 In addition to these operator arrangements, site sharing is an effective tool for minimising the influences of adjacent spectrum usages particularly in connection with TDD, which also has a cost-reducing effect.
- 128 Regarding the suggestion to set out the frequency usage conditions for synchronisation in more detail, the Chamber wishes to draw attention to the following:
- 129 The Chamber agrees that synchronised operation between adjacent assignment holders can make sense for reasons of spectrum efficiency. On account of the complexity of the various applications, however, the Chamber does not consider it possible to make a general stipulation. In this context, the Chamber would expect cooperation between all the assignment holders with a view to making local or regional arrangements to achieve the best possible use of the spectrum resources.
- 130 Regarding the call for early information on planned usages below 1920 MHz, the Chamber wishes to draw attention to the scope for input in consultations on planned changes to the Frequency Plan and, at an even earlier stage, at European level. These transparent proceedings inform and involve the interested parties at an early stage.

131 Specifically:

Protection of 2 GHz MSS

132 MSS applications above the 2 GHz band must be protected by the assignment holders. Holders must take suitable steps to ensure protection where required in specific cases. In particular, the Chamber assumes that, at least for the complementary ground components, the same technology will be deployed in the 2 GHz MSS band as in the 1920 MHz – 1980 MHz / 2110 MHz – 2170 MHz band, such as an OFDM-based transmission system.

133 ECC Decision (06)01 addressed the harmonised use of the 1920.0 MHz – 1980.0 MHz / 2110.0 MHz – 2170.0 MHz band for mobile communications. This ECC Decision is currently being revised to incorporate 5G systems, including active antenna systems (AAS). The revision of the decision and corresponding studies are likely to be concluded by mid-2019. Depending on the technology deployed (eg AAS), the assignment holder may be required to take precautions to protect the MSS.

134 Regarding comments that provision of the 2 GHz band was not compatible with Commission Implementing Decision 2012/688/EU, the Chamber wishes to draw attention to the following: The European Commission has already given CEPT a mandate to revise the technical conditions in the 2 GHz band. The Chamber expects that, as a result, a guard band for satellite services will no longer be essential and that Implementing Decision 2012/688/EU will be modified accordingly. If, contrary to expectations, a defined guard band is still considered necessary, the frequency usage conditions will be updated accordingly within the framework of European harmonisation. Nevertheless, the frequencies are still available up to each band edge.

135 As in the past, the Bundesnetzagentur will not be stipulating specific guard bands.

136 The Chamber is not following the call to retain a 300 kHz guard band with respect to the adjacent upper MSS spectrum.

137 MSS applications above the 2 GHz band must be protected by the assignment holders. Holders must take suitable steps to ensure protection where required in specific cases. In particular, the Chamber assumes that, at least for the complementary ground components, the same technology will be deployed in the 2 GHz MSS band as in the 1920 MHz – 1980 MHz / 2110 MHz – 2170 MHz band, such as an OFDM-based transmission system.

138 Regarding calls to clearly define the protection measures with respect also to the use of MSS terminals at airports, the Chamber wishes to draw attention to the following: MFCN assignment holders are required to set out the measures planned to protect satellite services at and near airports as part of the procedure for determining site-related frequency usage parameters. The Bundesnetzagentur will therefore take this into account in each individual case when determining the site-related frequency usage parameters applicable to the assigned frequencies. The Chamber therefore does not consider it necessary to impose general restrictions on MFCN in advance for the use of the band.

Protection of satellite communications in the 2200 MHz – 2290 MHz band

139 The 2200 MHz – 2290 MHz band is currently used locally to receive satellite communication signals (space research service, space operation service, earth exploration service). Satellite applications (EESS, SRS and SOS) in this band must be protected by MFCN assignment holders. Future MFCN applications could disrupt satellite communications in this area, for example if active antenna systems are deployed. Depending on the outcome of harmonisation efforts at a European level, additional measures may be necessary when setting the parameters in order to protect existing and future earth station sites receiving in the 2200 MHz – 2290 MHz band.

140 Here, the Chamber wishes to draw attention to the ongoing revision of ECC Decision (06)01, which refers to ERC Recommendation 74-01. Protection for EESS/SRS/SOS above 2200 MHz is ensured through compliance with the limits in ERC Recommendation 74-01 for unwanted emissions from 5G systems in the 2110 MHz – 2170 MHz band.

Protection of existing regional assignments in the 3400 MHz – 3700 MHz band

141 Alongside the broadband wireless access (BWA) usage rights assigned de facto on a nationwide basis, spectrum was assigned in an application process for regional and local use. The spectrum is assigned for MFCN in blocks of 5 MHz in accordance with Annex 1 to ECC Decision (11)06. There are currently around 80 regional and local assignments, in particular for rural areas (see Table 1 for details). The assignment holders are generally small and medium-sized enterprises that use the frequencies for residential customers, coverage for business parks, and offshore wind farms, for instance. To ensure compatibility with adjacent radio applications, suitable separation distances have been specified on a case-by-case basis.

Federal state	Assignment area	Frequency band (MHz)	Time limit
Baden-Württemberg	Leonberg	3600-3660	31 December 2022
Baden-Württemberg	Villingen-Schwenningen	3600-3680	31 December 2022
Bavaria	Herrngiersdorf	3480-3500 3580-3600 3620-3640	28 March 2022
Bavaria	Immenstadt im Allgäu	3640-3660 3680-3700	31 December 2022
Bavaria	Oberallgäu Süd	3600-3640	16 April 2022
Bavaria	Regensburg	3490-3500 3590-3600	14 March 2021
Bavaria	Waltenhofen	3480-3500 3580-3600	31 August 2021
Brandenburg	Neuzelle	3480-3500 3580-3600	23 December 2021
Brandenburg	Scharmützelsee	3480-3500 3580-3600	14 November 2020
Brandenburg	Seelow	3490-3500 3590-3600	10 January 2021
Brandenburg	Treuenbrietzen	3473-3494	12 July 2022
Brandenburg	Wandlitz	3480-3500 3580-3600	30 November 2020
Brandenburg	Wölsickendorf	3490-3500 3580-3600	25 October 2021
Brandenburg	Wriezen	3480-3490	25 October 2021
Hesse	Marburg-Biedenkopf	3600-3640	31 December 2022
Mecklenburg-Western Pomerania	Boizenburg/Elbe	3600-3620	18 December 2021
Mecklenburg-Western Pomerania	Friedland	3480-3500 3580-3600	12 April 2021
Mecklenburg-Western Pomerania	Goldberg	3480-3500 3580-3600	31 July 2021
Mecklenburg-Western Pomerania	Kentzlin	3480-3500 3580-3600	6 December 2021

Federal state	Assignment area	Frequency band (MHz)	Time limit
Mecklenburg-Western Pomerania	Lübz	3590-3600	30 June 2021
Mecklenburg-Western Pomerania	Ludorf	3480-3500 3580-3600	7 April 2021
Mecklenburg-Western Pomerania	Marlow	3480-3500 3580-3600	12 April 2021
Mecklenburg-Western Pomerania	Tessenow	3480-3500 3580-3600	2 December 2021
Mecklenburg-Western Pomerania	Trinwillershagen	3480-3500 3580-3600	7 April 2021
Lower Saxony	Filsum	3600-3620	16 June 2022
Lower Saxony	Friedeburg	3490-3500	31 October 2020
Lower Saxony	Friesoythe	3600-3620	16 June 2022
Lower Saxony	Jübberde	3480-3500 3580-3600	28 March 2022
Lower Saxony	Löningen	3480-3500 3580-3600	21 June 2022
Lower Saxony	Meppen	3600-3660	1 October 2022
Lower Saxony	Norden	3480-3500 3580-3600	28 March 2022
Lower Saxony	Schirum	3480-3500 3580-3600	16 April 2022
Lower Saxony	Stuhr	3600-3620	25 October 2021
Lower Saxony	Tülau	3490-3500 3590-3600	8 March 2022
Lower Saxony	Westoverledingen-Weener	3480-3500 3580-3600	13 September 2021
Lower Saxony	Wittmund	3480-3500 3580-3600	13 September 2021
North Rhine-Westphalia	Aachen	3580-3600	31 December 2022
North Rhine-Westphalia	Ammeloe	3480-3490	31 December 2022
North Rhine-Westphalia	Goch	3490-3500	18 May 2021
North Rhine-Westphalia	Goch	3480-3500 3580-3600	28 February 2022
North Rhine-Westphalia	Marienheide	3490-3500 3590-3600	1 February 2021
Saarland, Rhineland-Palatinate	Saarland/Pfalz	3473-3494 3573-3594	31 December 2021
Saxony	Borna	3600-3700	31 December 2022
Saxony	Diera-Zehren	3600-3640	31 December 2022
Saxony	Ebersbach	3600-3680	31 December 2022
Saxony	Großpösna	3600-3620 3660-3680	15 March 2022
Saxony	Klipphausen	3600-3680	31 December 2022

Federal state	Assignment area	Frequency band (MHz)	Time limit
Saxony	Krensitz	3600-3630	31 July 2021
Saxony	Leipzig-Paunsdorf	3600-3640	15 March 2022
Saxony	Lommatzsch	3600-3680	31 December 2022
Saxony	Nünchritz-Priestewitz	3600-3640	31 December 2022
Saxony	Riesa	3600-3640	18 August 2022
Saxony	Wülknitz	3600-3620	18 August 2022
Saxony-Anhalt	Arneburg	3480-3500 3580-3600	31 May 2021
Saxony-Anhalt	Born	3600-3640	31 December 2022
Saxony-Anhalt	Gardelegen	3480-3500 3580-3600	22 September 2021
Saxony-Anhalt	Genthin	3480-3500	1 September 2021
Saxony-Anhalt	Havelberg	3480-3500 3580-3600	31 May 2021
Saxony-Anhalt	Kuhfelde	3480-3500 3580-3600	23 December 2021
Saxony-Anhalt	Magdeburgerforth	3590-3600	20 April 2021
Saxony-Anhalt	Naumburg	3480-3500 3580-3600	17 September 2021
Saxony-Anhalt	Oebisfelde	3480-3500 3580-3600	28 March 2022
Saxony-Anhalt	Stendal	3480-3500 3580-3600	31 August 2021
Saxony-Anhalt	Stendal	3600-3700	31 December 2022
Saxony-Anhalt	Zerbst	3600-3680	31 December 2022
Schleswig-Holstein	Fehmarn	3490-3500 3590-3640	2 December 2021
Schleswig-Holstein	Grammdorf	3490-3500 3590-3600	30 September 2020
Schleswig-Holstein	Kirchnüchel	3490-3500	16 December 2020
Schleswig-Holstein	Köhn	3490-3500	9 December 2020
Thuringia	Saalfeld	3480-3500	31 December 2022
-	North Sea	3480-3490	31 December 2022
-	North Sea	3490-3500	31 December 2022
-	North Sea	3480-3500 3580-3600	9 October 2022
-	North Sea	3590-3600	31 December 2022
-	Baltic Sea	3480-3500 3580-3600	22 September 2022

Table 1: Local and regional assignments in the 3400 MHz – 3700 MHz band

- 142 The assignments were provided in an application process and therefore expire on different dates, but at the latest on 31 December 2022. The frequencies will therefore be available from different dates up to 1 January 2023. The Bundesnetzagentur is also examining whether the local and regional assignments are being used efficiently in all the areas. Frequencies that are assigned but not in use will have to be returned to the Bundesnetzagentur, otherwise revocation of the frequency assignment will be considered. Frequencies that are assigned and in use can be relocated to the 3700 MHz – 3800 MHz band upon application by the frequency assignment holder.
- 143 However, since the local and regional assignments mentioned above are limited to 31 December 2022 at the latest, they are due to expire relatively soon and must not be protected permanently.
- 144 Coordination will take place in specific cases based on the site-related frequency usage parameters defined for the base stations used for nationwide assignment.

De facto nationwide assignments in the 3.6 GHz band

- 145 In the 3400 MHz – 3600 MHz band, consideration is to be given to temporary assignments in the following areas and frequency blocks:

Region	Federal state	Frequency band	
All regions	De facto nationwide	3410 – 3452 MHz / 3510 – 3552 MHz	1st and 2nd BWA packages
All regions	All regions except for Rhineland- Palatinate and Saarland	3452 – 3473 MHz / 3552 – 3573 MHz	3rd BWA package
Ahrweiler	Rhineland-Palatinate	3452 – 3473 MHz / 3552 – 3573 MHz	
Altenkirchen (Westerwald)			
Berncastel-Wittlich			
Bitburg-Prüm			
Cochem-Zell			
Daun			
Frankenthal (Pfalz) (urban)			
Germersheim			
Koblenz (urban)			
Ludwigshafen am Rhein (urban)			
Mainz (urban)			
Mainz-Bingen			
Mayen-Koblenz			
Neuwied			
Rhein-Hunsrück-Kreis			
Rhein-Lahn-Kreis			
Rhein-Pfalz-Kreis			
Speyer (urban)			
Trier (urban)			
Trier-Saarburg			
Westerwaldkreis			

Region	Federal state	Frequency band	
Alzey-Worms	Rhineland-Palatinate	3473 – 3494 MHz / 3573 – 3594 MHz	4th BVA package
Bad Dürkheim			
Bad Kreuznach			
Birkenfeld			
Donnersbergkreis			
Kaiserslautern (rural)			
Kaiserslautern (urban)			
Kusel			
Landau in der Pfalz (urban)			
Neustadt/Weinstraße (urban)			
Pirmasens (urban)			
Südliche Weinstraße			
Südwestpfalz			
Worms (urban)			
Zweibrücken (urban)			
All regions	Saarland	3473 – 3494 MHz / 3573 – 3594 MHz	
Baden-Baden (urban)	Baden-Württemberg	3470 – 3480 MHz / 3570 – 3580 MHz	Former WLL frequency assignments
Heidelberg (urban)			
Mannheim (urban)			
Rastatt			
Rhein-Neckar-Kreis			
Munich (rural)	Bavaria	3470 – 3480 MHz / 3570 – 3580 MHz	
Munich (urban)			
Demmin	Mecklenburg-Western Pomerania	3470 – 3480 MHz / 3570 – 3580 MHz	
Greifswald (urban)			
Western Pomerania (north)			
Western Pomerania (east)			
Rostock (urban)			
Schwerin			
Saarbrücken conurbation	Saarland	3450 – 3480 MHz / 3550 – 3580 MHz	

Table 2: Assignments for MFCN in the 3400 MHz – 3600 MHz band

- 146 Following the auction, the Chamber will make the spectrum available for early reallocation. This will put the right conditions in place for the early deployment of spectrum for 5G rollout, thus promoting the regulatory objectives of efficient spectrum use in accordance with section 2(2) para 7 TKG and advancing the accelerated rollout of high-speed next-generation telecommunications infrastructure in accordance with section 2(2) para 5 TKG.
- 147 In the event that a holder of the above existing, nationwide assignments does not acquire spectrum in the auction or acquires less spectrum than is assigned at present, the Chamber draws attention to the following:
- 148 Existing uses of the above spectrum assigned to existing nationwide mobile network operators are to be shifted to the new band locations before the end of the current assignment periods and adapted to the future spectrum packages created by the auction. This should enable assignment holders to use spectrum for 5G nationwide without delay after the auction in the same way as the new assignments until 2040 will allow. At the same time, where no successive assignments have been issued to

existing assignment holders up to 2040, the spectrum concerned will be made available early for re-assignment.

Protection of military radar and radio astronomy in the 3.6 GHz band

- 149 Military radar in the band below 3400 MHz must be protected. The federal armed forces operate fixed radar systems in the band below 3400 MHz at a single-digit number of rural locations. The Bundesnetzagentur will, as requested by respondents, inform future assignment holders of the relevant frequency blocks about the geographical location to enable the frequencies to be used efficiently and free of interference.
- 150 The military radar protection thresholds specified in Annex 3 apply nationwide. Further, a coordination zone with a radius of 12 km must be observed around existing radar sites.
- 151 In addition, the radio astronomy service at the Effelsberg site must be protected below 3400 MHz (cf Annex 3).

Protection of earth station sites in the 3400 MHz – 3600 MHz band

- 152 In the Frequency Plan, the 3400 MHz – 3600 MHz band is allocated to the fixed-satellite service (space-to-earth) but is not designated for a specific application (see Frequency Plan, April 2016, entry nos 315003 and 316002). In light of this, the reception of satellite communications in the 3400 MHz – 3600 MHz band is in principle possible, but no protection from interference can be claimed.
- 153 The Bundesnetzagentur is aware of around ten existing earth stations, some of which are used for security-related communications or are of considerable economic importance. The Bundesnetzagentur is assuming that the earth station operators and MFCN assignment holders will cooperate during network rollout to avoid harmful interference. In the event of harmful interference to earth station reception in the 3400 MHz – 3600 MHz band, the Bundesnetzagentur will advocate a mutually acceptable solution taking account of the legal, technical and economic aspects. In this case, the Bundesnetzagentur would expect the MFCN assignment holders to show willingness to work out acceptable solutions with the earth station operators.
- 154 The monitoring earth station in Leeheim is the Bundesnetzagentur's satellite monitoring station. The reception of satellite communications in the 3400 MHz – 3600 MHz band by the earth station has been coordinated and must be protected. To ensure that frequency usage is monitored effectively in accordance with section 64 TKG, frequency usages cannot cause interference to the Bundesnetzagentur's radio monitoring stations (cf Communication No 613/2012, Bundesnetzagentur Official Gazette No 17/2012, page 3161). With respect to the Leeheim monitoring station, it is intended to apply a coordination radius of 20 km for terrestrial spectrum use. The technical parameters for mobile base stations within this radius will be set on a case-by-case basis when assigning spectrum, taking account of the topography and usage parameters. The mobile radio parameters available at present will be used to define the coordination zone.
- 155 Here, the Chamber would like to point out that the coordination radius is not a protection radius within which frequency usage is not possible. The separation distances required to protect the monitoring station as determined when setting the technical parameters may be smaller, as experience with other frequency bands has shown.

Protection of earth station sites in the 3600 MHz – 3700 MHz band

- 156 Assignment holders are under obligation to protect existing coordinated receiving stations of the fixed-satellite service in the sub-band 3600 MHz – 3700 MHz (cf Annex 3).

- 157 In addition to the earth stations in Annex 3, a single-digit number of earth stations used for security-related communications are also to be given consideration. In light of this, the assignment holders will only be informed of the locations bilaterally when the site-related frequency parameters are set. A coordination radius of 20 km for a general wide-angle area of 100° to 260° from north through east applies to the main lobes. A coordination radius of 5 km applies to the remaining wide-angle areas. The mobile radio parameters available at present will be used to define the coordination zone.
- 158 Furthermore, attention is drawn to the following with respect to the scope for development at existing coordinated sites:
- 159 Operators of existing coordinated earth stations can apply for coordination for reception for new uses in the 3600 MHz – 3700 MHz band. The application must include a frequency usage concept giving an account of why the 3800 MHz – 4200 MHz band is not sufficient in the specific case. If the account is conclusive and the mobile assignment holder is not using the frequencies and agrees to use by the earth station, use will be coordinated. If the mobile operator is already using the frequencies, coordination between the earth station operator and the mobile operator will be required. The operators will only have to apply for coordination in compliance with the extended obligation to present the facts where new uses are planned. New uses via additional antennas at existing earth stations that are successfully coordinated using this procedure will be protected.
- 160 The mobile operator's specific rollout plans are also to be taken into consideration in the coordination. The mobile operator may be required to present the plans to the Bundesnetzagentur. In the event that frequencies are leased or provided for temporary use, the involvement of each specific frequency user will be required as well.
- 161 However, reception at new earth station sites in the 3600 MHz – 3700 MHz band will not be protected. The Chamber wishes to make it clear that mobile operators may object to an earth station operator using a frequency if the frequency is already being used or its use is planned in the specific rollout plans. The mobile operator may be required to present the plans to the Bundesnetzagentur. In the event that frequencies are leased or provided for temporary use, the involvement of each specific frequency user will be required as well.
- 162 The monitoring earth station in Leeheim is the Bundesnetzagentur's satellite monitoring station. The reception of satellite communications in the 3600 MHz – 3700 MHz band by the earth station has been coordinated and must be protected. To ensure that frequency usage is monitored effectively in accordance with section 64 TKG, frequency usages cannot cause interference to the Bundesnetzagentur's radio monitoring stations (cf Communication No 613/2012, Bundesnetzagentur Official Gazette No 17/2012, page 3161). With respect to the Leeheim monitoring station, it is intended to apply a coordination radius of 20 km for terrestrial spectrum use. The technical parameters for mobile base stations within this radius will be set on a case-by-case basis when assigning spectrum, taking account of the topography and usage parameters. The mobile radio parameters available at present will be used to define the coordination zone.

Consideration of the Geodetic Observatory Wettzell

- 163 In connection with the availability of the 3.6 GHz band, consideration is to be given to protection for the Geodetic Observatory Wettzell (GOW) (cf Annex 3).
- 164 The observatory carries out geodetic measurements in cooperation with other stations worldwide operating on the same frequencies. The legal basis for the work of the Federal Agency for Cartography and Geodesy (Bundesamt für Kartographie und Geodäsie – BKG) is the Federal Georeference Data Act

(Bundesgeoreferenzdatengesetz – BGeoRG) of 10 May 2012 (Federal Law Gazette I page 1081). One of the aims of the Act is to ensure the availability of the geodetic reference systems and networks and the geo-topographical reference data for Germany and other Member States of the European Union.

- 165 Measurements are carried out at the observatory as part of the BKG's statutory tasks. The observatory receives signals from space over a large number of frequency bands. The measurements at the observatory are used, inter alia, for maximum accuracy when determining the position of objects on Earth. A high degree of measuring accuracy could also be of greater use to 5G applications such as autonomous driving in the future.
- 166 Even if the observatory's measurements may not constitute a frequency usage that warrants protection within the meaning of the Frequency Plan, the observatory requires protection by virtue of other statutory provisions.
- 167 Also applicable are the resolution adopted at the sixty-ninth session of the General Assembly of the United Nations on 26 February 2015 entitled "A global geodetic reference frame for sustainable development" (A/RES/69/266) (TOP 9) and Directive 2007/2/EC of the European Parliament and of the Council of 14 March 2007 establishing an Infrastructure for Spatial Information in the European Community (INSPIRE), EU Official Journal L 108 of 25 April 2007.
- 168 The Chamber sees no reason in the arguments presented against applying a coordination zone around the observatory. The coordination zone is a geographic zone within which measures may need to be taken when setting the site-related parameters and operator arrangements made when frequencies are assigned. This is necessary to guarantee fulfilment of the observatory's statutory tasks and to protect the observatory's measurements.
- 169 The BKG has pointed out that provision of the spectrum for MFCN may compromise the measurements and thus fulfilment of its tasks. It has also highlighted the particular importance of the 3.6 GHz band for the measurements.
- 170 However, the 3.6 GHz band has also been identified as a pioneer band for 5G rollout. The Bundesnetzagentur therefore opened a dialogue with the BKG to establish whether future restrictions would affect the scope and accuracy of observatory measurements and to what extent these effects could be tolerated without jeopardising its operations. Unrestricted use of the spectrum in question for 5G is not possible as the observatory cannot shift to other frequency bands, in particular spectrum above 3800 MHz.
- 171 As a result, a coordination zone of 120 km around Wettzell that will include the Greater Munich area is required for 5G applications. 5G can be used within this zone in principle, but must be coordinated as necessary.
- 172 With respect to urban areas on the boundary of the coordination zone, the Bundesnetzagentur assumes that only minor technical and planning restrictions will be imposed on 5G mobile network operators in the future due to the small amount of additional attenuation necessary, the attenuation from buildings, and plans that include the expected installation of hot spots to deliver very high-speed data rates. The 3.6 GHz band is in principle available for assignments in the vicinity of the observatory.
- 173 Base station sites within the coordination zone of 120 km around the observatory will be assessed on a case-by-case basis when determining the technical parameters applicable to assigned frequencies. Mobile operators could take various measures at their individual sites to minimise restrictions on the observatory, such as:
- restricting the transmitter power;
 - reducing the antenna height;

- adjusting the antenna elevation angle;
- adjusting the direction of the antenna (away from Wettzell); and
- restricting use to urban areas (shielding offered by buildings).

174 The closer a mobile base station is to the observatory, the more mitigation measures are likely to be needed.

175 In this context, arrangements can in principle be agreed between the operators themselves, as for instance between mobile and train radio network operators.

176 Regarding the respondents' view that the protection requirements for the observatory considerably restricted 5G rollout, the Chamber wishes to point out that the coordination radius is not a protection radius within which frequency usage is not possible. The separation distances required to protect the observatory as determined when setting the technical parameters may be smaller, as experience with other frequency bands has shown. The Chamber is also aware, however, that deploying MFCN in the vicinity of the observatory will entail more effort and usage restrictions owing to the protection requirements. The 120 km coordination zone around the observatory denotes the area within which more effort for advance planning and deployment is required. The larger the distance to the observatory, the smaller the degree to which protection measures are necessary.

177 Regarding comments that the general feasibility of rolling out 5G in the area around the observatory was being called into question, the Chamber wishes to point out that 5G rollout is not restricted to spectrum in the 3.6 GHz band.

Coordination of mobile communications at borders

178 In border areas and some additional geographical regions within the Federal Republic of Germany, only limited spectrum is available for MFCN. This especially applies to border regions since usage rights are distributed equally between spectrum users in the Federal Republic of Germany and its neighbours, resulting in the need to coordinate frequency usage with neighbouring countries.

179 Restrictions will differ from region to region with respect to spectrum and scope, depending on whether two, three or even four countries have to be involved in coordination efforts. Not only that, but the restrictions will be dependent on the radio applications and transmission methods in place on each side of the border, which may be different.

180 Coordination is carried out on the basis of contracts and agreements concluded between the Federal Republic of Germany and its neighbours.

181 The Bundesnetzagentur approves base station sites using a process agreed by numerous European frequency administrations and laid down in the "Harmonised Calculation Method (HCM) Agreement on the co-ordination of frequencies between 29.7 MHz and 43.5 GHz for the fixed service and the land mobile service". This method has been used in all procedures to determine parameters to date (eg in connection with GSM, UMTS and LTE) and serves to improve mobile coverage at national borders. The HCM Agreement and the procedure to determine parameters are continually updated to take account of the latest technical developments.

182 The HCM Agreement also envisages the use of operator arrangements in order to permit adequate mobile coverage by the respective network operators in areas with varying population densities at the Federal Republic's borders. In principle, these operator arrangements allow network operators to implement better coverage in line with demand at national borders, even in local regions where demand is particularly high. As a side effect, site sharing would significantly reduce coordination-related restrictions between two domestic mobile network operators operating on

neighbouring frequencies, which would have a positive effect on investment needs going forward.

Protection of the radio monitoring stations of the radio monitoring and inspection service

- 183 To secure the aims of frequency regulation in accordance with section 64 TKG, frequency usages cannot cause interference to the Bundesnetzagentur's radio monitoring stations. Electromagnetic fields generated by transmitting equipment operated in close proximity to the Bundesnetzagentur's receiving stations can result in desensitisation and overloading, thus impairing the ability of the Bundesnetzagentur's measuring equipment to receive signals (cf Bundesnetzagentur Official Gazette No 17/2012, Communication No 613/2012).
- 184 The Bundesnetzagentur has evolved its administrative practice for setting MFCN parameters in line with the above regulation and feels that it will continue to offer a fair framework for balancing the individual interests of mobile network operators as regards their network rollout efforts with the Bundesnetzagentur's legal mandate.
- 185 With a view to protecting stationary radio monitoring stations operated and planned by the Bundesnetzagentur's radio monitoring and inspection service in Germany, the field strength of transmissions in the frequency band above 694 MHz may not exceed a value of 90 dB μ V/m at these sites (cf Bundesnetzagentur Official Gazette No 3/2016, Communication No 35/2016). Regarding the call to increase the limit, the Chamber wishes to point out that the limit is based on a balancing of the interests of the mobile operators and the Bundesnetzagentur's statutory task.
- 186 Regarding the comments that the protection for the radio monitoring stations operated by the Bundesnetzagentur's radio monitoring and inspection service hindered the fast rollout of new mobile technology, the Chamber wishes to point out that the purpose of the service's radio monitoring stations is to ensure efficient and interference-free spectrum use, and the stations cannot be relocated.

Prevention of prohibited outside contact via mobile communications in correctional facilities

- 187 All outside contact for inmates of correctional facilities is governed by law. Accordingly, prohibited outside contact using mobile communications must be prevented.
- 188 In view of the risk of evidence tampering – grounds for arrest as codified in section 112(2) para 3 of the German Code of Criminal Procedure (StPO) – this applies in particular to the area of remand detention.
- 189 To date, prohibited outside contact via mobile communications has been prevented using what are known as managed access systems on the basis of section 55(1) fourth and fifth sentences TKG in conjunction with statutory regulations put in place by the individual federal states and the relevant framework conditions imposed by the Bundesnetzagentur.
- 190 As networks become denser, with regard to both households and main transport routes (road and rail), mobile coverage will also begin to encroach upon correctional facilities. This could result in the managed access systems alone not being able to prevent prohibited outside contact.
- 191 For this reason, preventing prohibited outside contact via mobile communications in correctional facilities must be accounted for when determining site-related frequency usage parameters for MFCN or through appropriate measures on the part of the mobile network operators. This also advances the regulatory objective of safeguarding the interests of public safety (section 2(2) para 9 TKG).

192 While the Bundesnetzagentur expects mobile network operators to include this in their network rollout plans going forward, the operators should also be able to use the spectrum as freely as possible with a view to implementing the regulatory objectives set out in section 2(2) TKG, in particular the regulatory objective of section 2(2) para 5 TKG.

Re III.4.2 Expiry of usage rights

The Chamber has ruled as follows:

- 193 The spectrum assignments are all due to expire on 31 December 2040. In accordance with section 55(9) first sentence TKG, spectrum is, as a rule, assigned for a limited period. Under section 55(9) second sentence TKG, time limits must be reasonable with respect to the service in question and must take reasonable account of the associated investment costs to be recouped.
- 194 When setting the time limit the Chamber considered on the one hand the interests of frequency assignment holders in keeping the spectrum for a period of time that is reasonably sufficient for recouping the investment costs involved.
- 195 On the other hand it also gave due consideration to ensuring that the Bundesnetzagentur's decision-making leeway with respect to frequency planning was not restricted to an unreasonable degree, ie that the time limit as a control mechanism did not exceed a reasonable period of time.
- 196 The time limit of 31 December 2040 already meets the requirements of the Directive of the European Parliament and of the Council establishing the European Electronic Communications Code that is due to enter into force. In future, Article 49 of the Directive will specify a lower limit for the minimum assignment duration of 15 years. The possibility provided for in the Directive of extending an assignment for a total duration of up to 20 years in order to safeguard business planning and investment certainty is laid down in section 55(9) third sentence TKG. This section permits the extension of assignments provided the frequency assignment requirements continue to be met after the time limit.
- 197 The limitation to the end of 2040 results in assignment periods of between 15 and 20 years, which are in line both with the provisions under future Community law and existing administrative practice when providing spectrum for mobile communications. Earlier proceedings also applied assignment periods of between 15 and 20 years. In 2000, the usage rights for 2 GHz spectrum were assigned for 20 years. During the award proceedings in 2010, the assignment period was set at 15 years. The most recent usage rights were assigned in the 700 MHz, 900 MHz, 1800 MHz and 1.5 GHz bands in an auction in 2015. Here, the usage rights were limited to 2033, ie the time limit was set at 17 years.
- 198 In view of the need to give assignment holders a period of time considered reasonable for recouping the investment costs involved, the expiry date set in these proceedings, ie the end of 2040, appears to be both reasonable and necessary. Holders of assignments from the current proceedings – including in particular any new network operators entering the market – must be given sufficient time to set up and roll out their networks, implement their business models and recoup their investments. This applies all the more to network operators that are already active in the market and can build on existing infrastructure to potentially take advantage of shorter payback periods.
- 199 Further, specifying 2040 as a uniform expiry date for the spectrum usage rights allows award proceedings to take place at reasonable intervals. The alternative scenario would involve multiple award proceedings within a short space of time. As such, this gives assignment holders a high degree of planning and investment certainty.

Re III.4.3 – III.4.12 Coverage obligation

The following comments were made:

- 200 On one side, which included the majority of the respondents, there were calls for high-performance blanket coverage, with some demanding 5G coverage. Merely pointing out the possibility of imposing more far-reaching coverage obligations in later frequency awards in 2026 and 2033 was not sufficient.
- 201 The current draft was not considered acceptable. The scope and quality of the coverage had to be increased. Experience with UMTS and LTE had shown that blanket coverage will not be achieved, which would create a disadvantage for businesses in rural areas.
- 202 Some respondents raised the issue of access for business parks, industrial sites, tourism and agriculture, particularly in rural areas.
- 203 There were calls for clear quality parameters to be defined.
- 204 Some questioned the statements about costs running into the tens of billions in connection with the coverage obligations proposed by the Advisory Council on 25 June 2018. Concerns were expressed that the planned coverage obligations will exceed the limits of what is economically feasible or legally possible.
- 205 Some respondents suggested holding a negative price auction before the auction proceedings in order to secure 5G coverage in rural areas. Regions in the rural areas should be divided between the network operators and the network operator in each region should be able to use the full bandwidth of 300 MHz (3400 MHz – 3700 MHz) for a minimum of five years without any competition. This should avoid any uneconomic duplication of infrastructure in sparsely populated areas. The rollout costs should be offset against the auction revenues for the 2 GHz and 3.6 GHz frequency bands.
- 206 It was said that coverage in rural areas for the population and industry irrespective of population density was more important than a pioneering role in 5G. One respondent called for full coverage to be stipulated throughout Germany of at least 100 MBit/s by the end of 2022. It was also claimed that the networks should be consolidated. To reduce public resistance in this regard, a greater spirit of cooperation should be fostered among the operators.
- 207 The rollout must be inspected and any non-compliance with the requirements should be met with sanctions as necessary.
- 208 From respondents on the other side – especially the present mobile network operators – the coverage obligations in the draft or any more far-reaching ones were rejected. However, although they welcomed taking economic feasibility into account, in economic terms the planned obligation could not be met with the spectrum to be awarded and it tended more towards a universal service obligation. Costs in the tens of billions would arise. Political objectives did not justify a lack of proportionality. Another respondent pointed out the costs of about €20 billion for the 3.6 GHz spectrum rollout throughout the country, claiming this was unaffordable.
- 209 It was stated that the coverage obligations should not be disproportionately high. The current obligation was not considered reasonable as it would force recourse to spectrum assigned earlier. The obligation should be adjusted so that it can still be met with only the spectrum available for award. Rural area spectrum from earlier award proceedings would be retroactively burdened with obligations as the planned obligations can only be met with existing rural area spectrum. This would make the entire auction award legally contestable. Too ambitious coverage obligations would lead to inefficient investment and place an excessive burden on the network operators, which would compromise Germany's 5G edge in Europe.

- 210 There were calls for the obligations to be scaled back or the deadline to be postponed until the end of 2025.
- 211 Moreover, it was stated that the quality of supply should be defined more precisely.
- 212 It was claimed that if the network rollout were to be limited in the vicinity of correctional facilities, this would cause new regions to be without mobile coverage as a result of regulatory requirements; in particular this would affect regions in urban areas and/or close to federal highways or rail routes. The restrictions in coverage for household and transport routes that result from these requirements must be fully taken into account as part of the relevant obligations.
- 213 With respect to an asymmetrical coverage obligation, firstly it was stated that this would create an artificial scarcity of spectrum, secondly, any such coverage was rejected as it would lead to a significant distortion of competition. Hence an assignment holder would have the advantage of a lower price limit for a frequency block subject to the coverage condition, whereas the competitor, who is likewise expanding its network, would not receive this financial benefit. A non-discriminatory award of frequencies would therefore no longer exist. Moreover, additional obstacles would be created that would prevent other assignment holders from competing in the relevant areas. Bidders without specific obligation would have to pay a higher price for more moderate coverage obligations, which would deprive all network operators of the financial means necessary for the network rollout. Consequently, the rollout in rural and urban areas would slow down. An asymmetric obligation would therefore contradict the regulatory aims of the TKG. With a view to future auctions, an asymmetric obligation would follow a path that would make later symmetrical coverage obligations difficult. Future coverage obligations relating to transport routes or urban and rural areas may then have to be drawn up asymmetrically once again. In the long-term, this could even lead to individual coverage obligations for each undertaking. Any such approach, however, would not be compatible with a regulatory approach committed to free network competition and most likely would not be politically desirable either.
- 214 It was stated that the arrangement for coverage along roads was insufficient and appeared to be unduly moderate. In the medium term, blanket 5G coverage along transport routes was necessary for all types of road (national, state, local and municipal) for automated and networked driving. Hence a suitable reception model should be developed and future requirements should be addressed.
- 215 It was suggested that direct communication between vehicles was not sufficient for all types of application.
- 216 It was said that coverage of national roads should be linked to all 2 GHz spectrum.
- 217 In addition, respondents felt that suitable quality parameters (latency, data rates, dynamic availability and quality of service) should be specified and that merely pointing to later awards or making reference solely to LTE was not sufficient. Data rates higher than 100 Mbit/s should be provided for gradually.
- 218 There were calls for more extensive coverage obligations for transport routes to be completely suspended. To achieve the desired coverage along transport routes, it was suggested that instead of imposing an asymmetrical coverage obligation for federal roads following the auction, each assignment holder should be given an opportunity to commit to providing coverage of 100 Mbit/s along German motorways and federal roads in return for a discount of €150 million on the holder's winning bid.
- 219 Respondents claimed that complete coverage of motorways and federal roads with 100 Mbit/s by 2022 in connection with the obligation to achieve 98% coverage of the population with 100 Mbit/s would fail through insufficient construction resources. In the event of such obligation, the deadline – possibly alongside other interim stages – should be extended to 31 December 2025.

- 220 It was said that there was still a need to limit the obligation so that coverage had only to be provided as long as it was not legally or actually impossible.
- 221 Comments were made that the inclusion of federal roads due to the blanket coverage nature of the obligation must be viewed in an extremely critical legal light. The inclusion of state or local roads, as demanded in the Advisory Council decision, was not reasonable and could not be achieved with the spectrum available for award. Extending the scope in this way would have a prohibitive effect.
- The Chamber has ruled as follows:**
- 222 In accordance with section 61(4) second sentence para 4 TKG, prior to award proceedings the Chamber determines the frequency usage conditions, including the degree of coverage with the frequency usage and the time for achieving such coverage. The coverage obligation forms an integral part of the frequency assignment, as laid down in section 61(6) TKG.
- 223 The imposition of a coverage obligation is designed to achieve two objectives: that the rollout of networks is started promptly and continued consistently. This serves the interests of consumers by ensuring telecommunications networks and services are available quickly. It also aims to ensure that the spectrum assigned is deployed and utilised as quickly and efficiently as possible.
- 224 The imposition of a coverage obligation is designed to fulfil the regulatory objectives arising from the federal government's mandate to ensure the availability of telecommunications infrastructure (Article 87f Basic Law (GG)). In particular, it realises the regulatory objectives of safeguarding user and most notably consumer interests in telecommunications (section 2(2) para 1 TKG), of promoting telecommunications markets with sustainable competition in services and networks and in associated facilities and services (section 2(2) para 2 TKG), of encouraging efficient investment in infrastructure within the meaning of section 2(3) TKG, of accelerating the rollout of high-speed next-generation public telecommunications networks (section 2(2) para 5 TKG), of promoting the development of the internal market of the European Union (section 2(2) para 3 TKG), and of securing the efficient and interference-free use of frequencies (section 52 in conjunction with section 2(2) para 7 TKG).
- 225 On account of the physical properties of the spectrum to be awarded, and the coverage obligations imposed in previous award proceedings, it is important to ensure the appropriateness and economic reasonableness, and ultimately the proportionality, of any measure.
- 226 A coverage obligation is permissible per se, but its substance is governed by the principle of proportionality and the prohibition of discrimination:
- High, blanket coverage obligations can lead to unprofitable investments.
 - Coverage obligations tied to particularly high costs can lead to a fall in market demand for spectrum, which means it cannot be used for network rollout.
 - Coverage obligations can result in certain provider groups as well as existing and innovative business models being squeezed out.
 - High coverage obligations that apply to all assignment holders equally can reduce infrastructure competition due to a lack of the ability to differentiate.
- 227 As such, an obligation must be suitable, necessary and reasonable for meeting the regulatory objectives in section 2(2) TKG. The goal is to improve mobile broadband coverage in Germany in the interests of consumers.
- 228 A coverage obligation proves to be no longer reasonable the more it obliges the applicants to use spectrum that is either no longer deployed or would not be deployed in the future due to business considerations. In densely populated areas mobile

networks are already being built that are capable of dealing with extremely high data rates in order to meet consumer demand. The question also arises of whether a blanket increase to data rates for rural areas would be proportionate with regard to the costs involved and actual demand. It is therefore necessary to look at whether an increase, and if so which increase, to data rates by way of a coverage obligation could reasonably be considered to be in the interests of consumers.

- 229 The Chamber thus based its considerations on the following principles with respect to the coverage obligations:
- A coverage obligation must be structured transparently and ensure the efficient use of spectrum in accordance with section 52 TKG and/or the regulatory objectives in section 2 TKG.
 - The coverage obligation cannot result in comparable applicants being treated unequally with respect to acquiring scarce spectrum resources, or non-comparable applicants being treated equally, unless justifiable on objectively legitimate grounds.
 - A coverage obligation proves to be no longer reasonable the more it obliges the applicants to use spectrum that is either no longer deployed or would not be deployed in the future due to business considerations. It is to be viewed all the more as no longer reasonable the more specific the requirements are that it imposes on the applicants for their future network planning.
 - A coverage obligation will be assessed all the more as being no longer reasonable, the closer it becomes materially to being a universal service obligation.
 - A coverage obligation is to be viewed all the more as no longer reasonable the larger the deficit created by the network rollout it stipulates. An unacceptable financial burden is to be assumed in particular when the costs reduce the value of the spectrum package to nil and the operators are thus prevented entirely from acquiring spectrum (prohibitive effect).
 - A coverage obligation is to be viewed all the more as no longer reasonable the more it causes applicants to use spectrum already assigned in order to fulfil their obligations, even if it does not constitute a subsequent change versus earlier coverage obligations. Provided the network operators can calculate the costs involved in the coverage obligation into their bids, however, these will not have a retroactive effect on economic evaluations carried out in previous spectrum assignment proceedings and are thus proportionate.
- 230 The Advisory Council included targets to improve mobile broadband coverage to households and along transport routes in its resolution of 25 June 2018 (cf Annex 10).
- 231 These targets were also addressed during the oral hearing of the Chamber on 13 July 2018. It was suggested that efforts should be made to roll out 5G mobile coverage nationwide, in particular along all transport routes. However, attention was drawn to the substantial volume of investment this would require. Costs could run into the tens of billions for each network operator.
- 232 The Chamber has set the coverage obligations on the basis of the targets in the Council resolution and taking public comments into consideration. These coverage obligations apply to all successful bidders that already hold nationwide assignments. Moreover, special coverage obligations were set for new entrants.
- 233 No asymmetrical block-related coverage obligations as originally planned in the draft consultation document will be set. The Chamber is thus accommodating respondents' objections to an asymmetrical coverage obligation for transport routes.

- 234 After weighing all the interests, the Chamber concluded that a symmetrical determination of the coverage obligations was better suited to achieving the regulatory objectives than an asymmetrical obligation.
- 235 Future assignment holders that already have mobile radio networks throughout Germany are in competition with each other in the same market. From the Chamber's point of view, it is imperative that companies competing with each other in the same market should also be treated the same. This will create a level playing field for effective competition between market players. The Chamber recognises that a block-related obligation could have the effect of benefiting just one competitor as already pointed out by some respondents. This could give rise to different initial conditions. As an example, and as mentioned by respondents, competitors could be required to observe the obligation for reasons of competition without having any possible benefit from doing so due to a lower award price for the frequency block subject to the obligation.
- 236 Moreover, the Chamber also considered the fact that an asymmetrical obligation in these auction proceedings could make it difficult to impose symmetrical coverage obligations in future proceedings. Finally the Chamber also took into consideration that imposing symmetrical coverage obligations would markedly reduce the auction's complexity.
- 237 Even if no asymmetric obligations are provided for, the burdens on the assignment holder caused by high coverage obligations have still been taken into account by the Chamber, albeit in a different manner, in order to retain proportionality:
- Scaling down the minimum bids (cf. subsection III.5);
 - Reduction in the minimum bid increment (cf. subsection IV.3.6)
 - Later payment date for spectrum that will be available from 2026 (cf. subsection IV.4.1);
 - The possibility of coverage by other network operators counting towards individual coverage obligations;
 - Increasing the opportunities for cooperation (cf. subsection III.4.17).
- 238 Taking into account the consultation responses received, the following coverage obligations and associated quality parameters are being set:
- coverage with a transmission rate of at least 100 Mbit/s for at least 98% of households by the end of 2022,
 - coverage with a transmission rate of at least 100 Mbit/s and a maximum latency of 10 milliseconds (ms) for all German motorways by the end of 2022,
 - coverage with a transmission rate of at least 100 Mbit/s and a maximum latency of 10 ms for all federal roads with connectivity function levels 0 or 1 by the end of 2022,
 - coverage with a transmission rate of at least 100 Mbit/s and a maximum latency of 10 ms for all other federal roads by the end of 2024,
 - coverage with a transmission rate of at least 50 Mbit/s for all state roads by the end of 2024,
 - coverage with a transmission rate of at least 50 Mbit/s for seaports and the inland waterways core network by the end of 2024,
 - coverage with a transmission rate of at least 100 Mbit/s for rail routes with more than 2,000 passengers daily by the end of 2022,

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- coverage with a transmission rate of at least 50 Mbit/s for all other rail routes by the end of 2024,

and, by the end of 2022:

- operation of 1,000 "5G base stations", and
- operation of 500 base stations with a transmission rate of at least 100 Mbit/s in not-spots.

The following coverage obligations apply to new market entrants:

- coverage of at least 25% of households by the end of 2023, and
- coverage of at least 50 % of households by the end of 2025.

New market entrants purchasing spectrum in the 3.6 GHz band only must achieve:

- coverage of at least 25% of households by the end of 2025.

New market entrants purchasing 3.6 GHz spectrum must:

- take into operation 1,000 "5G base stations".

- 239 When compared with the coverage obligations provided for in the draft consultation, the coverage obligations prescribed aim at significantly broader coverage, especially along transport routes. The originally planned coverage, which included only the motorways, the federal roads and heavily used rail routes, has been extended so that the obligation now covers all state roads, rail routes and waterways. Whilst motorways and federal roads will still be subject to a latency requirement, the Chamber is of the opinion that, when taken together, these obligations would clearly exceed the limits of what is economically feasible if each assignment holder had to implement all the obligations in full solely by physically expanding its own network. In this respect the Chamber has taken into consideration the expansion of existing mobile networks as a whole, as well as the vastly different stages of development, in part, of the networks. Furthermore, account was taken of the fact that current coverage will improve considerably by the end of 2019 as a result of meeting the coverage obligations from the 2015 auction.
- 240 From the Chamber's point of view, the proportionality of the coverage obligations is especially taken into account by the possibility of counting other network operators' coverage towards the obligations. The coverage obligations with respect to the transport routes (federal and state roads, waterways and rail routes) allow coverage provided by other mobile network operators to count towards the target coverage. This and the enhanced possibilities for cooperation enable network operators to meet all the obligations not simply by rolling out their own physical network infrastructure.
- 241 Even if not every mobile customer can fully benefit from allowing coverage provided by other mobile network operators to count towards the target coverage, the Chamber still expects that assignment holders will enter into cooperation on a contractual basis within the limits set by competition and telecommunications law, for instance regarding infrastructure sharing or roaming, so that further expansion will occur through every assignment holder.
- 242 Overall the coverage obligations are suited to promoting the regulatory aims of the TKG.

- 243 The coverage obligations are suited to safeguarding consumer interests in the area of telecommunications (section 2(1) para 1 TKG). The obligations should promote network expansion to the benefit of consumers with improved mobile coverage. Efficient networks are a prerequisite for consumers to use mobile broadband services and thus being able to benefit from the digital transformation. Alongside improved coverage for households and transport routes, the obligations are also intended to help remove not-spots, where no mobile coverage has so far existed. From a demographic perspective, not-spots frequently occur in rural areas, hence the coverage obligations described can also help to maintain equal living conditions between town and country.
- 244 The Chamber points out in this respect that even more far-reaching investment would be required of the assignment holders if more stringent coverage obligations – as called for by numerous respondents – were imposed. The costs of more far-reaching obligations would have an adverse impact on mobile prices in the medium to long-term and therefore would negatively affect consumer interests.
- 245 The rollout requirements are also suited to ensuring fair competition (section 2(1) para 2 TKG). In particular, the different obligations provided for new market entrants would reduce the market entry barriers.
- 246 The coverage obligations further meet the regulatory objective of promoting sustainable and competitive telecommunications markets for services and networks (section 2(1) para 2(1) para 2 TKG). Firstly the obligations are intended to ensure that consumers benefit from telecommunication services and networks being available in rural as well as urban areas. Whereas, secondly, the obligations safeguard infrastructure competition by allowing the individual assignment holders the opportunity to set themselves apart from the competition with respect to choice, price and quality through their own network expansion.
- 247 The coverage obligations for the transport routes (federal and state roads, waterways and rail routes) allow other mobile network operators' coverage to count towards the target coverage.
- 248 This and the greater possibilities for cooperation enable network operators to meet all the obligations not simply by rolling out their own physical network infrastructure. In particular the fact that coverage by other mobile network operators counts towards the target coverage allows operators to implement different network coverage and thus different business models. The possibilities for cooperation allow unused spectrum to be leased and, in return, coverage to be achieved through roaming. Moreover, there is opportunity for competitive differentiation regarding network quality (eg data rates and latency).
- 249 By contrast, stricter symmetrical obligations without the opportunity for cooperation or for offsetting coverage could lead to increasing uniformity in mobile networks. This would have a considerable effect on the choice, price and quality offered by the telecommunication services and networks. The objective most notably expressed in political spheres of achieving connectivity for all users irrespective of their network operator is at odds with the safeguarding of infrastructure competition. From the assignment holders' point of view, coverage obligations that are too rigid could exclude certain business models or make their implementation so difficult that the assignment holder is forced into making investments that do not pay off for the business model. From the consumer's point of view, a restriction of possible business models could also limit the choice of competing services and networks.
- 250 Furthermore, the set coverage obligations are suited to speeding up the rollout of next generation high-speed public telecommunications networks (section 2(1) para 5 TKG). The obligations will help to expand the mobile networks. Even if the obligations are designed to be technologically neutral, the network rollout that they encourage will enable the current infrastructure to be upgraded to new technologies, especially in

areas that previously suffered a lack of cover as soon as the corresponding business models have been developed. The quality parameters linked to the obligations, such as data rates and latency requirements, are aimed at the speedy implementation of 5G features in the networks, thus making them 5G-capable. Moreover, the obligations requiring base stations to be made available for 5G applications facilitate the rollout of fifth generation mobile communications and consumers in every federal state will benefit from this.

- 251 The coverage obligations serve to promote efficient spectrum use (section 2(2) para 7 TKG). Although the Chamber assumes that the frequencies assigned nationwide will be used efficiently within each business model, the network rollout will be planned according to the assignment holders' economic considerations. In view of this, frequencies will possibly not be fully used in regions where rollout is not, or only partially, economically viable. It is especially in these regions that the coverage obligations promote the use of frequencies so that consumers in as many locations as possible can benefit from the frequency usage. It must also be considered that coverage obligations to ensure the provision of basic services may create competitive incentives for further network expansion. Furthermore, the first-time availability of broadband connections in those regions still without cover could foster demand for broadband services and, given the willingness of consumers to pay for these, contribute to the economic efficiency of base stations in a region.
- 252 The coverage obligations are necessary and proportionate in their entirety in order to promote the regulatory aims of the TKG. Furthermore they play a role in achieving the broadband policy targets of the federal government and of the EU, while at the same time supporting the objectives set out in the coalition agreement. In particular, they will push the rollout of mobile telecommunications in rural areas – as called for by respondents – to the benefit of business parks, industrial sites, tourism and agriculture.
- 253 The type and scope of investment in network rollout is generally subject to the decision of private sector undertakings. Should the network rollout only take place within the limits of economic considerations, however, this runs the risk of some consumers only gaining very limited use from the frequency usage. Moreover, it appears appropriate to encourage further network expansion with respect to both available quality and mobile coverage in order to promote the development of innovative broadband services and that of Germany as a location for business and investment.
- 254 The frequency usage rights and the subsequent possible network rollout are particularly significant both for national economic growth and the extent to which the consumer can benefit from the frequency usage. In forming the obligations it must be taken into consideration that the assignment holders are receiving a scarce asset with a particularly high economic value in the form of frequencies. The Chamber has balanced the individual interests of the assignment holders against the public interest in the efficient and nationwide deployment of the frequencies.
- 255 With this in mind, the coverage obligations set out above are based in their entirety on cost estimates in order to maintain proportionality. The Chamber is aware that each bidder subjectively allocates a different value or costs both to the frequency usage rights on offer and to their associated obligations, and weighs these up against each other. The auction proceedings are particularly suited to taking due regard of these subjective cost estimates. The auction enables the bidders to determine a pricing structure for the obligations in their respective bids, and the minimum bids are set along these lines.
- 256 In the Chamber's view, the obligations set out above maintain the cost framework that is dictated by the value of the spectrum.

- 257 Firstly, it was taken into account that assignment holders may use all their assigned spectrum – including frequencies below 1 GHz — for cost-effective network rollout, which can avoid unreasonable costs for the assignment holders. The physical propagation characteristics of the frequencies below 1 GHz make them particularly suited to coverage in rural areas as their large range means that considerably fewer base stations would be required, for instance for coverage of 98% of households, than would be needed with the 2 GHz and 3.6 GHz frequencies currently made available for auction. Moreover, the possibility of deploying the entire assigned spectrum gives the respective network operator the flexibility to decide how to fulfil its obligation in line with its business model and previous network rollout.
- 258 Secondly, care must also be taken that the coverage obligations do not cause any disproportionate retroactive effect on the spectrum already assigned. At best this could be the case if the assessment of the economic aspects of rural area spectrum carried out in the previous award proceedings would be retroactively questioned because of the possible excessive costs of a coverage obligation in these proceedings. In view of the cost estimate, however, the Chamber is of the opinion that the financial burdens of the obligations mandated in these proceedings can be assessed in the pending bidding competition for the 2 GHz and 3.6 GHz spectrum. In the Chamber's view, the costs of the coverage obligations in these proceedings do not exceed the value of the spectrum available for award.
- 259 The coverage obligations set out above are also non-discriminatory. In particular, the obligations relating to transport routes allow other operators' coverage to count towards the target coverage to prevent placing disproportionate burdens on individual assignment holders. Moreover, a different coverage obligation is planned for potential new entrants that do not yet have their own national mobile communications network.
- 260 The Chamber is basing its considerations expressly upon the opportunities for cooperation between mobile network operators, for instance through infrastructure sharing and roaming. This could allow the burdens arising out of the coverage obligations to be reduced for the benefit of all assignment holders. The pertinent negotiation requirement is suited to creating incentives for all market participants to meet the special challenges of nationwide network rollout by way of cooperation.
- 261 Where nationwide coverage with 5G was called for by the respondents, the Chamber has not complied with this and points out that the associated financial burden would be disproportionate, would not satisfy the actual needs of consumers, could lead to a rise in mobile communications prices and therefore would have a negative effect on consumer interests. This would not be suitable, necessary or appropriate. Any such expansion would have costs running into the billions, which it would not be possible to factor in within the scope of this auction.
- 262 Insofar as respondents call for coverage of all transport routes, including local and rural roads, and also for higher quality parameters, the Chamber cannot accept this. The costs involved would exceed the value of the frequencies and therefore would no longer be reasonable.
- 263 In respect of the call for the expansion to be checked and any non-compliance with the obligation to be sanctioned, reference is made to the statements under subsection III.4.13.
- 264 Where the respondents assumed that the mobile coverage would be restricted in the vicinity of correctional facilities and there were calls for this to be fully addressed in the coverage obligations, the Chamber clarifies this as follows: The rollout of the mobile communications network should still be possible even in the vicinity of correctional facilities. However, the interests of the correctional facilities should be taken into consideration in the network planning. Alternatives should be examined on a case-by-case basis that do not place any restrictions on coverage for consumers yet take account of the interests of the correctional facilities to a reasonable extent.

Specifically with respect to the coverage obligations:

Re III.4.3 Coverage obligation with respect to households

The following comments were made:

- 265 It was said that coverage should not only relate to households, but must also be mobile and take account of industry, businesses/industrial estates, agriculture and tourism in rural areas.
- 266 Since coverage for households with 100 Mbit/s by 2022 could (only) be achieved using LTE, the obligation led to a technological dead end. This was one of the reasons the obligation conflicted with the regulatory objectives.
- 267 The fact must also be taken into account that not all the network operators had the same amount of spectrum below 1 GHz. Only Deutsche Telekom would be able to achieve high bandwidths in rural areas without using spectrum in the 700 MHz band. Since the combination of 800 MHz and 700 MHz spectrum was considerably more cost-intensive than the combination of 800 MHz and 900 MHz spectrum, however, Deutsche Telekom had a competitive advantage in this case. It was not foreseeable at the time of the 2015 auction that the coverage obligations imposed would be tightened later.
- 268 It was also pointed out that an obligation of coverage with 100 Mbit/s for 98% of households would result in over-dimensioned network capacity in rural areas.
- 269 The deadline for meeting the obligation should be extended to 31 December 2025. This presupposed, however, that the rollout target could be achieved with 20 MHz of spectrum at each base station site and that, consequently, there would be no need to increase the density of the network or the number of base station sites. The technical parameters in the coverage obligation for households had to remain unchanged and should on no account be modified at a later date.

The Chamber has ruled as follows:

- 270 Coverage of at least 98% of households with transmission rates of 100 Mbit/s in each sector by each assignment holder is suitable, necessary and proportionate for realising the regulatory objectives pursued by the assignment of spectrum and the federal government's broadband targets defined in the coalition agreement between the CDU, CSU and SPD parties of 7 February 2018.
- 271 The coverage obligation is considered to be met for a household when the above data rate is generally available. As such, the above data rate must not only be made available at the antenna but also in the sector. This does not take account of traffic loads generated by other subscribers.
- 272 In this context, the Chamber refers to its statements in the decision of the President's Chamber of 28 January 2015 (BK1-11/003, margin no 661):
- "The Chamber wishes to clarify that a coverage obligation in respect of geographical areas eg rural districts, administrative districts or federal areas without taking the population or demand there into account is neither reasonable nor suitable to achieve the broadband strategy and Digital Agenda 2014-2017 objectives. Even a stipulation to serve a geographical area, such as 98 % of a specific region, will not ensure that every single household is covered."*
- 273 This obligation – together with those from the auction in 2015 – will ensure that rural regions will also benefit from the mobile broadband rollout.
- 274 By raising the level of coverage in all federal states to 98% of households when compared with the obligation from the auction in 2015, the Chamber expects better coverage to be achieved in rural areas, in particular in those federal states with lower

- population densities. The coverage obligation increases from 97% at present to 98% of households to be covered in every federal state.
- 275 The Chamber also feels that lifting the transmission rate from 50 Mbit/s to 100 Mbit/s is reasonable. The aim is to make adequate broadband services available to users nationwide. Such broadband services include applications that require high bit-rate connections. The Chamber feels that a minimum transmission rate of 100 Mbit/s in each sector is appropriate to enable the use of innovative services, particularly in rural areas where they are often in greater demand. This can also help to reduce the digital divide between urban and rural areas and promote equal living conditions. This can lead to transmission rates for subscribers in rural areas that are comparable with the rates in urban areas, as in most rural areas fewer people are logged into mobile radio cells at any one time.
- 276 The Chamber anticipates that the obligation to roll out mobile networks under competitive conditions is also in consumer interests as defined in section 2(2) para 1 TKG, since it will result in higher data rates.
- 277 In this context, the Chamber wishes to clarify that the assignment holder can use its entire package of spectrum to meet the coverage obligation and is not restricted to using only the frequency blocks acquired in these award proceedings. In the Chamber's view, this will not involve any unacceptable repercussions on spectrum assigned in earlier award proceedings. The deployment of rural area spectrum already assigned can significantly reduce the cost burden of the coverage obligations on existing network operators. At the same time, applicants can incorporate the costs associated with the coverage obligation into their bids.
- 278 The increase in data rates can be accommodated using a proportionate amount of technical effort, in particular by deploying 700 MHz spectrum. All existing nationwide mobile operators hold sufficient sub-1 GHz spectrum to meet the obligation cost effectively. In most cases this does not require extensive cell densification as existing sites can be upgraded. The fact that not all the network operators had the same amount of spectrum below 1 GHz is not relevant in this context. What is important in the Chamber's view is that every mobile operator has sufficient spectrum. Regarding comments that the required coverage can only be achieved using LTE, the Chamber wishes to make it clear that the required data rate does not relate to each individual subscriber but to overall capacity in the sector. This does not restrict operators to a certain technology. The rollout of new technologies such as 5G is therefore not hindered.
- 279 The Chamber has also considered the fact that all existing nationwide mobile operators are already under obligation to cover 98% of households with 50 Mbit/s by the end of 2019.
- 280 This applies all the more since the coverage obligation applies to every assignment holder, meaning that the Chamber expects the competitive wireless broadband rollout to result in coverage to virtually every household, including in rural areas. The Chamber bases this on the fact that the three current nationwide network operators will be obliged to cover 98% of households across Germany.
- 281 Increasing the data rate from 50 Mbit/s to 100 Mbit/s will implicitly also improve network coverage in areas in which the rates currently available are still below 50 Mbit/s. Rates below 50 Mbit/s already exist at the outer edges of the sector that continue to fall with decreasing proximity to the antenna. Increasing the required data rate to 100 Mbit/s will double the data rates over the entire sector. This means that where speeds of, for example, 30 Mbit/s are currently available, the rates could climb to 60 Mbit/s in future. As a result, therefore, mobile broadband will be available to more than 98% of households.

- 282 This obligation must be met by all assignment holders since all existing mobile network operators will start from similar positions at the end of 2019 as a result of the coverage obligation from the auction in 2015.
- 283 On the other hand, the Chamber feels that further increasing the data rate, for example to 300 Mbit/s for each network operator, is not proportionate:
- 284 A data rate higher than 100 Mbit/s for 98% of households would require massive cell densification efforts in rural areas. However, a substantial number of new base stations would have to be erected in order to cover 98% of households. If a mobile network operator with 26,000 base stations were to achieve nationwide coverage of 300 Mbit/s in each sector exclusively in the 3.6 GHz band, for instance, it would have to erect more than ten times the number of base stations. According to the Chamber's estimates, this would result in costs in the double-digit billion range for each network operator. This would also be the case, albeit to a lesser extent, if other frequencies were used. A rate of 300 Mbit/s would not be reached even if the assigned rural area spectrum in the existing networks were used. Thus the deployment of rural area spectrum to reduce costs would not be possible.
- 285 In its deliberations, the Chamber considered the fact that the availability of three infrastructures each with 100 Mbit/s will make total mobile communications capacity of 300 Mbit/s available to 98% of households. Further, the Chamber believes that nominally higher data rates can be provided in urban areas in any case.
- 286 Since the assignment holders already have sufficient spectrum to fulfil the obligation and are also required by the obligation from the spectrum auction in 2015 to achieve coverage of 98% of households by the end of 2019, the deadline – end of 2022 – for meeting the obligation appears reasonable. The Chamber has therefore not followed the suggestion to extend the deadline to 31 December 2025.
- 287 In response to the comments that the technical parameters in the coverage obligation for households should not be changed, the Chamber wishes to draw attention to its explanations in subsection III.4.13.
- 288 If a bidder only purchases spectrum in the 2 GHz band that is available from 2026, the deadline for meeting the obligation will be extended. In this case, the deadline will be 31 December 2027.
- 289 The coverage obligation does not apply to new entrants (cf subsection III.4.12).

Re III.4.4 Coverage obligation with respect to German motorways

The Chamber has ruled as follows:

- 290 For German motorways, assignment holders must, by 31 December 2022, achieve coverage with a downlink transmission rate of at least 100 Mbit/s per sector. The German motorway network comprises around 18,000 km.
- 291 The obligation must be met by all assignment holders since all existing mobile network operators will start from similar positions at the end of 2019 as a result of the coverage obligation from the auction in 2015.
- 292 The requirement to provide 100 Mbit/s coverage for German motorways will follow the lines of the coverage obligation for households. The intention is to ensure that in future consumers have access to high-performance broadband connections on Germany's motorways. The Chamber feels that a minimum transmission rate of 100 Mbit/s in each sector is appropriate to accommodate the increasing demands, particularly in light of the high volume of traffic on the motorways and the increasing degree of automation on transport routes.
- 293 The coverage obligation is considered to be met for a route when the above data rate is generally available. As such, the above data rate must not only be made available

- at the antenna but also in the sector. This does not take account of traffic loads generated by other subscribers.
- 294 A latency of no more than 10 ms between a terminal and the associated base station must be ensured.
- 295 The obligation is proportionate. The situation is similar to when the 2015 auction imposed its rollout obligation for German motorways. The mobile operators are required by the coverage obligation from the auction in 2015 to provide full coverage for Germany's motorways. The Chamber believes that the transmission rate of 100 Mbit/s as required in these proceedings is reasonable, since it can largely be achieved by upgrading existing sites.
- 296 The Chamber also took account of the fact that, on a contractual basis but within the limits of competition and telecommunications law, assignment holders can enter into cooperation arrangements (eg on infrastructure sharing or roaming), which significantly reduce network costs.
- 297 The coverage obligation for German motorways only applies where network rollout is legally permissible and actually possible. There could conceivably be restrictions along these motorways, eg in natural conservation areas.
- 298 The assignment holder may use all the assigned spectrum usage rights for fulfilling the coverage obligation. In the Chamber's view, this will not involve any unacceptable repercussions on spectrum assigned in earlier award proceedings. The deployment of rural area spectrum already assigned can significantly reduce the cost burden of the coverage obligations on existing network operators. At the same time, applicants can incorporate the costs associated with the coverage obligation into their bids.
- 299 In this respect, too, the end of 2022 as the deadline for fulfilling the coverage obligation seems appropriate. The broadband coverage required under the terms of the 2015 auction for the German motorways will basically be in place by the end of 2019, and will serve the assignment holder in question as the base on which to expand.
- 300 The Chamber does not feel it generally necessary to impose specific quality parameters – such as latencies or specific transmission rates. Latency and transmission rate requirements are different depending on the application, eg voice applications or Industry 4.0 applications. Nevertheless, the Chamber feels it necessary to impose latency requirements for motorway coverage in these proceedings. This should promote the introduction of new services such as automated driving. The Chamber feels it is appropriate to require a latency of no more than 10 ms between a terminal and the associated base station with a view to ensuring both efficient and secure coverage for the motorway network.
- 301 A required maximum latency of 10 ms between a terminal and the associated base station seems to be adequate today to accommodate the requirements of automated driving, for instance to increase road traffic safety, and thus the interests of consumers as well as societal objectives. Latency is highly important in this particular case. The Chamber is not unaware of the fact that demands regarding latency may increase as technical developments in the field of automated and networked driving progress. The Chamber will, however, also take into account whether and how the demand for corresponding applications in the market changes.
- 302 The Chamber feels it is not proportionate to impose a blanket end-to-end latency requirement, especially if there is currently no demand for such quality parameters. Furthermore, different latency times will be needed for different requirements. As such, the responses themselves varied with respect to automated driving.
- 303 The fact must also be taken into account that, depending on the services provided, the assignment holder is not always solely responsible for latency. As soon as a

service uses third-party network infrastructure, the assignment holder may no longer be able to influence the latency.

304 It can be assumed, however, that the mobile operators will achieve appropriate quality parameters based on the demand in their networks. Regarding the calls to gradually increase the quality parameters in the long term, the Chamber wishes to point out that the quality requirements will need to be re-examined in future award proceedings on the basis of demand and technical developments at that time.

305 If a bidder only purchases spectrum in the 2 GHz band that is available from 2026, the deadline for meeting the obligation will be extended. In this case, the deadline will be 31 December 2027.

306 The coverage obligation does not apply to new entrants (cf subsection III.4.12).

Re III.4.5 Coverage obligation with respect to federal roads

The Chamber has ruled as follows:

307 For federal roads with connectivity function levels 0 or 1, the assignment holder must, by 31 December 2022, achieve coverage with a downlink transmission rate of at least 100 Mbit/s per sector.

308 Coverage for the other federal roads must be achieved accordingly by 31 December 2024.

309 The network of federal roads with connectivity function levels 0 or 1 is about 5,350 km. The network of other federal roads is about 32,700 km (Annex 4).

310 To ensure the population has mobile broadband coverage, it is appropriate for the federal roads to have full coverage too, provided this is possible in law and in practice. It is necessary to supply these transport routes with mobile broadband and meet the need for connectivity.

311 The order for the obligation to provide 100 Mbit/s coverage for federal roads corresponds to the coverage obligation for households. The intention is to ensure that in future consumers will have access to high-performance broadband connections on federal roads. The Chamber feels that a minimum transmission rate of 100 Mbit/s in each sector is appropriate to accommodate the increasing demands, particularly in light of the high volume of traffic on the federal roads and the increasing degree of automation on transport routes.

312 The coverage obligation is considered to be met for a route when the above data rate is generally available. As such, the above data rate must not only be made available at the antenna but also in the sector. This does not take account of traffic loads generated by other subscribers.

313 A latency of no more than 10 ms between a terminal and the associated base station must be ensured on federal roads.

314 The obligation is proportionate. The mobile network operators are already required by the coverage obligation from the auction in 2015 to provide coverage for 98% of households and full coverage for Germany's motorways. It is therefore likely that a large proportion of federal roads will also have coverage by mobile operators by the end of 2019.

315 The degree of rollout of the individual mobile networks on federal roads is asymmetric, however, which means that imposing an obligation for full rollout by every assignment holder would result in wide differences of rollout costs between network operators.

316 The Chamber takes account of this situation by allowing coverage of federal roads provided by other assignment holders to count towards the target coverage.

- 317 However, the Chamber expects assignment holders to enter into cooperation arrangements (eg on infrastructure sharing or roaming) on a contractual basis within the limits of competition and telecommunications law, so that each assignment holder contributes to rollout along the federal roads.
- 318 The coverage obligation for federal roads only applies where network rollout is legally permissible and actually possible. There could conceivably be restrictions along the federal roads, eg in nature conservation areas.
- 319 The assignment holder may use all the assigned spectrum usage rights to fulfil the coverage obligation. In the Chamber's view, this will not involve an impermissible retroactive effect on spectrum assigned in earlier award proceedings. The deployment of rural area spectrum already assigned can significantly reduce the cost burden of the coverage obligations on existing network operators. At the same time, they can incorporate the costs associated with the coverage obligation into their bids.
- 320 Given the length of the total network of federal roads, it seems appropriate to introduce deadlines to fulfil the coverage obligation in phases. Federal roads with connectivity function levels 0 or 1 must have coverage by 31 December 2022. Coverage for the other federal roads must be achieved by 31 December 2024. The Chamber has thus taken into account the suggestion that the obligations should be imposed in phases, also with a view to the available construction resources.
- 321 The Chamber does not feel it generally necessary to impose specific quality parameters – such as latencies or specific transmission rates. Latency and transmission rate requirements vary depending on the application, eg voice applications or Industry 4.0 applications. Nevertheless, the Chamber feels it necessary to impose latency requirements for federal roads, too, in these proceedings. This should promote the introduction of new services such as automated driving. The Chamber feels it is appropriate to require a latency of no more than 10 ms between a terminal and the associated base station with a view to ensuring both efficient and secure coverage for the federal road network.
- 322 A required maximum latency of 10 ms between a terminal and the associated base station seems to be adequate from today's perspective to accommodate the requirements of automated driving, for instance to increase road traffic safety, and thus the interests of consumers as well as societal objectives. Latency is highly important in this particular case. The Chamber is aware of the fact that demands regarding latency may increase as technical developments in the field of automated and networked driving progress.
- 323 The Chamber feels it is not proportionate to impose a blanket end-to-end latency requirement, especially if there is currently no demand for such quality parameters. Furthermore, different latency times will be needed for different requirements. As such, the responses themselves varied with respect to automated driving.
- 324 The fact must also be taken into account that, depending on the services provided, the assignment holder is not always solely responsible for latency. As soon as a service uses third-party network infrastructure, the assignment holder may no longer be able to influence the latency.
- 325 It can be assumed, however, that the mobile operators will achieve appropriate quality parameters based on the demand in their networks. Regarding the calls to gradually increase the quality parameters in the long term, the Chamber wishes to point out that the quality requirements will need to be re-examined in future award proceedings on the basis of demand and technical developments at that time.
- 326 If a bidder only purchases spectrum in the 2 GHz band that is available from 2026, the deadline for meeting the obligation will be extended. In this case, the deadline will be 31 December 2027 or 31 December 2029 respectively.

327 The coverage obligation does not apply to new entrants (cf subsection III.4.12).

Re III.4.6 Coverage obligation with respect to state roads

The Chamber has ruled as follows:

- 328 For state roads, the assignment holder must, by 31 December 2024, achieve coverage with a downlink transmission rate of at least 50 Mbit/s per sector.
- 329 Assignment holders may enter into cooperation agreements or lease frequencies. Coverage achieved by other assignment holders counts towards the target coverage.
- 330 The German network of state roads comprises around 80,000 km.
- 331 The Bundesnetzagentur aims to improve coverage on state roads as well. To ensure the population has mobile broadband coverage, including outside urban areas, it is appropriate for the state roads to have full coverage too.
- 332 While federal roads connect larger towns and cities (regional centres), state roads fulfil an important function by linking smaller towns and acting as feeders to more important roads. This makes them particularly important in rural areas. Moreover, broadband coverage is necessary on state roads as well to allow automated driving in the future to the greatest extent possible.
- 333 The imposition of the abovementioned coverage obligation for state roads is also in the interest of consumers. They will wish to use automated driving in the foreseeable future, even on roads that are not main transport routes. The coverage obligation for state roads will also help to bring equality to living standards in urban and rural areas and rural areas will not be excluded from improvements in mobile broadband coverage.
- 334 The Chamber feels that a minimum transmission rate of 50 Mbit/s in each sector is appropriate. The Chamber takes the view that coverage with a transmission rate of 50 Mbit/s – ie, half of that which is to be achieved on German motorways and federal roads – is sufficient. Mobile communications are a shared medium, which means the transmission rate provided depends to a large extent on the number of users located in the same sector. There is no doubt that there is less traffic on state roads compared to German motorways and federal roads. Therefore, even taking account of the fact that users share the transmission rate provided in a sector, 50 Mbit/s seems sufficient initially. The Chamber also considered that state roads make up a total of about 80,000 km, significantly more than German motorways and federal roads put together. A transmission rate of 50 Mbit/s seems sufficient, taking account of the higher demands of rollout along state roads and so as not to burden assignment holders with inappropriately high investment costs.
- 335 The coverage obligation is considered to be met for a route when the above data rate is generally available. As such, the above data rate must not only be made available at the antenna but also in the sector. This does not take account of traffic loads generated by other subscribers.
- 336 The obligation is proportionate.
- 337 In imposing a coverage obligation for state roads, the Chamber was guided by the fact that the coverage obligation from the 2015 auction means that a proportion of these roads will be included in coverage. Yet even after this requirement is met by the end of 2019, there will still be many sections of state roads where no mobile broadband coverage is available. The majority of such routes – about 62,000 km – run through unpopulated areas where coverage is particularly difficult, due to the topography, for example. Therefore, imposing an obligation for full rollout by every assignment holder would result in very high costs for each network operator. The Chamber takes account of this situation by allowing coverage of state roads provided by other assignment holders to count towards the target coverage.

- 338 However, the Chamber expects assignment holders to enter into cooperation arrangements (eg on infrastructure sharing or roaming) on a contractual basis within the limits of competition and telecommunications law, so that each assignment holder contributes to rollout along the state roads.
- 339 The coverage obligation for state roads only applies where network rollout is legally permissible and actually possible. There could conceivably be restrictions along the state roads, eg in nature conservation areas.
- 340 The assignment holder may use all the assigned spectrum usage rights to fulfil the coverage obligation. In the Chamber's view, this will not involve an impermissible retroactive effect on spectrum assigned in earlier award proceedings. The deployment of rural area spectrum already assigned can significantly reduce the cost burden of the coverage obligations on existing network operators. At the same time, they can incorporate the costs associated with the coverage obligation into their bids.
- 341 The Chamber does not feel it necessary to impose further quality parameters – such as latency – because demands regarding latency will only arise gradually for state roads with the development of automated driving. It can be assumed that the mobile operators will achieve appropriate quality parameters based on the demand in their networks. Regarding the calls to gradually increase the quality parameters in the long term, the Chamber wishes to point out that the quality requirements will need to be re-examined in future award proceedings on the basis of demand and technical developments at that time.
- 342 The deadline for the coverage obligation will be 31 December 2024.
- 343 The deadline for the fulfilment of the coverage obligation on state roads by the end of 2024 is proportionate. While there will be better broadband coverage along German motorways by the end of 2019 thanks to the obligation from the 2015 auction, and assignment holders will be able to base their expansion on this, state roads will have a lower level of coverage. Also taking account of the larger network, a deadline that is two years later than the one for motorways and federal roads with connectivity function levels 0 or 1 seems appropriate.
- 344 If a bidder only purchases spectrum in the 2 GHz band that is available from 2026, the deadline for meeting the obligation will be extended. In this case, the deadline will be 31 December 2029.
- 345 The coverage obligation does not apply to new entrants (cf subsection III.4.12).

Re III.4.7 Coverage obligation with respect to waterways

The following comments were made:

- 346 Many respondents point out that waterways also need coverage, given their economic significance. This includes coverage for seaports and sea regions and the exclusive economic zone (EEZ), as well as inland waters. Improving coverage for households and other transport routes would not necessarily improve coverage for waterways and coastal areas, it was noted.

The Chamber has ruled as follows:

- 347 For seaports and inland waterways within the federal core network, the assignment holder must, by 31 December 2024, achieve coverage with a downlink transmission rate of 50 Mbit/s per sector.
- 348 The coverage obligation applies to seaports and inland waterways of the federal core network. The Chamber views this as necessary and sufficient. The seaports and inland waterways of the core network are the most important waterways for freight transport, making their coverage a priority. Regarding the inland waterways of the core network, a length of about 4,500 km to be covered may be assumed (Annex 5).

- 349 The Chamber therefore accepts the suggestion of imposing such a coverage obligation. Waterways and seaports play a crucial role in maintaining Germany's leading global position as an export nation. As freight transport is increasing across the world, it is essential for the German economy that the country has a well-functioning network of waterways that is fit for the future. Transporting freight on waterways can relieve pressure on other transport routes, like rail and roads.
- 350 It is therefore essential to increase the attractiveness of waterways as transport routes and to maintain it in the future. Rising requirements in the light of technological developments need to be met on waterways and in seaports as well to ensure that they are a competitive means of transport. High-speed mobile coverage is becoming increasingly important for the introduction and further development of new, radio-based technology in the field of transport and logistics.
- 351 The coverage obligation for waterways is particularly suited for meeting the regulatory objective of promoting the development of the internal market of the European Union pursuant to section 2(2) para 3 TKG. A functioning internal market relies on the creation, maintenance and promotion of efficient and attractive freight transport routes. Mobile coverage of the seaports and waterways of the core network is required to keep pace with technological developments in transport and logistics and to make transport by water an alternative for the future, alongside freight transport on the roads, rails and in the air. As freight transport continues to increase, this coverage forms the basis for efficient, forward-looking transport of goods within the European Union.
- 352 For these reasons, the Chamber takes the view that is appropriate to take coverage for the most important waterways into consideration in the award of spectrum. The aim of the coverage obligation is to provide the basis for a high-speed mobile coverage of waterways and seaports that is fit for the future.
- 353 The Chamber takes the view that coverage with a downlink transmission rate of 50 Mbit/s per sector is initially sufficient and also appropriate. Mobile communications are a shared medium, which means the transmission rate available at a terminal depends to a large extent on the number of users located in the same sector. Taking as a starting point the transmission rate of 100 Mbit/s to be provided on German motorways and busier federal roads, the Chamber believes half this figure is sufficient for waterways, even considering that users in a sector share the transmission rate provided, since the waterways have much less traffic than the motorways and federal roads and a far smaller number of devices being used at the same time.
- 354 The coverage obligation is considered to be met for a route when the above data rate is generally available. As such, the above data rate must not only be made available at the antenna but also in the sector. This does not take account of traffic loads generated by other subscribers.
- 355 The Chamber also points out that as many inland waterways are situated near to roads that will also have to be covered, there will be synergy effects in coverage, so it is fair to assume that some waterways will achieve coverage anyway, because of the obligations for roads. The Chamber took this fact into account in its consideration of the proportionality of the obligation.
- 356 In addition, seaports must have coverage. The Chamber took account of the fact that some of them already have coverage. However, seaports are to be fully covered with mobile broadband because they have great economic importance. Achieving complete coverage in these areas may require the cooperation of port operators.
- 357 The coverage obligation for waterways and seaports only applies where network rollout is legally permissible and actually possible.

- 358 Regarding comments that the term "waterways" refers not just to inland waterways but, in particular, also to seaward access routes to ports through to the respective EEZ, the Chamber wishes to draw attention to the following:
- 359 The seaward access routes to the ports are included in the coverage obligation as part of the inland waterways. A more far-reaching obligation cannot be imposed since providing broadband coverage at sea with terrestrial mobile radio networks is practically ruled out. The requirements for border coordination, in particular, provide barriers to network rollout.
- 360 The spectrum assigned nationwide for MFCN applies only to the mainland and coastal waters (the "12 mile zone", cf Article 12 of the Convention on the Law of the Sea), but not to the EEZ, which is the area up to 200 nautical miles off the coast. Since there is, as yet, no extension clause in the TKG, it is not currently applicable in the EEZ.
- 361 Assignment holders may enter into cooperation agreements or lease frequencies. Coverage achieved by other assignment holders counts towards the target coverage. This makes it possible to reduce, to a large extent, the financial burden on individual assignment holders with respect to the obligation that requires all assignment holders to achieve coverage. This applies in particular with a view to the scope of the total obligations for coverage of households and other transport routes.
- 362 This coverage must be achieved by 31 December 2024. The Chamber believes this deadline to be appropriate in light of the financial burden and the feasibility of all the coverage obligations.
- 363 If a bidder only purchases spectrum in the 2 GHz band that is available from 2026, the deadline for meeting the obligation will be extended. In this case, the deadline will be 31 December 2029.
- 364 The coverage obligation does not apply to new entrants (cf subsection III.4.12).

Re III.4.8 Coverage obligation with respect to rail routes with more than 2000 passengers daily

The following comments were made:

- 365 It was stated the obligation to provide rail routes with 50 Mbit/s would not be sufficient to provide 5G internet access for rail passengers sustainably and allow them to make telephone calls without being disconnected. Rail transport should be made more attractive in comparison to roads. The obligation seems inappropriately mild and by no means suited to achieving the goal of transferring a significant amount of transport to the environmentally-friendly means of the rail network. The rail business contributes to the achievement of societal objectives.
- 366 Based on the 5G strategy of the federal government and the coalition agreement, there must be comprehensive mobile coverage of the rail network, including for freight transport. The planned provision of 100 Mbit/s for long-distance roads should also apply to rail routes. Moreover, there should be requirements to prove availability of uninterrupted mobile phone reception.
- 367 Some respondents rejected the provision to make the rollout of the mobile network along rail routes dependent on the cooperation of infrastructure managers and the condition precedent on the application of the obligation. It was said to be possible to share rail infrastructure under market conditions. The current cooperation requirement was said to be unclear and could be interpreted as a licence to delay fulfilling the obligation.
- 368 Rollout is economically possible for mobile network operators, eg if rural area spectrum is used and the duplication of infrastructure is avoided.

- 369 Some respondents suggested adjusting the condition precedent for the coverage of rail routes. Where most infrastructure is offered at the usual market conditions, mobile network operators should be obliged to use these sites.
- 370 By contrast, some respondents welcomed the linking of the obligation for mobile network operators to an obligation for infrastructure managers and railway undertakings to provide suitable infrastructure, as well as other cooperation requirements. It is an essential prerequisite for the rail companies to do the necessary preliminary work, since these undertakings will benefit from improved mobile coverage on the railways in terms of their product range, and some of the coverage improvements can only be made with measures by the rail companies. A coordinated rollout is the best means of taking account of the interference-free use of the spectrum assigned to the infrastructure managers, since the network planning of both sides can be optimised with a view to avoiding interference. The condition precedent of the rail obligation is necessary and must be fulfilled for individual routes and not interpreted as a general or abstract rule. It is assumed that the provision of infrastructure to the mobile network operators will be free of charge, since the main beneficiaries of the coverage of rail routes will be the rail companies themselves.
- 371 With regard to heavily-used passenger routes, it was stated that an objective determination is not currently possible. The definition of "heavily-used passenger routes" for rail coverage is insufficient and not transparent. It is necessary for the determination of the routes and the georeferencing of these to be binding for the whole period of the spectrum assignment.
- 372 It was argued that the figure of 2000 passengers a day is too high, if the equal living conditions stipulated in the constitution are to serve as a yardstick. This figure is also not an adequate parameter for the required transmission rate.
- 373 By contrast, it was also argued that a figure of 2000 passengers a day is far too low, as trains carrying less than 60 people could also be included. It may be assumed that a majority of all rail routes, including secondary lines, would be included in the definition of "heavily used", which is not the point of the provision.
- 374 The call for repeaters for the trains is an unjustified, one-sided technological requirement, given the deadline of 2022. Rather, there should be an emphasis on "suitable measures to offset the physical impairments of mobile radio signal reception on trains".

The Chamber has ruled as follows:

- 375 For rail routes carrying more than 2000 passengers daily, the assignment holder must, by 31 December 2022, achieve coverage with a downlink transmission rate of at least 100 Mbit/s per sector, taking into consideration cooperation with the infrastructure managers and railway undertakings.
- 376 The Bundesnetzagentur aims to improve coverage along heavily used local and long-distance rail routes (such as commuter routes). Rail routes used by more than 2000 passengers a day are to be given coverage as a priority. The Chamber has based this on the volume of traffic on the main transport routes, resulting in around 21,000 km of routes to be given coverage (cf Annex 6). Freight transport on these routes will also benefit. Attention is drawn to the fact that all rail lines are to be given coverage in a second step.
- 377 The obligation imposed in the 2015 auction requires main transport routes to be covered by the end of 2019. The obligation to cover the abovementioned routes can build on this to cover additional rail routes with mobile broadband and thus meet demand for connectivity along these additional routes.

- 378 The coverage obligation only applies where network rollout is legally permissible and actually possible. Limitations may apply along some parts of the rail network, such as in nature conservation areas and railway tunnels.
- 379 It is important to note here that the network rollout along rail routes is heavily reliant on the cooperation of the infrastructure managers. In addition, onboard coverage – eg by installing repeaters or other suitable measures to offset the physical impairments of mobile radio signal reception on trains – is reliant on the cooperation of the railway undertakings. The more requirements a coverage obligation imposes on a mobile operator, the higher the associated investment costs. In particular given that railway lines cover distances of up to several thousands of kilometres, coupled with the special demands involved in covering railway transport, the obligation could place unreasonable cost burdens on the mobile operators, thus rendering it disproportionate.
- 380 Coverage is made particularly difficult since although the mobile radio cells must be extremely powerful, they are utilised by a large number of users for only a very short period of time as the train travels through the cell. In addition, network rollout along the railway lines must take account of the high speeds involved, the shielding of mobile signals caused by the physical characteristics of the trains, and compatibility with the train radio network.
- 381 As such, the cost burden on mobile network operators must be taken into consideration in order to keep the coverage obligation proportionate. The more infrastructure managers and railway undertakings cooperate, the more the costs of the mobile network rollout can be reduced. In this context, during the proceedings to date Deutsche Bahn has expressed its interest in rolling out full mobile coverage to meet passenger demand for uninterrupted telephone calls and high-speed broadband connections aboard trains.
- 382 The Chamber will take cooperation with the infrastructure managers and railway undertakings into account for the fulfilment of this obligation. This could take the form of the provision of suitable masts, electricity connections and fibre connections by infrastructure managers, for example.
- 383 Equally, the railway undertakings should equip trains with repeaters or other suitable measures to offset the physical impairments of mobile radio signal reception on trains if required by the physical characteristics (eg the carriage construction causes signal damping or shielding).
- 384 In the Chamber's view, taking cooperation between the infrastructure managers and railway undertakings into account, coverage of at least 100 Mbit/s can be ordered along railway lines. This data rate has been raised from the one proposed in the draft document for consultation in line with respondents' comments and brought up to the one required for German motorways and federal roads.
- 385 As far as the cooperation of infrastructure managers and railway undertakings is concerned, some respondents said that this should be free of charge, while others said it should take place under the usual market conditions. In setting this obligation, the Chamber assumes that cooperation will take place under fair conditions, taking adequate account of the interests of both sides. It should also be noted that the passengers are customers both of the mobile network operators and of the railway undertakings.
- 386 The Chamber takes the view that coverage with a transmission rate of 100 Mbit/s is appropriate. Mobile communications are a shared medium, which means the transmission rate provided depends to a large extent on the number of users located in the same sector. The Chamber does not believe that a transmission rate of 50 Mbit/s is adequate for routes carrying many passengers a day. Moreover, a data rate of 100 Mbit/s can be achieved using a proportionate amount of technical effort, in

- particular by deploying rural area spectrum. All existing nationwide mobile operators hold sufficient sub-1 GHz spectrum to meet the obligation cost-effectively.
- 387 By contrast, higher data rates would require massive cell densification efforts and consequently far higher investment costs. However, the Chamber anticipates that higher data rates can be provided if the necessary infrastructure is made available by the infrastructure managers and railway undertakings. Regarding the calls for higher data rates, assignment holders may cooperate with the infrastructure managers to roll out a significantly denser network with higher data rates, notwithstanding the order.
- 388 The coverage obligation is considered to be met for a route when the above data rate is generally available. As such, the above data rate must not only be made available at the antenna but also in the sector. This does not take account of traffic loads generated by other subscribers.
- 389 The Chamber does not feel it necessary to impose further quality parameters such as requirements for uninterrupted telephone calls. Coverage in trains is technically demanding and thus dependent to a large extent on cooperation with the railway undertakings.
- 390 The obligation is proportionate. Mobile network operators are already obliged to achieve coverage for about 7500 km of main transport routes by the end of 2019 due to the coverage obligation in the spectrum award from 2015. The requirements for coverage of households from the 2015 award proceedings will also contribute to better coverage of rail routes. A proportion of the abovementioned rail routes will thus also receive coverage from mobile network operators.
- 391 In its consideration of proportionality, the Chamber took account of the fact that coverage of rail routes is very demanding and associated with high costs.
- 392 It is demanding because of the considerable length of the routes and the fact that some of them run through unpopulated areas. Moreover, the degree of rollout of the individual mobile networks along rail routes is currently asymmetric, which means that imposing an obligation for full rollout by every assignment holder would result in wide differences of rollout costs between network operators. The Chamber takes account of this situation by allowing coverage of rail routes provided by other assignment holders to count towards the target coverage
- 393 The Chamber also expects assignment holders to enter into cooperation arrangements (eg on infrastructure sharing or roaming) on a contractual basis within the limits of competition and telecommunications law, so that each assignment holder contributes to rollout along the rail routes.
- 394 The Chamber points out that total coverage of rail routes will occur in stages. In the first step, rail routes with over 2000 passengers per day are to be given coverage by the end of 2022. This deadline is appropriate. The current status of the rollout and the objective of achieving coverage for heavily used routes as a priority in the interest of consumers were taken into account in setting the deadline. In addition, regarding the deadline the Chamber has taken into account that coverage provided by other mobile network operators will count towards the target coverage and therefore considered the fact that each mobile network operator will not have to supply coverage for the entire route itself.
- 395 If a bidder only purchases spectrum in the 2 GHz band that is available from 2026, the deadline for meeting the obligation will be extended. In this case, the deadline will be 31 December 2027.
- 396 The coverage obligation does not apply to new entrants (see subsection III.4.12).

Re III.4.9 Coverage obligation with respect to all other rail routes

The Chamber has ruled as follows:

- 397 The assignment holder must, by 31 December 2024, achieve coverage of all rail routes with a downlink transmission rate of at least 50 Mbit/s per sector, taking into consideration cooperation with the infrastructure managers and railway undertakings.
- 398 Assignment holders may enter into cooperation agreements or lease frequencies. Coverage achieved by other assignment holders counts towards the target coverage.
- 399 The German rail network comprises around 40,000 km. The coverage obligation thus applies to around 20,000 km in addition to those routes with more than 2000 passengers a day (Annex 7).
- 400 The Bundesnetzagentur aims to improve coverage on all rail routes. To ensure the population has mobile broadband coverage outside urban areas as well, it is appropriate for all rail routes to have full coverage too.
- 401 While rail routes with more than 2000 passengers a day connect larger towns and cities (regional centres), the other routes also fulfil an important function by linking smaller towns. This makes them particularly important in rural areas. Broadband coverage on all rail routes is also necessary to promote equality of living standards in urban and rural areas. It is therefore appropriate to achieve a similar level of coverage as on state roads.
- 402 The Chamber feels that a minimum transmission rate of 50 Mbit/s in each sector is appropriate. The Chamber takes the view that coverage with a transmission rate of 50 Mbit/s – ie, half of that which is to be achieved on rail routes with more than 2000 passengers a day – is sufficient. Mobile communications are a shared medium, which means the transmission rate provided depends to a large extent on the number of users located in the same sector. The number of passengers on each train on such routes is smaller than on trains on routes with more than 2000 passengers a day. Therefore, even taking account of the fact that passengers on a train share the transmission rate provided, 50 Mbit/s seems sufficient initially. The Chamber took account of the fact that the combined length of all the other rail routes is about 20,000 km.
- 403 It is important to note here that the network rollout along rail routes is heavily reliant on the cooperation of the infrastructure managers. In addition, onboard coverage – eg by installing repeaters or other suitable measures to offset the physical impairments of mobile radio signal reception on trains – is reliant on the cooperation of the railway undertakings. The more requirements a coverage obligation imposes on a mobile operator, the higher the associated investment costs. In particular given that railway lines cover distances of up to several thousands of kilometres, coupled with the special demands involved in covering railway transport, the obligation could place unreasonable cost burdens on the mobile operators thus rendering it disproportionate.
- 404 Coverage is made particularly difficult since although the mobile radio cells must be extremely powerful, they are utilised by a large number of users for only a very short period of time as the train travels through the cell. In addition, network rollout along the railway lines must take account of the speeds involved, the shielding of mobile signals caused by the physical characteristics of the trains, and compatibility with the train radio network.
- 405 As such, the cost burden on mobile network operators must be taken into consideration in order to keep the coverage obligation proportionate. The more infrastructure managers and railway undertakings cooperate, the more the costs of the mobile network rollout can be reduced and rail customers, who are also

- customers of the mobile operators, can receive the best possible coverage with mobile broadband.
- 406 The Chamber will take cooperation with the infrastructure managers and railway undertakings into account for the fulfilment of this obligation. This could take the form of the provision of suitable masts, electricity connections and fibre connections by infrastructure managers, for example.
- 407 Equally, the railway undertakings should equip trains with repeaters or other suitable measures to offset the physical impairments of mobile radio signal reception on trains if required by the physical characteristics (eg the carriage construction causes signal damping or shielding).
- 408 The coverage obligation is considered to be met for a route when the above data rate is generally available. As such, the above data rate must not only be made available at the antenna but also in the sector. This does not take account of traffic loads generated by other subscribers.
- 409 The coverage obligation only applies where network rollout is legally permissible and actually possible. Limitations may apply along some parts of the rail network, such as in nature conservation areas and railway tunnels.
- 410 The obligation is proportionate. The Chamber points out that as many rail routes are situated near to roads and households that will also have to be covered, there will be synergy effects in coverage, so it is fair to assume that some rail routes will achieve coverage anyway, because of the other obligations. The Chamber took this fact into account in its consideration of the proportionality of the obligation. The requirements for coverage from the 2015 award proceedings also contribute to better coverage of rail routes. A proportion of the abovementioned rail routes will thus also receive coverage from mobile network operators.
- 411 In its consideration of proportionality, the Chamber took account of the fact that coverage of rail routes is very demanding and associated with high costs.
- 412 It is demanding because of the considerable length of the routes and the fact that some of them run through unpopulated areas. Moreover, the degree of rollout of the individual mobile networks along rail routes is currently asymmetric, which means that imposing an obligation for full rollout by every assignment holder would result in wide differences of rollout costs between network operators. The Chamber takes account of this situation by allowing coverage of rail routes provided by other assignment holders to count towards the target coverage.
- 413 The Chamber also expects assignment holders to enter into cooperation arrangements (eg on infrastructure sharing or roaming) on a contractual basis within the limits of competition and telecommunications law, so that each assignment holder contributes to rollout along the rail routes.
- 414 The assignment holder may use all the assigned spectrum usage rights to fulfil the coverage obligation. In the Chamber's view, this will not involve an impermissible retroactive effect on spectrum assigned in earlier award proceedings. The deployment of rural area spectrum already assigned can significantly reduce the cost burden of the coverage obligations on existing network operators. At the same time, they can incorporate the costs associated with the coverage obligation into their bids.
- 415 The deadline for the coverage obligation will be 31 December 2024.
- 416 The Chamber points out that total coverage of rail routes will occur in stages. In the first step, rail routes with over 2000 passengers per day are to be given coverage by the end of 2022. In the second step, the other rail routes are to be given coverage by the end of 2024. This deadline is appropriate. The current status of the rollout for transport routes and households by the end of 2022 was taken into account in setting the deadline. In addition, regarding the deadline the Chamber has taken into account

that coverage provided by other mobile network operators will count towards the target coverage and therefore considered the fact that each mobile network operator will not have to supply coverage for the entire route itself.

417 If a bidder only purchases spectrum in the 2 GHz band that is available from 2026, the deadline for meeting the obligation will be extended. In this case, the deadline will be 31 December 2029.

418 The coverage obligation does not apply to new entrants (cf subsection III.4.12).

Re III.4.10 Coverage obligation with respect to not-spots

The following comments were made:

419 On the one hand, it was stated that the obligation to put 500 base stations, each with at least 100 Mbit/s, into operation in previously defined not-spots by 31 December 2022 will not bring a swift end to the inadequate coverage in rural areas.

420 On the other, it was stated that coverage of not-spots by 2022 was unacceptable and could not be implemented with regard to planning requirements. The definition should relate solely to the requirements notified by rural districts and municipalities, which the Bundesnetzagentur can review based on the network operators' available data, it was argued.

The Chamber has ruled as follows:

421 The assignment holder must, by 31 December 2022, put into operation 500 base stations with a transmission rate of at least 100 Mbit/s in previously defined not-spots.

422 In each federal state, coverage must be rolled out in accordance with the proportionate share of federal territory. Assignment holders may enter into cooperation agreements or lease frequencies.

423 It is the Bundesnetzagentur's aim to provide existing not-spots with broadband coverage. The coverage obligations resulting from the 2015 auction and other obligations imposed in those proceedings will mean a further reduction in not-spots.

424 The number of base stations per federal state needs to be increased in proportion to each state's share of total territory in Germany. This will ensure that consumers in all the federal states will profit from the above-stated obligation, with the additional benefit that mobile rollout can be boosted in the states with a larger surface area.

425 The not-spots will be identified successively during the period up to the deadline for the fulfilment of the base station obligation, ie the end of 2022. On the one hand the not-spots can be designated by the federal states in line with their requirements, so the Chamber does not believe that a single definition of not-spots is appropriate. On the other, the Bundesnetzagentur may also identify not-spots – eg using the so-called "dead spot app".

426 The data transmission rate of 100 Mbit/s is stipulated for every federal state, in the same way as 98% household coverage, in order to provide consumers with adequate blanket broadband services, which depend on high transmission rates.

427 The assignment holders can exercise all the spectrum usage rights assigned to them for coverage of the not-spots.

428 Regarding comments that it is not possible to implement the obligation by 2022 due to planning requirements, the Chamber draws attention to the following:

429 The coverage obligation only applies where network rollout is legally permissible and actually possible. The Chamber will take account of the fact that a suitable run-up time is needed to build new base stations. In addition, the Chamber points out that construction also requires the involvement of districts and municipalities, eg to acquire sites and in the approval procedure.

430 If a bidder only purchases spectrum in the 2 GHz band that is available from 2026, the deadline for meeting the obligation will be extended. In this case, the deadline will be 31 December 2027.

431 The coverage obligation does not apply to new entrants (cf subsection III.4.12).

Re III.4.11 Coverage obligation with respect to "5G base stations"

The following comments were made:

432 It will only be possible to set up 5G base stations by the deadline if the 3.6 GHz spectrum is usable from 2019. Otherwise, the period for fulfilment of the obligation should be automatically extended by a year, it was argued.

The Chamber has ruled as follows:

433 The assignment holder in the 3.6 GHz band must, by 31 December 2022, put into operation 1000 base stations to be used for 5G applications. In each federal state, coverage must be rolled out in accordance with the proportionate share of federal territory.

434 The Chamber's objective is to promote the rollout of 5G. With a view to the great interest in 5G applications, including in the comments submitted, the number of base stations has been raised from 500 in the draft document for consultation to 1000. The Chamber has based this change on the circumstance that the existing mobile network operators, too, are seeking to introduce 5G worldwide at an early stage. Germany is to play a leading role in this process.

435 The Chamber's aim is to promote the rollout of high-speed telecommunications networks with the pioneer band 3.6 GHz with a view to accelerating 5G rollout. Even where spectrum has been assigned on a technology and service-neutral basis, the 5G pioneer band 3.6 GHz should be launched at an early stage. Assignment holders are consequently not required to make use of "5G New Radio", but instead to establish base stations which meet 5G requirements. New applications, which require, for example, very high data transmission rates, very low latency periods or specific infrastructure, are therefore to be made possible. The Chamber takes the view that raising the number of required base stations will not pose an unreasonable burden.

436 5G is in particular intended to bring about the introduction of innovative services such as Industry 4.0 and Smart City. What is therefore expected – unlike with mobile broadband – is a heterogeneous demand for special-purpose solutions, especially from industry, towns and municipalities.

437 The number of base stations per federal state needs to be increased in proportion to each state's share of total territory in Germany.

438 The deadline for the fulfilment of the obligation by the end of 2022 seems to be an appropriate one. There is above all enough time to fulfil this obligation. On the one hand it is intended to make spectrum available in the 3400 MHz – 3700 MHz band at an early stage – even before the end of the current assignment periods. On the other there should soon, on current estimates, be devices available which will support the 3.6 GHz band. The deadline by which the coverage obligation is to be achieved is applicable on condition that the relevant technology is available on the market.

439 Contrary to what was contained in the draft document for consultation, the coverage obligation applies to new entrants as well (see subsection III.4.12).

Re III.4.12 Coverage obligation with respect to new entrants

The following comments were made:

- 440 There was opposition from some quarters to exempting new entrants from the coverage obligation for rail routes, on the grounds that this would entrench the extremely poor mobile coverage along large parts of the rail network for many years. One respondent called for new entrants to be subject to the same obligations as existing network operators.
- 441 It was said that the deadlines of the coverage obligations for new entrants were ambitious and should be revised. A new entrant would fulfil the coverage obligation with 5G infrastructure. To cover 50% of the population, it would have to build thousands of 5G base stations with the spectrum currently available for award. To uphold the principle of proportionality, the start of the rollout obligation for new entrants should be linked to the usability of the spectrum. This should be based on the availability of the frequency block acquired at auction with the latest option of usability.
- 442 The time limit for the fulfilment of coverage obligations for new entrants should also be linked to the outcome of pending court cases. Unlike established network operators, a new entrant could not turn to other spectrum bands if the condition subsequent were fulfilled.
- 443 It is more economically efficient to focus coverage obligations more strongly towards cooperation and shared use. These joint efforts would lead to the greatest possible 5G coverage, because it will only be possible to achieve comprehensive coverage quickly if unnecessary duplication is avoided.

The Chamber has ruled as follows:

- 444 New entrants must achieve coverage of at least 25% of households by 31 December 2023 and at least 50% by 31 December 2025.
- 445 If a new entrant only purchases spectrum in the 2 GHz band that is available from 2026, the deadline for meeting the obligation will be extended. In this case, the deadline will be 31 December 2028 or 31 December 2030 respectively.
- 446 This degree of household coverage is appropriate, as it can basically be reached by rolling out high-capacity spectrum in Germany's major cities and towns. However, the Chamber expects new entrants, depending on their business models, to implement a more extensive network rollout on a scale that satisfies their customers' demand.
- 447 If a new entrant purchases spectrum in the 3.6 GHz band only, however, a coverage of at least 25% of households must be achieved by 31 December 2025. The Chamber hereby takes account of the suggestion that a coverage obligation of 50% of households with only 3.6 GHz band spectrum would be associated with disproportionately high costs.
- 448 This special provision for scenarios in which a new entrant only acquires 3.6 GHz spectrum will reduce the cost burden associated with the obligation. The Chamber believes that this takes into consideration the particular propagation characteristics of 3.6 GHz spectrum. Even rolling out the network to cover 25% of the population requires the construction of a large number of base stations. It must also be borne in mind that different business models are conceivable with the "pioneer" 3.6 GHz band, but a very high level of coverage of the population could prevent certain innovative business models.
- 449 If a new entrant purchases spectrum in the 3.6 GHz band, it must put into operation 1000 base stations to be used for 5G applications by 31 December 2022. In each federal state, coverage must be rolled out in accordance with the proportionate share of federal territory. This will mean that even a new entrant will construct and operate

network infrastructure in all federal states at an early stage. The Chamber does not believe that the construction of 1000 base stations is a disproportionate requirement for new entrants, since it is necessary in the course of network rollout in any case. The obligation merely steers the geographical distribution of the network rollout, supporting the efficient use of spectrum across Germany.

- 450 With a view to the efficient use of spectrum, the Chamber presumes that a new entrant will set up and operate its own mobile network, thus fulfilling the coverage obligation. The new entrant is free to enter into cooperation arrangements with other mobile network operators to achieve rural area coverage.
- 451 The deadline by which the coverage obligation is to be achieved is applicable on condition that the relevant technology is available on the market.
- 452 It is not appropriate to impose on new entrants a more exacting requirement in terms of household coverage, quality and transport routes – as was called for in the responses – because, unlike existing network operators, they do not already have the necessary infrastructure. In particular, there are at present no frequencies below 1 GHz available to new entrants that would enable them to roll out cost-effective broadband nationwide. The above-stated decision makes it possible to take into account the interests of small and medium-sized enterprises (cf subsection 61(4) TKG), as the coverage obligation will not make it disproportionately difficult to enter the market.
- 453 Regarding the request from one respondent for spectrum in litigation to be taken into consideration, the Chamber draws attention to the fact that even new entrants are required to start using spectrum as soon as possible.
- 454 Spectrum in litigation is still available and can be used for network build and rollout once it has been assigned. Besides, bidders can take the risk of litigation into account when deciding on the height of their bids at auction.

Re III.4.13 Reporting obligations

The following comments were made:

- 455 One respondent was opposed to ad hoc reporting obligations and called for annual reporting obligations on the grounds that ad hoc reporting obligations would require a disproportionate amount of resources without any identifiable benefit. In view of the speed of mobile rollout, it is not necessary to give constant new status reports, according to the respondent.

The Chamber has ruled as follows:

- 456 At the request of the Bundesnetzagentur, the spectrum assignment holder must provide a written report on the progress of spectrum usage and of network build and rollout and on the rollout plans. The reporting obligation comprises plausible statements and corresponding evidence.
- 457 The reason for imposing this reporting obligation is to make sure that the coverage obligations are in fact fulfilled. It is appropriate for the Bundesnetzagentur to be kept continuously informed about the status of frequency usage in order to ensure that all spectrum assignment holders make prompt use of their frequencies. In this context there is a provision requiring assignment holders to submit a written report on the matter every year.
- 458 In addition, the Bundesnetzagentur will in individual cases request reports – which may also be purely regional or local – on the status of network build and rollout. Pursuant to section 127(1) para 1 TKG, the Bundesnetzagentur can require public telecommunications network operators and providers of publicly accessible telecommunications services to provide information on request that is required for enforcement of the Act. The Bundesnetzagentur may, in particular, require

- information for the systematic or case by case verification of compliance with obligations ensuing from or by virtue of the Act.
- 459 Given this background, the already established reporting obligation is to be maintained and extended. Specifically, assignment holders are to be obliged, as before, to report on the degree of coverage with respect to nationwide provision and the average transmission rate actually available before the time when the coverage obligation applies. In addition, it is planned for the reporting obligation in future to include the status of rollout planning.
- 460 The Bundesnetzagentur will determine a method for the systematic, ongoing and provider-specific monitoring of the state of the rollout and planned progress, in view of the coverage obligation and the public interest in mobile coverage.
- 461 Regarding one respondent's opposition to ad hoc reporting, the Chamber maintains its view that it is necessary to be able to order reports on a case by case basis to ensure the efficient use of spectrum. Examples of situations where information is necessary include possible spectrum leasing or the re-coordination of earth stations to ensure the efficient and interference-free use of spectrum. There could also be enquiries from the political sphere about the coverage situation in individual regions.
- 462 In this context, the Chamber would like to point out that the data presented will be subject to technical checks. Evidence of nationwide coverage must be substantiated unequivocally and plausibly through appropriate simulations. The Bundesnetzagentur will check this using appropriate measurement methods. The parameters to be met under the obligation will be decided subsequently, taking account of the technology deployed.
- 463 Network operators are required to enable the Bundesnetzagentur's radio monitoring and inspection service to conduct checks on the coverage obligations. This includes provision of the technical equipment needed for access to the network, eg the operators must provide suitable SIM cards free of charge for measuring purposes. The Bundesnetzagentur's checks on fulfilment of the coverage obligation will include radio monitoring operations designed to ascertain the transmission rates actually made available by particular assignment holders (drive tests).
- 464 The coverage obligation is part of the award of spectrum and will be included in the subsequent assignments. It will be in the form of a secondary condition attached to the frequency assignment in accordance with section 60(2) first sentence TKG, making it an obligation ensuing from the TKG. Breaching this secondary condition is the starting point for all relevant sanctions.
- 465 Once the coverage obligation has entered into force, the Bundesnetzagentur has a range of measures at its disposal, the details of which are based on section 126 TKG.
- 466 Pursuant to section 126(1) and section 60(2) first sentence TKG in conjunction with the frequency assignment, the Bundesnetzagentur can require undertakings not fulfilling their coverage obligation to state their views and take remedial action.
- 467 Where an undertaking fails to meet its obligations within the time limit set, the Bundesnetzagentur may order such measures as are necessary to secure adherence to the obligations (section 126(2) first sentence TKG). To enforce orders pursuant to section 126(2) TKG, a penalty not exceeding €500,000 may be set in accordance with the Administrative Enforcement Act (VwVG) (section 126(5) TKG). It is in principle possible to impose the penalty multiple times.
- 468 In the case of serious or repeated breaches of obligations by the undertaking or failure to comply with measures for remedial action ordered by the Bundesnetzagentur, the Bundesnetzagentur may, pursuant to section 126(3) TKG, prohibit the undertaking acting in the capacity of telecommunications network operator or service provider.

- 469 Apart from these sanctions as administrative enforcement measures (section 126 TKG), the Bundesnetzagentur can treat breaches of coverage obligations as regulatory offences under section 149(1) para 12 TKG.
- 470 The coverage obligation attached to the frequency assignment as a secondary condition pursuant to section 60(2) first sentence TKG is an enforceable condition, a breach of which constitutes a regulatory offence under section 149(1) para 12 TKG. Pursuant to section 149(2) first sentence TKG, such an offence may be punishable by a fine of up to €100,000. The fine can also be imposed multiple times if "the same act" within the meaning of section 19(1) OWiG does not apply. However, pursuant to section 149(2) second and third sentences TKG this sum can be exceeded if it is not sufficient to exceed the economic benefit derived from the offence. "Economic benefit" should be understood to mean not just a profit in terms of money but also other economic benefits such as an improved market position caused by the elimination or disadvantaging of competitors (Bundestag printed paper 15/2316, page 106; Bundestag printed paper 755/03, p 147).
- 471 The TKG as it stands thus contains no upper limit on fines for breaches of a coverage obligation.
- 472 The strongest possible sanction available to the Bundesnetzagentur is to revoke the frequency assignment pursuant to section 63 TKG. Section 63(1) sentence 2 para 2 TKG states that a frequency assignment may be revoked where an obligation arising from the frequency assignment is severely or repeatedly violated or has not been fulfilled despite repeated requests for fulfilment. Section 63(3) TKG expressly excludes compensation for loss incurred by relying on the validity of a declaration pursuant to section 49(6) of the German Administrative Procedure Act (VwVfG).

Re III.4.14 Condition subsequent for spectrum in litigation

The following comments were made:

- 473 One respondent was in favour of making the start of the time for the fulfilment of coverage obligations for new entrants dependent on the outcome of pending court cases.
- 474 Moreover, the spectrum in litigation in the 3420 MHz – 3700 MHz band must be awarded specifically and the spectrum in litigation in this band identified as such, it was said.

The Chamber has ruled as follows:

- 475 Assignments of spectrum in litigation must be tied to a condition subsequent for the event that the Bundesnetzagentur is compelled by a court ruling delivered outside these award proceedings to assign the usage rights to other undertakings, or that an assignment revoked by the Bundesnetzagentur is upheld by a final court ruling. These secondary conditions serve the purpose of ensuring the implementation of court decisions which may be delivered outside the award proceedings (decisions I to IV), provided that the administrative law dispute was already pending at the time of assignment.
- 476 The Chamber is of the opinion that a condition subsequent as set forth in section 36(2) para 2 VwVfG is the appropriate legal means to employ in order to assign frequency usage rights in compliance with a court ruling. The effect of imposing a condition subsequent is to enable a spectrum assignment to lapse without any further administrative action when the condition is fulfilled. By contrast, the exercise of a reserved right of revocation necessitates a further administrative act which can be challenged with legal remedies. It is therefore advisable for reasons of legal certainty to tie the assignment of spectrum to a condition subsequent. The exact terms of the condition subsequent will be determined as part of the assignment procedure.

Courtesy translation

- 477 The Chamber refers to the rationale for subsection III.4.12 with respect to the call to make the time limit for the fulfilment of coverage obligations for new entrants dependent on the outcome of pending court cases.
- 478 With regard to the call for the frequency blocks affected by litigation to be awarded specifically, the Chamber refers to the rationale for subsection IV.1.4.
- 479 In the 3.6 GHz band, there have so far been 32 regional assignments in blocks of 7 MHz for wireless local loop (WLL) as point-to-multipoint radio relay that have been revoked and are therefore available for future assignments. However, they are the subject of pending lawsuits.
- 480 The following regions and frequencies are affected:

District	Federal state	Frequency band		
Breisgau-Hochschwarzwald	Baden-Württemberg	3480 – 3494 MHz/ 3580 – 3594 MHz		
Enzkreis				
Freiburg im Breisgau (urban)				
Heidenheim				
Hohenlohekreis				
Karlsruhe (rural)				
Karlsruhe (urban)				
Pforzheim (urban)				
Schwäbisch Hall				
Zollernalbkreis				
Ebersberg			Bavaria	3480 – 3494 MHz/ 3580 – 3594 MHz
Erding				
Erlangen-Höchstadt				
Forchheim				
Freising				
Hof (rural)				
Hof (urban)				
Kitzingen				
Neustadt a.d. Aisch-Bad Windsheim				
Passau (rural)	Bavaria	3480 – 3494 MHz/ 3580 – 3594 MHz		
Passau (urban)				
Rottal-Inn				
Berlin (urban)	Berlin	3480 – 3494 MHz/ 3580 – 3594 MHz		
Havelland	Brandenburg	3480 – 3494 MHz/ 3580 – 3594 MHz		
Bremen (urban)	Bremen	3480 – 3494 MHz/ 3580 – 3594 MHz		
Bremerhaven (urban)				
Delmenhorst (urban)				
Hanover	Lower Saxony	3480 – 3494 MHz/ 3580 – 3594 MHz		
Oldenburg (urban)				
Oldenburg (rural)				
Osnabrück (rural)				
Osnabrück (urban)				
Bielefeld (urban)			North Rhine-Westphalia	3480 – 3494 MHz/ 3580 – 3594 MHz
Düsseldorf (urban)				
Essen (urban)				
Herford				
Lippe				

District	Federal state	Frequency band
Mettmann		
Minden-Lübbecke		
Mönchengladbach (urban)		
Mülheim a. d. Ruhr (urban)		
Münster (urban)		
Neuss		
Oberhausen (urban)		
Remscheid (urban)		
Solingen (urban)		
Wuppertal (urban)		
Kaiserslautern (rural)		
Kaiserslautern (urban)		
Dresden	Saxony	3480 – 3494 MHz/ 3580 – 3594 MHz
Leipzig (urban)		
Leipziger Land		
Zwickau (urban)		
Zwickauer Land		
Dessau (urban)	Saxony-Anhalt	3480 – 3494 MHz/ 3580 – 3594 MHz
Magdeburg		
Flensburg (urban)	Schleswig-Holstein	3480 – 3494 MHz/ 3580 – 3594 MHz
Herzogtum Lauenburg		
Kiel (urban)		
Lübeck (urban)		
Neumünster (urban)		
Pinneberg		
Schleswig-Flensburg		
Segeberg		
Stormarn		
Erfurt	Thuringia	3480 – 3494 MHz/ 3580 – 3594 MHz

Table 3: Revoked regional WLL assignments in the 3400 MHz – 3600 MHz band

Re III.4.15 Service provider regulation

The following comments were made:

- 481 The existing mobile network operators were opposed to regulations for service providers, saying that the provisions should be removed completely. They took a critical view of any type of regulation, seeing it as a one-sided intervention in contractual negotiations to the disadvantage of the network operators.
- 482 Other respondents were in favour of service provider regulations and believed that a requirement to engage in negotiations was insufficient. An obligation, ie, a compulsion to enter into and conclude a contract or agreement, is necessary, they said. In any case, the Bundesnetzagentur should examine closely whether the service provider regulation could be made more binding.
- 483 The mention of the voluntary commitments made by Telefónica as part of its merger is not sufficient. Service providers only have an entitlement to receive LTE access under the conditions of the Commission Decision from one of the three mobile network operators and they are discriminated against in this respect because Telefónica itself markets a higher LTE speed than the one it offers service providers for their own products. In addition, MVNOs have no entitlement to use the Telefónica network.

- 484 Some respondents called expressly for the service provider regulation to apply to MVNOs. They said that the definition of "service provider" should be clarified so that MVNOs are no longer excluded from the wholesale market. By contrast, the existing mobile network operators were against a possible extension to MVNOs, saying this would raise the risk of the German mobile market being abusively opened up to over-the-top (OTT) players.
- 485 If the negotiation requirement is kept, its level of firmness and transparency must be adjusted, it was said. The regulation is partially contradictory in its formulation and leaves a lot of room for interpretation, which would lead to legal uncertainty. Some respondents wanted obligatory framework conditions, in particular with regard to rules for pricing, a time frame for negotiations and a binding arbitrator function. It should also be clarified that a mobile operator is not allowed to discriminate against a service provider in favour of its own sales.
- 486 It was also stated that the example given of first-mover competition, in which service providers may be discriminated against for a certain period in the provision of wholesale services by network operators, should be seen critically and does not promote effective competition for services.
- 487 It must also be possible to enforce the service provider regulation by providing for an effective dispute resolution system. Sanctions and penalties are important signals to negotiating parties.
- 488 Moreover, as far as attaching a secondary condition to the assignments is concerned, it is not clear whether the precise formulation of the operative part will be included as a secondary condition or whether these principles are to be used as the basis to form a regulation with different wording.

The Chamber has ruled as follows:

- 489 Ever since liberalisation was launched in the early 1990s, the mobile services offered by service providers have helped to strengthen competition at the service level and thus promoted the interests of consumers. The service provider obligation imposed in 2000, which had its basis in the licence obligations of the 1990s, will continue to apply to the spectrum assignments resulting from those proceedings until the assignments expire on 31 December 2020.
- 490 The imposition of an obligation to grant access (section 21 TKG) after the expiry of the above-stated spectrum assignments is conditional on there being significant market power on the part of the network operators. Neither the Bundeskartellamt nor the Bundesnetzagentur has so far found this to be the case.
- 491 Regarding the question of whether more far-reaching obligations related to roaming or service providers would come within the scope of sections 19 or 21 TKG, which would have a blocking effect, both legal views were presented with reasoning in the responses. However, the Chamber takes the view that this legal question can be left open with a view to the specific formulation of the obligation because the requirement to engage in negotiations does not come within the scope of sections 19 or 21 TKG. In addition, the Chamber takes the view that the obligation in its current form is suitable to take the interests of market participants into account and to avoid stricter ex-ante regulatory obligations (cf section 2(3) para 6 TKG), by giving the Bundesnetzagentur a role as "arbitrator". This regulatory decision is based in particular on the legal principles of proportionality and necessity.
- 492 The Chamber intends to maintain and promote competition at the service level beyond 2020. This can only be done if there is no discrimination by mobile network operators against service providers during negotiations on the capacities to be made available. The point at issue here is that the spectrum resources in question are available not in unlimited but in limited quantities. Hence it is only possible for a limited number of undertakings on the market to acquire spectrum themselves and

- offer mobile services. Market entry is not free but restricted by the limiting resource of spectrum.
- 493 Assignment holders are to negotiate with suitable service providers regarding the shared use of mobile capacities, so that they can provide these radio-based services in their own name and for their own account.
- 494 It is not intended to restrict the capacities for mobile services to be provided by the assignment holders to specific services, radio technologies or applications, nor do the current regulations for service providers prescribe any settlement modalities (eg "retail minus"). The provision of mobile capacities and services is subject to the principle of technology and services neutrality, as the spectrum is also assigned on a technology and service-neutral basis. Within that framework the service providers are to have the possibility not only of resale but of development of their own innovative products as well.
- 495 A service provider is any party that provides telecommunication services in full or in part within a business capacity (cf section 3 para 6 TKG.)
- 496 In view of the previous service provider obligation for GSM and UMTS licences, the negotiation requirement essentially applies to undertakings that offer mobile services in their own name and for their own account and do not have their own mobile network infrastructure.
- 497 Regarding undertakings with their own network components (MVNOs), the Chamber draws attention to the following: while MVNOs are included by virtue of the wording of section 3 para 6 TKG, they require special treatment. It is highly demanding to connect a MVNO to the network of an assignment holder (eg physical connection of the networks). That could lead to a heavy burden for assignment holders, particularly as there are potentially many MVNOs, and could potentially affect assignment holders' trade or business secrets.
- 498 The negotiations between assignment holders and service providers should be non-discriminatory. To that end, assignment holders are not to adopt arbitrary positions during the negotiations and, on request, are to provide the Bundesnetzagentur with transparent information on the course the negotiations take (section 127 TKG). Non-discriminatory negotiations are intended to result in agreement between the two parties on reasonable terms that are not detrimental to either side. It should be prevented, for example, that suitable service providers are simply refused negotiations on shared use, including regarding individual products and technology, that negotiations are held in an abusive way or unreasonable terms are attached to services.
- 499 Regarding the response about an assignment holder not being allowed to discriminate against a service provider in favour of its own sales, the Chamber draws attention to the following: in the past, equal treatment of an assignment holder's own sales meant that settlement models were largely restricted to the "retail minus" model. It was also stated during the proceedings that this had had a considerable effect on network operators' innovation, because every new tariff from their own sales also had to be provided for service providers. The negotiation requirement, by contrast, gives contracting parties enough flexibility to negotiate on settlement modalities and pricing within their freedom of contract. There is also no risk of an assignment holder acting without discrimination by not providing mobile services to any service provider, thus treating all service providers equally. The negotiation requirement does not just include starting contractual negotiations but also the contractual arrangements with the user.
- 500 Assignment holders are not obliged to be non-discriminatory within the meaning of section 19 TKG. A mobile network operator must for example be allowed the right to conduct first-mover competition (secret competition) in the sale of its products,

- provided that the service provider has the chance to catch up on this competitive advantage, so that the mobile network operator does not develop a long-term unique selling point.
- 501 Regarding the response that the right to first-mover competition should be examined critically and does not promote effective competition for services, the Chamber draws attention to the following: passing on each product directly would place a disproportionate restriction on network operators' innovation by allowing new developments to be marketed immediately by competitors. This could cause an incentive not to develop innovative products at all. Yet innovation by network operators is to be supported in the interests of competition and to secure the regulatory objectives in accordance with section 2(2) TKG.
- 502 In contrast to the licences referred to above, there is no compulsion here to enter into and conclude a contract or agreement. Assignment holders cannot be forced to enter into a contract with any interested party, regardless of the terms. However, the requirement to negotiate includes the aim of negotiating and concluding a contract within the freedom of contract. Without the intention to conclude a contract, the negotiation requirement would be devoid of purpose and hence not suitable to promote the regulatory objectives laid down in the TKG.
- 503 The Bundesnetzagentur is therefore permitted, in the event of infringements of this requirement, to intervene in order to protect competition, ie by acting as an arbitrator. What is needed here is a comprehensive balancing of the interests of the parties in question along the lines indicated above.
- 504 The Chamber is aware of the fact that any potential breaches of the negotiation requirement can only be effectively combatted by an effective form of this arbitrator role. At the same time, in a market economy, agreements between parties in line with their interests should primarily be based on private-sector contractual negotiations. The Bundesnetzagentur will therefore only play a role if negotiations fail. The Chamber assumes that it will only be necessary for the authority to intervene in exceptional cases and in a subsidiary manner, not as part of the ongoing monitoring of anti-competitive practices.
- 505 In the event of a reported breach of the negotiation requirement, the Bundesnetzagentur can first require an assignment holder to take remedial action. If necessary, the Bundesnetzagentur can prohibit breaches of the negotiating requirement and impose a penalty (section 126(1), (2) and (5) TKG). In view of the potential discrimination service providers could be subject to, which could threaten their existence and require rapid intervention, the Bundesnetzagentur can in individual cases in derogation of this procedure take provisional measures at short notice (section 126(4) TKG).
- 506 The Bundesnetzagentur also has the possibility to penalise breaches as regulatory offences under section 149 TKG. Pursuant to section 149(2) second and third sentences TKG, fines should exceed the economic benefit the offender has derived from breaching the negotiation requirement.
- 507 The legal basis for the service provider regulation is section 60(2) first sentence TKG in conjunction with section 61(6) TKG. Pursuant to section 60(2) first sentence TKG, spectrum assignments can be tied to secondary conditions in order to ensure efficient and interference-free use of the frequencies and achievement of the other regulatory objectives specified in section 2 TKG. The imposition of a negotiation requirement is based on section 52(1) TKG in conjunction with the regulatory objectives and principles laid down in section 2(2) and (3) TKG and provisions of Community law. The regulatory principle of non-discrimination ensuing from section 2(3) para 2 TKG obliges the Bundesnetzagentur to ensure non-discriminatory negotiations in its arbitrator role and thus indirectly affects the relationship of market participants with each other.

- 508 A service provider regulation in the form of an obligation to negotiate, as provided for in section 60(2) first sentence TKG, is also an appropriate means of furthering efficient and interference-free spectrum usage and the achievement of the other regulatory objectives specified in section 2 TKG:
- 509 The service provider regulation is a suitable means of promoting the efficient and interference-free use of frequencies pursuant to section 2(2) para 7 TKG. As service providers do not operate their own mobile networks, they do not as a rule make a direct technical contribution to efficient spectrum usage. The regulation does, however, provide regulatory incentives that promote efficient use of frequencies by the assignment holders:
- 510 The service provider regulation helps to maintain and promote competition at the service provider level. Consumers thus have a wider choice of providers offering mobile tariffs. Given, in particular, the variety of price segments, this can help to boost penetration of the market and product diversity in the mobile sector and contribute to utilisation of network capacity.
- 511 Accordingly, the efficient use of spectrum is not restricted to efficiency in the technical sense. The concept also comprises economic efficiency in the sense of reaching the greatest possible number of consumers and achieving the greatest possible benefit for the wider economy. The socio-economic potential of the scarce spectrum resources should also be exploited to the greatest possible extent with a view to implementing the regulatory objectives. This means that the greatest possible number of end users should be enabled to use the services provided by the frequencies and thus profit directly from the spectrum usage. Moreover, it is in the interest of the economy as a whole that not only end users but also various mobile service providers should be able to make at least indirect use of spectrum resources to offer consumers innovative products and contribute to a competitive environment.
- 512 Infrastructure competition, however, is restricted by the scarcity of spectrum resources and by the fact that it does not make business sense to set up parallel mobile networks nationwide for an unlimited number of competitors. Consequently, there has already been a consolidation of the German mobile market, with the number of nationwide mobile network operators reducing from four to three. As infrastructure competition declines, competition at the services level becomes ever more important for the wider economy. Services competition can be decisively promoted by enabling undertakings that do not have their own mobile infrastructure to make shared use of existing networks.
- 513 It is also conceivable that competition, as boosted by the service provider regulation, could contribute to efficient use of spectrum in the technical sense as well. Service providers are customers for mobile capacity at the wholesale level. Where a service provider can offer mobile services via a variety of networks, the quality and availability of particular networks could be a decisive factor in the choice of network. It is likewise conceivable that service providers will switch their existing customers to the network of a different mobile network operator that offers better network quality. Depending on how much the service provider's customers contribute to the utilisation of the mobile network of the mobile network operator in any particular case, this could create incentives for extended rollout of mobile networks in a competitive environment.
- 514 Finally, the service provider regulation could foster cooperation between assignment holders and service providers, which would have a resultant impact on network rollout. For example, not long ago an undertaking supported rollout by a network operator with an amount running into millions specifically for this purpose. This kind of cooperation would also be conceivable if a service provider were interested in improved coverage of a specific region or a specific location. The regulation could be both a basis and an incentive for cooperation of that kind.

- 515 The service provider regulation provides a means of ensuring fair competition and promoting sustainable competitive markets as provided for in section 2(2) para 2 TKG:
- 516 As already explained above with regard to the economically efficient use of spectrum, the service provider regulation can help to ensure that, in addition to the distribution channels of the mobile network operators, further undertakings are given the opportunity to offer consumers mobile services in a competitive environment. This could mean that the existing variety of mobile providers, with its positive effect on competition, will be maintained or even expanded.
- 517 By contrast, if the present service provider obligation is terminated without substitute, there could be less provider variety. It is true that in such circumstances, the service providers would still be able to negotiate capacities with the mobile network operators on the basis of freedom of contract. Without any regulatory backing, however, the service providers would run the risk of not obtaining competitive terms in future.
- 518 The terms obtained by the service providers have an impact on their competitiveness. The less scope service providers have for deciding on mobile tariffs, the less they will be able to boost competition by offering innovative or attractively priced products. Thus in the end the terms have a direct influence on whether the providers will be able to hold their own in competition at the end customer level. The service provider regulation has a central role to play as the basis for negotiations.
- 519 It should also be borne in mind that independent service providers have a great deal to contribute to competition. While at present from the consumer perspective, there is a wide range of mobile providers to choose from, some of these providers are actually the distribution channels or brands of the mobile network operators. The providers are therefore – to an extent decided by their structure under company law – in most cases dependent on their parent companies. Effective competition can only develop between independent rival undertakings. If the independent service providers withdrew from the market or if their competitiveness were weakened by inadequate offers from the mobile network operators, competition would increasingly tend to be concentrated on the three mobile network operators and their distribution channels. The Bundesnetzagentur's mission, though, is to protect competition to the benefit of consumers (section 2(3) para 3 TKG).
- 520 The service providers can only be independent if they are bound to the assignment holder neither exclusively nor for an unduly long period of time. This was taken into account in the licences referred to above (cf section C, no 15, second subsection of the UMTS/IMT 2000 licences). Disproportionate dependence on the operator could limit the balancing power of service providers in their capacity as customers. This could have a significant influence on the drafting of the contractual terms and thus also on the long-term fostering of competition. This being the case, service providers must be free to provide new customers with coverage via a different mobile network and to switch existing customers to another network.
- 521 Furthermore, the reduction of infrastructure competition caused by the merger of Telefónica and E-Plus makes it seem appropriate – as already explained in connection with the efficient use of spectrum – to foster competition at the service level. The service provider regulation strengthens the negotiating capacity of existing and future service providers regarding the granting and drafting of terms. It provides the means for enhancing the competitiveness of independent service providers and the development of choice, prices and quality to the advantage of consumers.
- 522 In this connection, the Chamber is well aware that the European Commission carried out an in-depth review of the impact on competition on the German mobile market resulting from the merger of the mobile network operators Telefónica and E-Plus, and in the end approved the merger (cf Directorate-General for Competition, Decision M.7018 of 2 July 2014, Official Journal of the European Union of 13 March 2015,

information number 2015/C 086/07). The European Commission also addressed the importance of the contract terms of service providers for their competitiveness and the forthcoming expiry of the existing service provider obligations. The merger was accordingly approved, taking into consideration, among other aspects, certain voluntary commitments, which were intended both to upgrade existing service provider agreements and to install a competitive MBA-MVNO (Mobile Bitstream Access – MVNO) on the market. Within the limits of the merger control proceedings, however, the Commission was able to resort only to measures or voluntary commitments that affected the merging undertakings. With its service provider regulation, the Chamber is taking the arguments of the Commission further and addressing all assignment holders and service providers, with a view to using service provider regulations to uphold the principle of freedom from discrimination and create transparency and legal and planning certainty for all undertakings equally.

523 On the subject of competition and in line with the considerations of the Chamber, the Monopolies Commission also recommended, in its special report of 2017, that:

"To promote competition on the mobile communications markets and ensure the most efficient possible use of spectrum [...] the award of frequencies should be tied to the obligation of offering providers without their own mobile network wholesale products on non-discriminatory terms [...]"

(Monopolies Commission, Special Report 78, 2017, Policy recommendations, page 88)

524 With regard to the already explained promotion of competition and efficient spectrum usage, the service provider regulation also provides the means of safeguarding the interests of telecommunications users, particularly those of consumers, under section 2(2) para 1 TKG, and of delivering the greatest possible benefit for users in terms of choice, prices and quality (section 2(2) para 1 in conjunction with para 2 TKG).

525 The service provider regulation can be expected to favour the development of a diverse competitive environment to the benefit of consumers, who could then be offered innovative and attractively priced mobile services. In the past, service providers have particularly targeted price-sensitive consumers. A technologically neutral regulation could result in these consumers, too, being offered new mobile technology, such as 5G, more quickly. This could mean a significant rise in the penetration of the market with high-speed and efficient mobile technology, together with the resulting innovative applications.

526 In the Chamber's opinion, a service provider regulation will continue to make it possible for assignment holders to offer consumers innovative services. Current administrative practice regarding the service provider obligation of the GSM and UMTS licences has made it clear that it must be possible for assignment holders to engage in first-mover competition. Accordingly, innovative products do not have to be passed on to service providers immediately, but only after a reasonable period of time. This safeguards the innovation potential of the assignment holders without discriminating against the service providers.

527 There is no conflict between the service provider regulation and the regulatory objective of expediting the rollout of high-speed next-generation telecommunications networks under section 2(2) para 5 TKG.

528 A service provider regulation will not be detrimental to the investment capacity of assignment holders. Revenues from service provider agreements are in principle at the disposal of assignment holders as potential investment funds for network rollout. However, the regulation could also provide the basis for cooperation including a direct financial participation by service providers in network rollout.

- 529 Notwithstanding the above, however, in the Chamber's view the crucial criteria for decisions on investment in network rollout are the particular business models, demand trends and the level of competition on the market in question. So the impulse to roll out network also results from the infrastructure competition with the other assignment holders. A service provider regulation which affects all assignment holders equally is not likely to make them less willing to invest.
- 530 Even if, after the termination of the present service provider regulation, it were still possible for service providers to conclude agreements with assignment holders on the basis of freedom of contract and thus continue to be able to supply their customers with mobile services, following an evaluation of the in-depth consultation process it still seems appropriate to impose the regulation referred to above.
- 531 The service provider regulation is tied to the provision of scarce spectrum resources. Spectrum award proceedings are only conducted at irregular intervals. This makes it necessary to forecast the implementation of the regulatory objectives. The forecast encompasses the duration of the spectrum assignment or alternatively the period up to further award proceedings, which would provide another opportunity for the imposition of a service provider regulation.
- 532 The Chamber believes that service providers can make a substantial contribution to ensuring the regulatory objectives. However, the scope of their contribution depends – as already pointed out – on the terms. If there is no service provider regulation as a basis for their negotiation it is likely, in the Chamber's opinion, that the service providers will not be able to obtain competitive terms.
- 533 It is therefore necessary for regulatory action to be taken with a view to establishing transparency and legal and planning certainty for both assignment holders and service providers. In the Chamber's view the service provider regulation, which takes the form of an obligation to negotiate, is the mildest means of ensuring achievement of the regulatory objectives.
- 534 In particular, the service provider regulation would only affect suitable service providers and the negotiation requirement does not mean that every interested party must be granted capacity. Where cooperation is not reasonably possible in an individual case, or the assignment holder has reason to fear that the provider could use the capacity for inappropriate purposes, the cooperation can be refused, terminated or contractually restricted. In contentious cases the affected party will be at liberty to appeal to the Bundesnetzagentur as an "arbitrator".
- 535 In this context account should also be taken of the voluntary commitments made by Telefónica to the European Commission as a result of its merger (see proceedings M.7018 loc cit), which are in force for longer than the terms of the UMTS licences. They give the service providers, at least for a transitional period, the regulatory security that they can use at least one of the three existing mobile networks.
- 536 In the responses, it was stated that the mention of the voluntary commitments made by Telefónica as part of its merger was not sufficient. The Chamber is aware that the voluntary commitments in and of themselves do not constitute a comprehensive obligation that could replace a provision by the Bundesnetzagentur. The Chamber therefore orders the negotiating requirement as the most lenient means. It will be accompanied, at least for a time, by Telefónica's voluntary commitments, which are limited in some respects but also constitute an entitlement to access. If, as some respondents predicted, the negotiation requirement turns out to be insufficient to promote competition at the level of services, it would be possible to make use of the voluntary commitments, at least for a transition period.
- 537 The service provider regulation also provides a means of reconciling the constitutionally protected interests of both the assignment holders and the services providers. The regulation does, admittedly, in principle encroach on the freedom of

contract of the two sides. However, it is only the cooperation with networks that allows service providers to continue offering their services to customers or even to enter the market for the first time. Without the regulation creating that basis, the assignment holders would have no incentive to come to terms with the providers.

- 538 With reference to the matter of constitutionally protected occupational freedom, the Chamber is clear that the service provider regulation does in principle affect the professional activity of the assignment holders. However, in its pursuit of the TKG's regulatory objectives, the regulation serves the public interest.
- 539 It should be borne in mind at this point that what the assignment holders are assigned is a scarce public resource of importance to the wider economy. With a view to economically efficient use of spectrum, it needs to be made directly available to the service providers as well as a way of supporting the TKG's regulatory objectives – and thus also promoting the general interest in adequate nationwide telecommunications services (article 87f GG).
- 540 The Chamber further points out that the parties seeking assignment know what conditions are attached to the spectrum usage rights and are free to decide whether to participate in the proceedings. During the auction the bidders can therefore factor the service provider regulation into their bids.
- 541 It is planned to incorporate a regulation to the above effect in the spectrum assignments. In the interests of clarity, the Chamber points out that the assignments will correspond to the regulations of the President's Chamber decision and refers to the rationale above.

Re III.4.16 Shared use

The following comments were made:

- 542 The shared use of 3.6 GHz spectrum was welcomed in one quarter, as it would promote the effective use of spectrum. However, the provision was said to be too vague and in need of more concrete formulation. Past experience shows that assignment holders will probably not allow certain interested parties, such as PMSE users, access to the spectrum they have bought at auction.
- 543 Other respondents called for the provision to be removed completely, arguing it was legally inadmissible and detrimental to investments. Such agreements would carry the risk of significant competitive distortion because network operators would be able to access the spectrum of their competitors and regional network operators would be able to extend their business models outside their own region. In contrast, voluntary agreements on the shared use of spectrum are possible.

The Chamber has ruled as follows:

- 544 Assignment holders must negotiate the local or regional leasing of spectrum in the 3400 MHz – 3700 MHz band with suitable parties.
- 545 The purpose of the provision of the 3400 MHz – 3700 MHz band for nationwide assignments is to ensure planning and investment certainty at an early stage for a nationwide 5G rollout (cf subsection III.2.2). The Chamber is well aware that the physical characteristics of the 3.6 GHz band make it particularly suitable for local network rollout, eg at hotspots. Given the need for cost-effective rollout, the spectrum is therefore expected to be deployed flexibly according to specific customer needs, particularly at the local level.
- 546 The legal basis for the requirement to negotiate is section 60(2) first sentence TKG in conjunction with section 61(6) TKG. According to the first of those two provisions, spectrum assignments may be attached to secondary conditions in order to secure efficient and interference-free use of spectrum and pursue the regulatory objectives stated in section 2 TKG. The imposition of a negotiation requirement is based on

- section 52(1) TKG in conjunction with the regulatory objectives and principles laid down in section 2(2) and (3) TKG and provisions of Community law. The regulatory principle of non-discrimination ensuing from section 2(3) para 2 TKG obliges the Bundesnetzagentur in its arbitrator role to ensure non-discriminatory negotiations and thus indirectly affects the relationship of market participants with each other.
- 547 Assignment holders must negotiate about the local and regional leasing of spectrum in the 3400 MHz – 3700 MHz band as soon as demand for it is expressed. The negotiations must be non-discriminatory. To that end, assignment holders are not to adopt arbitrary positions and, on request, are to provide the Bundesnetzagentur with transparent information on the course the negotiations take (section 127 TKG). The negotiations are intended to result in agreement between the two parties on reasonable terms that are not detrimental to either side.
- 548 This does not constitute a leasing obligation. Assignment holders cannot be forced to lease 3.6 GHz spectrum to any interested party, regardless of the terms. This would inhibit the network operator's flexible rollout of 5G. Moreover, any leasing requires the consent of the Bundesnetzagentur in individual cases. The authority examines whether the potential leasing leads to concerns of distorted competition and whether the efficient and interference-free usage of spectrum is ensured (cf Communication 152/2005, OG RegTP of 29 June 2005, section 55(8) TKG).
- 549 This also takes account of the response that the negotiation requirement for the leasing of 3.6 GHz spectrum carries the risk of significant distortion of competition. The Bundesnetzagentur will consider individual cases and consult on whether a possible leasing would raise concerns of distortion of competition. If so, leasing is not permitted by law.
- 550 However, the requirement to negotiate includes the aim of negotiating and concluding a contract within the freedom of contract. Without the intention to conclude a contract, the negotiation requirement would be devoid of purpose and hence not suitable to promote the regulatory objectives laid down in the TKG.
- 551 Suitable interested parties can demand negotiations on leasing. Such parties generally include assignment holders in the 3700 MHz – 3800 MHz band wanting to use unused spectrum in the 3400 MHz – 3700 MHz band as additional capacity. Moreover, in strictly limited cases, negotiations can be demanded when use of spectrum in the 3700 MHz – 3800 MHz band is not possible in that case. For example, the 100 MHz made available could already be assigned to third parties and thus no longer available even though the applicant is in principle entitled to apply.
- 552 Regarding the reference by the stakeholder group of PMSE users to the shared use of spectrum for MFCN, the Chamber draws attention to the following: if it is only possible to implement certain PMSE applications in this band with 5G technology, it is conceivable that negotiations could take place about a shared use of spectrum for MFCN. However, any leasing must be negotiated with the assignment holder and requires the consent of the Bundesnetzagentur. With a view to the variety of PMSE applications, this must be reasonable and appropriate for the assignment holder. The Chamber expects PMSE services to be offered using 5G technology in the future within the framework of commercial applications of wireless access.
- 553 The Bundesnetzagentur is therefore permitted, in the event of infringements of this requirement, to intervene, ie by acting as an arbitrator.
- 554 Regarding the call for the arbitrator role to be clarified, the Chamber is aware of the fact that any potential breaches of the negotiation requirement can only be effectively combated by an effective form of this role. At the same time, in a market economy, agreements between parties in line with their interests should primarily be based on private-sector contractual negotiations. The Bundesnetzagentur will therefore only play a role if negotiations fail. It should only be necessary for the authority to

- intervene in exceptional cases and in a subsidiary manner, not as part of the ongoing monitoring of anti-competitive practices.
- 555 In the event of a reported breach of the negotiation requirement, the Bundesnetzagentur can first require the affected undertaking to take remedial action. If necessary, the Bundesnetzagentur can prohibit breaches of the negotiating requirement and impose a penalty (section 126(1), (2) and (5) TKG). In view of the potential discrimination, which could require rapid intervention, the Bundesnetzagentur can in individual cases in derogation of this procedure take provisional measures at short notice.
- 556 There is also the possibility of penalising breaches as regulatory offences under section 149 TKG. Pursuant to section 149(2) second and third sentences TKG, fines should exceed the economic benefit the offender has derived from breaching the negotiation requirement.
- 557 The obligation to negotiate provides the means of promoting efficient and interference-free use of spectrum and the other regulatory objectives set forth in section 2(2) TKG:
- 558 The obligation to negotiate is a means of promoting the regulatory objective of efficient use of spectrum (sections 52 and 2(2) para 7 TKG). The negotiations on leasing are intended to enable spectrum to be used in the largest possible number of regions in Germany. In principle the assignment holders operating nationwide can, in the context of infrastructure competition, take the decision on any specific rollout. In view of the physical propagation characteristics, the rollout of spectrum at 3.6 GHz is likely to start in the areas where the relevant demand exists and where economical rollout with small-cell network infrastructure is also possible. It is consequently conceivable that the spectrum will not be deployed nationwide, at least for a certain time.
- 559 The spectrum will, however, be assigned nationwide, which means there is in principle no question of the frequency being used by third parties, as the spectrum will no longer be available for further assignments.
- 560 Where an assignment holder operating nationwide has not carried out any local rollout to date or is not planning any, it therefore seems appropriate for this spectrum to be leased to other parties, so as to promote efficient spectrum usage. The requirement to negotiate will ensure that nationwide assignment holders will be prepared to negotiate on leasing spectrum.
- 561 Against that background the establishment of additional infrastructure on the basis of leasing spectrum, especially in rural regions, could contribute to expediting the rollout of high-speed telecommunications networks (section 2(2) para 5 TKG). Future assignment holders in the 3700 MHz – 3800 MHz band, in particular, could also expand their capacities in this way.
- 562 Depending on the business model of the lessee, this could help to bring about an improvement of broadband coverage and the offer of innovative services for the benefit of consumers (section 2(2) para 1 TKG).
- 563 For the above purposes it is necessary and proportionate to impose a requirement to negotiate. Agreements on the leasing of spectrum in the 3400 MHz – 3700 MHz band will supply the means of furthering implementation of the regulatory objectives set forth in section 2 TKG (see above). The requirement to negotiate is intended to create regulatory incentives for this sort of cooperation.
- 564 It is planned to incorporate a regulation to the above effect in the spectrum assignments. In the interests of clarity, the Chamber points out that the assignments will correspond to the regulations of the President's Chamber decision and refers to the rationale above.

Re III.4.17 Roaming and infrastructure sharing

The following comments were made:

- 565 The existing mobile network operators reject all the Chamber's provisions relating to national roaming including a negotiation requirement. There is no legal basis for such a rule in the regulatory provisions on spectrum, they believe. In particular, the law does not provide for a general ban on discrimination or for the Bundesnetzagentur to act as arbitrator. Moreover, the planned negotiation requirement is impracticable because it is not clearly defined and the room for interpretation could lead to considerable legal uncertainty. Viewed together with the other planned negotiating obligations, it would take resources away from a rapid 5G rollout and lead to negative reactions from the capital market. It should be left solely to undertakings to exploit the potential of shared use and cooperation agreements on the basis of bilateral commercial arrangements. Measures of ex post regulation and competition policy are available and sufficient protection mechanisms. The Chamber should make it clear that national roaming will not be imposed as an obligation, not even to the benefit of new entrants.
- 566 On the other hand, some respondents were in favour of national roaming being made compulsory, arguing it is legally permissible and appropriate. Such an order could be made regardless of market power, since market regulation provisions have different objectives and Community bases from spectrum regulation provisions and do not block the latter. Moreover, the European Electronic Communications Code will in future allow for national roaming and should be taken into consideration. A mere negotiation requirement is not sufficient because it does not have a binding effect. New entrants, in particular, need an obligatory order for national roaming so that they can be active in the retail market with competitive offers while they are rolling out their own network. Specific terms of agreements on national roaming, including the prices to be imposed, must be set before the beginning of the procedure to be admitted to the auction, so that they can be priced into bids. Alternatively, assignment holders must be required to submit an acceptable, specific offer.
- 567 Various respondents were in favour of making the planned negotiation requirement more binding and describing the stipulation of non-discrimination in more detail so as to avoid legal uncertainty and ensure planning certainty. There were also calls to provide more detail on the planned arbitrator role of the Bundesnetzagentur and make it a binding dispute resolution responsibility.
- 568 Respondents took differing views of the significance of national roaming for regional assignment holders as authorised parties. The success of regional public mobile networks depends directly on the mobile services offered on them being usable nationwide.
- 569 There were isolated calls for a national roaming obligation relating to the need for an accessible emergency number using data connections.

The Chamber has ruled as follows:

- 570 Subject to the provisions of telecommunication and antitrust law, assignment holders are to negotiate on the shared use of existing nationwide networks (known as roaming) and on infrastructure sharing whenever a nationwide mobile network operator gives notice of demand for such sharing.
- 571 Roaming refers to the process of enabling a mobile network operator to use the mobile networks of other operators for its end users in areas outside its coverage.
- 572 A distinction must be made between (national) roaming between an existing national mobile network operator and a new entrant from these proceedings, and (regional) roaming between existing national mobile network operators.

- 573 With regard to the promotion of competition, (national) roaming can make it easier for a new entrant to get into the market. By contrast, (regional) roaming between existing network operators can be used to utilise existing mobile coverage, especially in rural areas, in order to provide coverage to the customers of the other network operator. Where network operators agree on roaming, this can contribute to the promotion of cost-effective rollout of mobile infrastructure in areas which a single network operator would find economically difficult to develop on its own.
- 574 In the Chamber's opinion it is not possible to simply order national or regional roaming in the sense of an access obligation. The imposition of an access obligation (section 21 TKG) is conditional on the network operator having significant market power. Neither the Bundeskartellamt nor the Bundesnetzagentur has so far found this to be the case.
- 575 Regarding the question of whether more far-reaching obligations related to roaming would come under section 21 TKG and there would therefore be a blocking effect, both legal views were presented with reasoning in the responses. However, the Chamber takes the view that this legal question can be left open in respect of the specific formulation of the obligation because the requirement to engage in negotiations does not come within the scope of section 21 TKG. In addition, the Chamber takes the view that the obligation in its current form is suitable to take the interests of market participants into account and to avoid stricter ex-ante regulatory obligations (cf section 2(3) para 6 TKG), by giving the Bundesnetzagentur a role as "arbitrator". This regulatory decision is based in particular on the legal principles of proportionality and necessity.
- 576 The Chamber intends to take full advantage of the roaming possibilities with a view to implementing the regulatory objectives, with particular reference to the interests of consumers in high-speed mobile infrastructure – especially in rural areas – and in workable competition. This will be conditional on there being sufficient incentives for negotiating on roaming.
- 577 In addition incentives are to be created for entering into cooperation arrangements on sharing infrastructure.
- 578 With an infrastructure sharing arrangement, the mobile network operators can cooperate in various ways aimed at the joint rollout of network elements (from site sharing to frequency pooling). Infrastructure sharing can make a contribution to improved mobile coverage. Subject to the requirements of competition and antitrust law, spectrum assignment holders can enter into cooperation aimed at joint economical network rollout (burden sharing).
- 579 Distinctions are made with regard to the scope of the sharing. Shared use of passive network elements such as radio antenna sites, their connection to the power supply, etc, is unproblematic. The more network elements the sharing covers, however, the more likely that the Bundesnetzagentur and the Bundeskartellamt will look at the case. In this context it is necessary to ensure that competition among the mobile network operators is upheld even when sharing takes place.
- 580 The Bundesnetzagentur has already drawn up regulatory principles for this purpose (cf Communication No 458/2010, Bundesnetzagentur Official Gazette 15/2010, dated 11 August 2010, pages 2730-31). It believes that it is desirable for infrastructure sharing to be used for cost-effective rollout in the interest of improved coverage of the rural areas in those regions where there has been no network rollout to date and none is likely in the foreseeable future.
- 581 Regarding the views expressed in the responses about the legal bases of the negotiation requirement, the Chamber maintains its view, with the addition of its explanations. The legal basis for the negotiation requirement is section 60(2) first sentence TKG in conjunction with section 61(6) TKG. According to the first of those

two provisions, spectrum assignments may be attached to secondary conditions in order to secure efficient and interference-free use of frequencies and pursue the regulatory objectives stated in section 2 TKG. The imposition of a negotiation requirement is based on section 52(1) TKG in conjunction with the regulatory objectives and principles laid down in section 2(2) and (3) TKG and provisions of Community law. The regulatory principle of non-discrimination ensuing from section 2(3) para 2 TKG obliges the Bundesnetzagentur to ensure non-discriminatory negotiations in its arbitrator role and thus indirectly affects the relationship of market participants with each other.

- 582 Assignment holders must therefore negotiate on roaming and infrastructure sharing whenever a nationwide mobile network operator or new entrant gives notice of demand for such sharing. To that end, assignment holders are not to adopt arbitrary positions and, on request, are to provide the Bundesnetzagentur with transparent information on the course the negotiations take (section 127 TKG). The non-discriminatory negotiations should result in agreement on reasonable terms which are not detrimental to either side. It must be prevented, for example, that suitable network operators are simply refused negotiations on roaming and infrastructure sharing, that negotiations are held in an abusive way or unreasonable terms are attached to services.
- 583 However, a requirement to negotiate in a non-discriminatory manner does not mean a non-discrimination obligation within the meaning of section 19 TKG, nor is there a compulsion to enter into and conclude a contract or agreement. Assignment holders cannot be forced to enter into a contract with any interested party, regardless of the terms. However, the requirement to negotiate includes the aim of negotiating and concluding a contract within the freedom of contract. Without the intention to conclude a contract, the negotiation requirement would be devoid of purpose and hence not suitable to promote the regulatory objectives laid down in the TKG.
- 584 The Bundesnetzagentur is therefore permitted, in the event of infringements of the negotiation requirement, to intervene, ie by acting as an arbitrator. There must be a thorough weighing up of interests of the affected parties in the light of the regulatory objectives laid down in section 2 TKG. The intention is to create incentives for new entrants to set up their own nationwide networks as quickly as possible.
- 585 Regarding the call for the arbitrator role to be clarified, the Chamber is aware of the fact that any potential breaches of the negotiation requirement can only be effectively dealt with by an effective form of this role. At the same time, in a market economy, agreements between parties in line with their interests should primarily be based on private-sector contractual negotiations. The Bundesnetzagentur will therefore only play a role if negotiations fail. It should only be necessary for the authority to intervene in exceptional cases and in a subsidiary manner, not as part of the ongoing monitoring of anti-competitive practices.
- 586 In the event of a reported breach of the negotiation requirement, the Bundesnetzagentur can first require the affected undertaking to take remedial action. If necessary, the Bundesnetzagentur can prohibit breaches of the negotiating requirement and impose a penalty (section 126(1), (2) and (5) TKG). In view of potential discrimination that could require rapid intervention, the Bundesnetzagentur can in individual cases in derogation of this procedure take provisional measures at short notice.

There is also the possibility of penalising breaches as regulatory offences under section 149 TKG. Pursuant to section 149(2) second and third sentences TKG, fines should exceed the economic benefit the offender has derived from breaching the negotiation requirement.

National roaming for new entrants

- 587 In view of the possible appearance on the market of a new entrant following these proceedings, the negotiation requirement on (national) roaming under section 60(2) first sentence TKG is a suitable means of promoting efficient and interference-free use of spectrum and the achievement of the other regulatory objectives set forth in section 2(2) TKG:
- 588 A requirement for existing mobile network operators to negotiate with new entrants is a means of ensuring fair competition and promoting sustainable competitive markets as required in section 2(2) para 2 TKG. As the Chamber sees it, (national) roaming is a suitable instrument for facilitating entry to the market by new players in areas where spectrum resources are scarce. A new entrant cannot set up a nationwide network in short order but only step by step. However, as the responses confirmed, with a national business model a new entrant will have to be able to offer customers mobile coverage for as much of the country as possible right from the start. A negotiation requirement will lower the hurdles to market entry in the nationwide mobile market. This could increase the variety of mobile providers and promote competition. The Chamber here also took account of the fact that there are only three mobile networks operators still active nationwide since the merger of Telefónica and E-Plus.
- 589 Regarding comments on national roaming for regional assignment holders, apart from new entrants, the Chamber draws attention to the following: spectrum in the 3700 MHz – 3800 MHz band is assigned in an application process (drafts can be viewed at www.bundesnetzagentur.de/lokalesbreitband). In these proceedings, it has already been stated that it is not planned to order national roaming on existing mobile networks to the benefit of local or regional assignment holders in the 3700 MHz – 3800 MHz band. Spectrum for nationwide assignments is made available on the basis of a competitive selection procedure for the implementation of nationwide business models. By contrast, implementing nationwide business models on the basis of local or regional assignments could distort competition because it would circumvent the competitive selection procedure.
- 590 The negotiation requirement is a means of promoting the rollout of high-speed next-generation public telecommunications networks under section 2(2) para 5 TKG. (National) roaming can make it possible for a new market player to offer mobile services nationwide at an early stage while still rolling out its network step by step across the country. In the long term, this could mean that further high-speed broadband infrastructure becomes available. It can be assumed that a new entrant will avail itself of the latest mobile technology for its network rollout.
- 591 Pursuit of the above-stated regulatory objectives under section 2(2) paras 2 and 5 TKG means that the interests of consumers, as provided for in section 2(2) para 1 TKG, are also taken into consideration. An additional network operator could help to ensure that consumers are offered additional innovative services. Possible new entrants could mean that further providers contribute to infrastructure and services competition, which would produce the greatest possible benefit for consumers in terms of choice, price and quality.
- 592 In this connection, the Chamber wishes to clarify that new entrants in this sense are undertakings seeking entry to the market as new nationwide mobile network operators on the basis of their own assignments of nationwide spectrum auctioned in these proceedings.

Regional roaming between existing national network operators

- 593 With regard to roaming agreements between existing nationwide mobile network operators, the requirement to negotiate on national roaming under section 60(2) first sentence TKG is a suitable means of promoting efficient and interference-free use of

spectrum and the achievement of the other regulatory objectives set forth in section 2(2) TKG:

- 594 The requirement to negotiate on cooperation between existing nationwide mobile network operators is a means of promoting the interests of consumers as required in section 2(2) para 1 TKG. Regional roaming between existing network operators can be agreed as the means of using existing mobile coverage, particularly in rural areas, to supply the needs of the customers of the other operator. Consumers who up to now have had no regional coverage from their own network operator could thus become able to use mobile broadband services.
- 595 This applies particularly to the extent that regional roaming creates incentives for fostering the cost-effective rollout of mobile infrastructure in areas which a single network operator would find economically difficult to develop on its own. This could create incentives to expand into areas where so far no network operator has rolled out a network, having the effect of improving broadband coverage, particularly in rural areas, and reducing the digital divide between urban and rural areas.
- 596 In this context, the requirement to negotiate also provides the means of fostering the efficient use of spectrum (sections 52 and 2(2) para 7 TKG) and promoting the rollout of high-speed next-generation public telecommunication networks (section 2(2) para 5 TKG). Regional roaming is a suitable instrument for reducing rollout costs and encouraging network rollout. It can also be used to cut the costs of the coverage obligations imposed. The negotiation requirement is intended as an incentive for the nationwide mobile network operators to enter into the required cooperation agreements.
- 597 The regulatory objective of ensuring fair competition and promoting sustainable competitive markets under section 2(2) para 2 TKG is not in conflict with the obligation to negotiate on regional roaming. Cooperation is only permitted within the bounds of telecommunications and antitrust law. It requires the consent of the Bundesnetzagentur and, under some circumstances, the Bundeskartellamt as well. The main point is to ensure that consumers can continue to be served by effective infrastructure and services-based competition. In the Chamber's opinion, however, the possible cooperation agreements should be particularly directed at the areas where there is no effective competition because of the lack of network rollout.
- 598 In this connection the Monopolies Commission's recommendation is:
- "To promote competition on the mobile communications markets and ensure the most efficient possible use of spectrum [...]*
- In pursuing the goal of a comprehensive provision of all households with mobile broadband access, what should be avoided is an unnecessary duplication of infrastructure in regions that are difficult to develop. This can be done either by dispensing with exacting coverage obligations in favour of state support or by restricting such obligations to selected frequency blocks."*
- (Monopolies Commission, Special Report 78, 2017, Policy recommendations, page 88)*
- 599 Apart from the measures mentioned by the Monopolies Commission, however, roaming agreements between existing nationwide mobile network operators can also help to avoid unnecessary duplication of infrastructure in regions that are difficult to develop. Such agreements would reduce the costs of network build and thus create incentives for providing coverage to consumers in rural areas.

Infrastructure sharing

- 600 An unnecessary duplication of infrastructure in areas that are difficult to develop can also be avoided by sharing infrastructure.

- 601 With regard to agreements on infrastructure sharing, the negotiation requirement pursuant to section 60(2) first sentence TKG is a suitable means of promoting efficient and interference-free use of spectrum and the achievement of the other regulatory objectives set forth in section 2(2) TKG:
- 602 The requirement to negotiate on cooperation is a suitable means of fostering the interests of consumers as required by section 2(2) para 1 TKG. The sharing of infrastructure could create incentives for promoting cost-effective rollout of mobile infrastructure in areas which a single network operator would find economically difficult to develop on its own. The sharing could enable regions where no operator has so far provided rollout to be given coverage. This would have the effect of improving broadband coverage, particularly in rural areas, and reducing the digital divide between urban and rural areas.
- 603 In this context, the negotiation requirement also provides the means of promoting the rollout of high-speed next-generation public telecommunication networks (section 2(2) para 5 TKG). Infrastructure sharing is a suitable instrument for reducing rollout costs and encouraging network rollout. It can also be used to cut the costs of the coverage obligations imposed. The negotiation requirement is intended as an incentive for the nationwide mobile network operators to enter into the required cooperation agreements.
- 604 The requirement to negotiate on infrastructure in principle also provides a means of fostering efficient spectrum use (sections 52 and 2(2) para 7 TKG). Depending on how the agreements are formulated, RAN sharing or frequency pooling could also be carried out. While all that would be set up would be infrastructure, use would in fact be made of the spectrum resources of the operators involved in the cooperation. This would make the use of spectrum possible in areas which not all assignment holders are able to develop cost-effectively. Thus the sharing of infrastructure could make an even greater contribution than roaming to the promotion of efficient use of spectrum.
- 605 The regulatory objective of ensuring fair competition and promoting sustainable competitive markets under section 2(2) para 2 TKG is not in conflict with the requirement to negotiate on infrastructure sharing. Cooperation is only permitted within the bounds of telecommunications and antitrust law. It requires the consent of the Bundesnetzagentur and, under some circumstances, the Bundeskartellamt as well. The main point is to ensure that consumers can continue to be served by effective competition for infrastructure and services. In the Chamber's opinion, however, the possible cooperation agreements should be particularly directed at the areas where there is no effective competition because of the lack of network rollout.
- 606 It is necessary and proportionate to impose a negotiation requirement on roaming and infrastructure sharing.
- 607 Agreements on roaming and infrastructure sharing provide the means of promoting the achievement of the regulatory objectives stated in section 2 TKG (see above). A negotiation requirement could create incentives for this sort of cooperation. It is true that agreements on roaming and infrastructure sharing can be concluded on the basis of freedom of contract, but account has to be taken of the disparate interests of the potential contracting parties, which could prevent them from even entering into contractual negotiations.
- 608 Furthermore, agreements on roaming and infrastructure sharing presuppose that two or more direct competitors can reach agreement. In this context the negotiation requirement could provide a regulatory basis and make it clear that cooperation between competitors, within the limits of telecommunications and antitrust law, is desired with a view to taking full advantage of the potential offered by cooperation for advancing the regulatory objectives.

- 609 In the Chamber's view, having taken into account the responses received, a requirement to negotiate is still the mildest means of promoting cooperation. Measures involving more intrusive intervention are not necessary, from the current perspective. On the other hand, the Chamber does not believe that more lenient instruments would be sufficient to promote cooperation. In particular, ex post regulation and competition law are not sufficient to provide enough of an incentive for cooperation.
- 610 On the one hand, the principle of non-discriminatory negotiations enables the Bundesnetzagentur, in the role of arbitrator, to work towards objective negotiations. On the other, the requirement does not carry any regulatory compulsion – it is not mandatory to conclude a contract – so that its capacity to intervene with the assignment holder that has received a request for roaming or infrastructure sharing remains small. In assessing the level of intervention, the Chamber has already taken account of the total burden on assignment holders from the planned negotiation requirements mentioned by respondents. In its considerations, the Chamber was aware of the significance of cooperation arrangements for a rapid rollout of 5G and has taken the view that the resources needed to fulfil the planned negotiation requirements will not place a disproportionate burden on assignment holders.
- 611 The Chamber points out once again that the requirement does not involve an obligation related to roaming within the meaning of section 21 TKG. The aim is to maintain the contracting parties' freedom of contract and at the same time create incentives for non-discriminatory negotiations.
- 612 With regard to roaming, the usage charges and terms can in principle be determined on the basis of exercising freedom of contract. It would also be conceivable for cooperation to follow the principle of reciprocity. This could apply in particular where existing nationwide mobile network operators cooperate to fill in not-spots or provide coverage along a challenging transport route.
- 613 The Chamber is well aware that the requirement to negotiate can restrict the assignment holders' professional activity. However, it also does a great deal, in the public interest, to advance the TKG's regulatory objectives (see above), and thus also serves the public interest in having adequate nationwide telecommunications services (article 87f GG).
- 614 The Chamber would also like to state explicitly that provisions on infrastructure sharing and roaming are envisaged for the future Directive of the European Parliament and of the Council establishing the European Electronic Communications Code (EECC) that is due to enter into force. The Directive makes clear that roaming obligations may be attached to spectrum assignments. In addition, it also deals with the possibility of ordering passive infrastructure sharing or local roaming in the event that there are insurmountable obstacles to the rollout of network. Article 61(4) EECC reads as follows:

"Without prejudice to paragraphs 1 and 2, Member States shall ensure that competent authorities have the power to impose on undertakings providing or authorised to provide electronic communications networks obligations in relation to the sharing of passive infrastructure or obligations to conclude localised roaming access agreements, in both cases if directly necessary for the local provision of services which rely on the use of radio spectrum, in accordance with Union law and provided that no viable and similar alternative means of access to end-users is made available to any undertaking on fair and reasonable terms and conditions. Competent authorities may impose such obligations only where this possibility is clearly provided for when granting the rights of use for radio spectrum and where justified on the grounds that, in the area subject to such obligations, the market-driven deployment of infrastructure for the provision of networks or services which rely on the use of radio spectrum is subject to

insurmountable economic or physical obstacles and therefore access to networks or services by end-users is severely deficient or absent. In those circumstances where access and sharing of passive infrastructure alone does not suffice to address the situation, national regulatory authorities may impose obligations on sharing of active infrastructure.

Competent authorities shall have regard to:

(a) the need to maximise connectivity throughout the Union, along major transport paths and in particular territorial areas, and to the possibility to significantly increase choice and higher quality of service for end-users;

(b) the efficient use of radio spectrum;

(c) the technical feasibility of sharing and associated conditions;

(d) the state of infrastructure-based as well as service-based competition;

(e) technological innovation;

(f) the overriding need to support the incentive of the host to roll out the infrastructure in the first place.

In the event of dispute resolution, competent authorities may, inter alia, impose on the beneficiary of the sharing or access obligation, the obligation to share radio spectrum with the infrastructure host in the relevant area."

- 615 However, the transposition of this new legal framework into national law is subject to a decision by and the leeway of the legislature. With a view to a future version of the TKG transposing the European legislation, therefore, the Bundesnetzagentur must reserve the right in the exercise of its discretion to consider the imposition of roaming obligations on a case by case basis and if necessary to order them, taking into account the regulatory objectives laid down in section 2(2) TKG.
- 616 Finally, the Chamber points out that the parties seeking assignment know what conditions are attached to the spectrum usage rights and are free to decide whether to participate in the proceedings. During the auction the bidders can therefore factor the planned negotiation requirement into their bids.
- 617 It is planned to incorporate a regulation to the above effect in the spectrum assignments. In the interests of clarity, the Chamber points out that the assignments will include the operative part of the President's Chamber decision and refers to the rationale above.
- 618 Regarding the calls for national roaming obligations relating to the need for an accessible emergency number using data connections, the Chamber draws attention to the following: imposing a general obligation to transmit requests for emergency assistance via data connections, beyond the requirement for emergency calls, would require a change in the law (section 108 TKG).

Re III.5 Minimum bid, section 61(4) second sentence TKG

The following comments were made:

- 619 Most respondents wanted the minimum bids to be reduced, arguing this would increase network operators' investment opportunities in the network rollout, eg along transport routes. One respondent pointed out that the minimum bids were higher than in previous auctions. There is a risk that the allocation process would lead to excessive spectrum costs in the course of the auction, it was said. Minimum bids should be based more strongly on spectrum fees. A €25m minimum bid is proposed for 2 GHz with a duration of 20 years. Because of its less favourable wave propagation characteristics, the value of spectrum in the 3.6 GHz band is only a third

that of the 2 GHz spectrum. The minimum bid should therefore not exceed €8m per 10 MHz block.

- 620 One respondent called for the minimum bids in the 2 GHz band to be adjusted in the event that no asymmetric coverage obligations are imposed. At the same time, there should be a discount on the highest bids for obligations entered into voluntarily.

The Chamber has ruled as follows:

- 621 According to section 61(4) second sentence TKG, a minimum bid can be determined for participation in auction proceedings.
- 622 The minimum bids are determined with regard to the frequency band, the frequency range, the assignment term, usability and imposed obligations.
- 623 The minimum bids are based on the commercial value of the frequencies. One way of calculating this value is to base it on the results of past auctions of comparable frequencies.
- 624 There are two paramount aims to be borne in mind when determining minimum bids. They must in the first place not be set too high, and they must in particular not represent barriers to entry to the market. Thus it is necessary to take account of the interests of small and medium-sized enterprises (section 61(4) first sentence TKG). It is not the purpose of the auction to maximise revenues. The Chamber believes that the auction rules help to ensure that the auction proceedings do not lead to disproportionately high spectrum costs.
- 625 In the second place, minimum bids must not be set too low either. As a public resource, MFCN frequencies have a high social and economic value. It is therefore appropriate, when determining minimum bids, to ensure that they are proportionate to the value of the frequencies and their actual usability.
- 626 Mobile services use spectrum to provide mobile coverage as a basic aim and make the required capacity available. Assignment applicants can serve a forecast capacity demand for the future either by deploying additional frequencies, by increasing the density of the network – ie by rolling out more base station sites – or by using more efficient technology. In the context of the auction, each bidder has to weigh up whether to acquire more spectrum or to invest more in rollout, so as to realise the desired network capacity.
- 627 Finally, the minimum bids are intended to enable the auction proceedings to arrive at a price for a valuable and scarce resource. There should therefore be a certain room for manoeuvre in this pricing process.
- 628 Another point to be considered is that minimum bids influence the number of bidding rounds and hence the duration of the auction.
- 629 The Chamber will therefore not follow the suggestion of basing the minimum bids on the Fee Ordinance.
- 630 Following the responses and in particular with regards to the coverage obligations (cf subsection III.4), the Chamber believes it is appropriate to lower the minimum bids significantly from those presented in the draft document for consultation. It thus takes account of the fact that the value of the spectrum up for award can be significantly influenced by the obligations attached to the award. The minimum bids will therefore be lower, also in comparison to earlier auctions. The Chamber shares the view given in the consultation that this will increase network operators' investment opportunities in the network rollout, eg along transport routes – even though lower minimum bids will not automatically translate to lower highest bids.
- 631 Regarding the comments that asymmetric obligations in combination with asymmetric minimum bids could lead to distortion of competition, the Chamber points out that the coverage obligations and the minimum bids will now be set symmetrically for all

frequency blocks in the frequency bands (cf subsection III.4). The Chamber has thus followed the suggestion for the minimum bids to be adjusted. All minimum bids have been significantly reduced so that the obligations relating to the award of spectrum can be taken into account when bids are submitted.

Minimum bids in the 2 GHz band

- 632 The minimum bid for a frequency block of 2 x 5 MHz (paired) in the 2 GHz band that is available from 2021 will be €5 million and €3.75 million for a frequency block that is available from 2026.
- 633 To determine the minimum bid, the Chamber has referred to the results of auctions of comparable frequencies. The propagation characteristics of frequencies in the 2 GHz band make them comparable with those in the 1.8 GHz band. Moreover, the frequencies are assigned on a technology-neutral basis and are thus usable with all the standard systems, provided that technology has been developed for the band.
- 634 At the 2015 auction in Germany the average highest bid for frequencies in the 1.8 GHz band was about €240m per paired 5 MHz frequency block. The duration of the frequency assignment was 17 years.
- 635 Given the above considerations, the Chamber believes that a minimum bid of €75m for frequencies in the 2 GHz band, with an assignment period of 20 years, would be generally appropriate. However, taking account of the planned coverage obligations, which will now be expanded and imposed symmetrically, the Chamber has come to the conclusion that a minimum bid of €5m is appropriate. The same applies to the minimum bid of €3.75m for frequencies in the 2 GHz band with an assignment period of 15 years. The amount takes account of the shorter period of usability of 15 years.
- 636 Bidders must be given the possibility of allowing for the cost burden involved in the coverage obligation when making their bids.

Minimum bids in the 3400 MHz – 3700 MHz band

- 637 The minimum bid for a frequency block of 1 x 20 MHz (unpaired) in the 3400 MHz – 3420 MHz band will be €2 million. The minimum bid for a frequency block of 1 x 10 MHz (unpaired) in the 3420 MHz – 3700 MHz band will be €1.7 million.
- 638 Even though the specific frequency block up for award in the 3690 MHz – 3700 MHz band was said in the responses to have a different value, the minimum bid for this block will not be set differently. The Chamber takes the view that this frequency block has essentially the same value. To determine the minimum bids in the 3400 MHz – 3700 MHz band, the Chamber has referred to the results of auctions of comparable frequencies. For example, in 2010 the Bundesnetzagentur auctioned off spectrum in the 2.6 GHz band. The two frequency bands are comparable as they are both suitable for the local and regional rollout of additional capacity.
- 639 In 2010 the average auction revenues for spectrum in the 2.6 GHz band with an assignment term of 15 years were about €18m. Taking into account the planned assignment period of about 20 years and the inflation of recent years, a higher value can be set on the frequencies in the 3.6 GHz band.
- 640 As regards the value of the 3.6 GHz frequencies, what should be particularly borne in mind is that this frequency band was identified in Europe as a pioneering band for 5G and these frequencies can therefore be expected to be used soon. Very large bandwidths are available in this band for the first time, eg to make much higher transmission rates (enhanced mobile broadband) and real-time communication possible.
- 641 The RSPG has also paid tribute to the special characteristics of the 3.6 GHz band in relation to 5G rollout. The band is expected to be used both for 5G rollout nationwide and for capacities:

"The 700 MHz band can be used to provide wide area coverage, the 3.6 GHz band can be used to provide high capacity and coverage, using both existing macro cells and small cells. The 26 GHz band is likely to be deployed in areas with very high demand, for example transport hubs, entertainment venues, industrial or retail sites and similar. Because of its characteristics, the 26 GHz band will not be used to create wide area coverage." (RSPG18-005 FINAL, "Second Opinion on 5G-Networks" dated 30 January 2018, page 6)

- 642 If account is also taken of the awards of the 2.6 GHz and 3.6 GHz bands elsewhere in Europe, the value resulting for a 10 MHz frequency block in the 3.6 GHz band runs into medium to high two-digit million figures.
- 643 Taking into account the coverage obligations tied to the usage rights, the minimum bid set for a frequency block of 1 x 10 MHz (unpaired) in the 3420 MHz – 3700 MHz band is €1.7m. This creates scope for competitive bidding, which would establish the actual value of the spectrum when the obligations imposed are taken into account at the auction.
- 644 Moreover, the Chamber has taken into account the physical propagation characteristics of the spectrum in the 3.6 GHz band compared to the 2 GHz band. The minimum bid of €1.7m for 1 x 10 MHz (unpaired) in the 3.6 GHz band, when the duration is the same, is about a third of the minimum bid of €5m for 2 x 5 MHz (paired) in the 2 GHz band.
- 645 In view of the frequency usage conditions (cf Annex 3) and the restricted usability of the 3400 MHz – 3420 MHz band that will possibly result, the minimum bid set for this band will be different at €2m. This corresponds to about half of the minimum bid for one of the other frequency blocks of 1 x 10 MHz (unpaired).

The minimum bids for the 2 GHz and 3.6 GHz bands are the following:

Frequency band	Duration	Frequency block	Minimum bid
2 GHz	20 years	2 x 5 MHz (paired)	€ 5,000,000
2 GHz	15 years	2 x 5 MHz (paired)	€ 3,750,000
3400 – 3420 MHz	~ 20 years	1 x 20 MHz (unpaired)	€ 2,000,000
3.6 GHz	~ 20 years	1 x 10 MHz (unpaired)	€ 1,700,000

Table 3: Overview of minimum bids

- 646 The operative part has been amended accordingly.

Re IV Auction rules

Re IV.1 General provisions

Re IV.1.1 Venue

The following comments were made:

- 647 There were calls to conduct the auction online. A presence auction was said to require a lot of resources and make it harder to coordinate between the auction venue and the undertaking's headquarters.

The Chamber has ruled as follows:

- 648 The auction will be conducted in the presence of the bidders at the Bundesnetzagentur's Mainz office (physical auction), using locally networked computers.

- 649 This is intended to ensure that the spectrum award proceedings are conducted briskly, smoothly and efficiently.
- 650 In the Chamber's view, the brisk and smooth conduct of physical auctions in the past has demonstrated their worth.
- 651 On account of the high security requirements laid down by the Bundesnetzagentur – and in the past by the bidders as well – for such award proceedings, it is still absolutely necessary to run a physical auction.
- 652 Holding the auction at one central venue makes it easier to ensure that it is conducted correctly, and to counteract any collusion, than would be the case if the bidders placed their bids from their business premises.
- 653 The Chamber understands, as respondents pointed out, that a physical auction involves considerable expense and logistical effort for the bidders. However, these arguments do not outweigh the advantages of a physical auction. Having weighed up all the arguments, the Chamber has decided that a physical auction will be held.

Re IV.1.2 Eligibility

The Chamber has ruled as follows:

- 654 Subsection IV.1.2 lists the formal criteria which an applicant must meet in order to be able to participate as a bidder in the auction. These are formal qualification, the provision of security and authorisation of the bidder's representatives.
- 655 Before conducting the auction the Bundesnetzagentur will issue a public announcement stating which applicants are entitled to take part in the auction as bidders.

Re IV.1.3 Security

The Chamber has ruled as follows:

- 656 One of the conditions for participation in the auction is that the qualified applicant provides a security. The point of the security is to demonstrate that the applicant has a serious intention to take part; it also serves as cover for at least part of the amount to be paid by the successful bidder. It is without prejudice to the need to supply proof of financial capacity, which is done primarily by submission of a financing statement.
- 657 The security can be furnished by transferring the amount in question to an account to be specified by the Bundesnetzagentur. The account must be credited not later than 14 days before the start of the auction.
- 658 Alternatively the provision of the security may also take the form of an unconditional, continuing, irrevocable, absolute bank guarantee issued by a domestic (ie German) financial institution or a financial institution authorised as a customs and tax guarantor. Under section 766 first sentence BGB, the surety bond must be in written form; and if this method is used the original must be submitted to the Bundesnetzagentur. If the bond is notarised, only a copy intended for the Bundesnetzagentur need be submitted. The condition that the guarantee may only be issued by one of these two types of institution aims to ensure applicability of German law to claim assertion and enforceability in accordance with German law. The surety bond must have been received by the Bundesnetzagentur not later than 14 days before the start of the auction.
- 659 The security amount will be determined by the maximum number of bidding entitlements held by the applicant, determined on the basis of the application to qualify. The benchmark used is the minimum bid for a 10 MHz frequency block in the 3.6 GHz band, which is €1.7m. This is the lowest minimum bid for 10 MHz apart from the 1 x 20 MHz frequency block (unpaired) in the 3.6 GHz band that is subject to

special conditions. The security has been adjusted from that given in the draft document for consultation to reflect the changed minimum bids (cf subsection III.5). The security therefore amounts to €1.7m for each bidding entitlement (expressed as lot ratings).

- 660 The purpose of making the security amount dependent on the minimum bid is to ensure that interested undertakings are not deterred from participation in the auction solely because of the security amount.
- 661 If the security amount was transferred to the Bundesnetzagentur's account, it will be set off against the award price or other payment obligations under the auction rules in the event of a successful bid.
- 662 If the security was furnished in the form of a bank guarantee, this will be returned in full after payment has been made.
- 663 No interest is paid on the security deposit. If a bidder has not been awarded spectrum and has no other payment obligations, the security will be reimbursed immediately the complete auction proceedings have ended. In this case the surety bond will be returned.

Re IV.1.4 Lots

The following comments were made:

- 664 There were calls to award the spectrum in the 2 GHz band uniformly in blocks of 2 x 5 MHz (paired) and the spectrum in the 3.6 GHz band in blocks of 1 x 10 MHz (unpaired). Awarding larger blocks would make bidders less flexible in their biddings, which would tend to drive up prices, it was said. The frequency blocks should therefore be the smallest unit that makes technical sense so as to avoid unpredictable risks in the bidding dynamics and to prevent the proceedings from becoming unnecessarily complex and unclear.
- 665 With respect to the 2 GHz band, it was suggested to split the lots into two groups. One group should contain all the available lots with an assignment period from 1 January 2026 – ie 12 abstract frequency blocks of 2 x 5 MHz – while the other should contain the 8 blocks whose assignments expire on 31 December 2020. The latter would have an assignment period from 1 January 2021 to 31 December 2025. This proposal would have the advantage of affording bidders greater flexibility in choosing between the different periods and would thus make the auction result more efficient.
- 666 With respect to the 3.6 GHz band, it was said that the highest frequency block directly below 3700 MHz should be awarded specifically, as its value was said to be different from all the other blocks in the 3.6 GHz band. On the one hand, this frequency block is directly adjacent to the regional spectrum and thus has the advantage that the necessary guard band is to be located in the regional spectrum, making the block fully usable. Moreover, this block is particularly suited to contiguous spectrum uses between the nationally and regionally available spectrum. For all other assignment holders, leased regional spectrum would be separated from the nationwide assignment. On the other hand, this block also contains the most satellite uses that have to be protected, which reduces its value.
- Respondents believe that awarding the highest frequency block in the 3.6 GHz band specifically would have the advantage that the subsequent block allocation for the assignment of contiguous spectrum would be predefined. Allotting by lot would therefore only occur in the 3.6 GHz band if at least four successful bidders took part in the auction.
- 667 There were also calls to award all frequency blocks in litigation in the 3420 MHz – 3700 MHz band specifically and identify them as such. These blocks, for which major

infrastructural rollout plans have to be made, have a high degree of legal, and therefore also investment, uncertainty. Litigation has an effect on the value of spectrum and must be taken into account when deciding on bids. Any undesirable obstacles must be made clear to allow new entrants to enter the market without discrimination.

The Chamber has ruled as follows:

- 668 The President's Chamber awards the frequency blocks in the 2 GHz and 3.6 GHz bands in an abstract manner wherever possible, ie without defining the specific position of the respective frequency block in the radio spectrum. The actual position of the frequency blocks auctioned off is determined in a separate allotment procedure after the auction has ended (cf subsection IV.4.2).
- 669 The award of frequency blocks in an abstract manner offers bidders advantages over the award of frequency blocks at specific positions in the spectrum. In the case of abstract award, it is easier for bidders to make bidding decisions and to ensure the acquisition of contiguous spectrum. Bidders have a keen interest in having contiguous spectrum in a frequency band. Combining several frequency blocks into one package of contiguous frequency blocks generates efficiency gains regarding spectrum usage, since the efficiency of the use of contiguous frequency blocks increases disproportionately compared to the efficiency of the use of individual, non-contiguous frequency blocks. It also reduces the likelihood of interference between adjacent frequency blocks of different operators. It is therefore in the legitimate interest of bidders to ensure the acquisition of contiguous spectrum.
- 670 These objectives can be achieved by awarding the blocks in abstract form. The allotment of the frequency blocks auctioned off in an abstract manner to a package of contiguous frequency blocks following the bidding procedure therefore takes the objective of ensuring efficient and interference-free use of spectrum into account (section 2(2) para 7 and section 52(1) TKG).
- 671 The Chamber firmly believes that the abstract award of frequency blocks has proven to be successful in previous auction procedures.
- 672 On the other hand, it is necessary to award specific frequency blocks if there are considerable differences in value between the frequency blocks in a frequency band. Otherwise, it is possible that major conflicts of interest might arise with the subsequent allotment of frequencies. In addition, it is possible that the associated uncertainties in the auction could lead to inefficient bidding behaviour.

Against this backdrop, in the current award proceedings it is in principle possible to assign frequency blocks in the 2 GHz and 3.6 GHz bands in an abstract manner. One prerequisite for the abstract award of frequency blocks is that the frequency blocks within a frequency band may be regarded as equivalent.

On the 2 GHz frequency band:

- 673 The paired frequency blocks in the 2 GHz band may be regarded as equivalent with regard to their position in the spectrum and will therefore be assigned in an abstract manner, also with regard to their position in the spectrum.
- 674 In this context, the Chamber points out that:
- Although the frequency blocks will be assigned specific assignment periods, they will be auctioned off in abstract blocks in terms of their spectral position. The frequency blocks in the 2 GHz band have different durations in terms of their availability. Eight of these blocks are available from 2021 and four of them are available from 2026. In view of this particular feature, although the frequency blocks at 2 GHz will be assigned specific assignment periods, they will be auctioned in abstract blocks in terms of their spectral position. This enables bidders to bid specifically on 2 GHz blocks with the respective duration at auction. However, the frequency blocks will be

awarded in an abstract manner with regard to the location in the spectrum in order to enable the assignment of contiguous spectrum (cf Annex 9 for details). The allocation in accordance with subsection IV.4.2 ensures that contiguous spectrum is assigned. It may be necessary for existing spectrum usage rights to be reassigned in accordance with subsection IV.4.3.

675 By assigning contiguous spectrum, it is ensured that the above-mentioned objective of securing efficient use of the spectrum within the meaning of section 52 in conjunction with section 2(2) para 7 TKG is achieved.

676 Regarding the suggestion to divide the usage rights in the 2 GHz band into two groups, the Chamber is unable to see how this would increase flexibility in the auction. On the contrary, the Chamber takes the view that this kind of division of the usage rights would actually make the auction proceedings more complex. Successfully acquiring usage rights from one group would not ensure that a bidder would bid successfully for usage rights from the other group. There would therefore be a risk that usage rights for individual frequency blocks would not be assigned continuously over the entire period up to 31 December 2040. This would impact planning and investment certainty. The Chamber will therefore keep to its plan of providing eight blocks with an availability from 2021 and four blocks with an availability from 2026 and of setting an assignment period for all 12 blocks up to the end of 2040.

On the 3.6 GHz frequency band:

677 The frequency blocks 3400 MHz – 3420 MHz and 3690 MHz – 3700 MHz will be awarded specifically because of the possible restrictions on their use.

678 As explained in the frequency usage conditions (cf subsection Re III.4.1), assignment holders must ensure the protection of military radar and radio astronomy below 3400 MHz in the 3400 MHz – 3700 MHz band. The limit value for out-of-band transmissions specified in Annex 3 must be observed nationwide.

679 These restrictions apply in particular to the 3400 MHz – 3420 MHz frequency block directly at the band edge. With a view to this, the Chamber currently assumes that the use of this frequency block will be restricted accordingly. The Chamber believes that these restrictions will primarily relate to the band at 3400 MHz – 3410 MHz. However, responses to the above steps argued that there could be restrictions to the usability of the spectrum outside that band as well, and the Chamber agrees with this view. Therefore, the 3400 MHz – 3420 MHz frequency band, unlike the rest of the 3.6 GHz band, will be made available in a block of 1 x 20 MHz (unpaired).

680 The Chamber has followed the suggestion from the consultation to award the highest block directly below 3700 MHz specifically. The Chamber understands the assessments that this frequency block has a different value from all the other blocks in the 3.6 GHz band. Specifically awarding the 3690 MHz – 3700 MHz frequency block as 1 x 10 MHz (unpaired) is not contrary to the aim of assigning contiguous spectrum. However, auctioning the two specific frequency blocks at the lower end (3400 MHz – 3420 MHz) and upper end (3690 MHz – 3700 MHz) would obstruct the assignment of contiguous spectrum, so it is not possible to auction these two specific frequency blocks together. That means that each participant in the auction is only allowed to submit (a maximum of) one active bid for one of the two specific frequency blocks. This rule has been implemented technically in the auction software. The operative part has been amended accordingly.

681 The frequency blocks in the 3420 MHz – 3690 MHz band are to be regarded as equivalent and will therefore be assigned in an abstract manner in 27 frequency blocks of 1 x 10 MHz (unpaired). The Chamber has thus acceded to respondents' request for the greatest possible flexibility. Regarding the call for the frequency blocks to be divided into the smallest unit that makes technical sense, given future

broadband technology and the particular importance of this frequency band as a pioneer band for the next generation of mobile services, the Chamber continues to believe that a block size of 1 x 10 MHz (unpaired) is appropriate. The Chamber has thus followed the suggestion for the smallest unit for award in the draft document for consultation and the comments submitted in response. The operative part has been amended accordingly.

- 682 Insofar as regional assignments still exist in the 3420 MHz – 3690 MHz band at present (cf subsection Re III.4.1), this does not preclude abstract assignment. Firstly, these assignments are regional and are largely in rural areas. Moreover the assignments are due to expire on 31 December 2022 at the latest, so any regional restrictions would only apply on a temporary basis.
- 683 Regarding the risk of litigation for spectrum, the Chamber is of the opinion that it applies equally to all frequency blocks in the 3.6 GHz. Even though all the WLL assignments to be relocated and most of the BWA assignments are in the 3400 MHz – 3600 MHz band, it is possible for allotment to occur to a large extent within the bidding process, in particular because of the specific award of the upper and lower frequency blocks in the 3.6 GHz band. It is therefore possible to anticipate the specific spectral position during the bidding process and determine it by an undertaking acquiring a specific frequency block. Awarding all frequency blocks affected by litigation specifically would increase the complexity of the proceedings and be counter to the objective of assigning contiguous spectrum.
- 684 In addition, the entire 3400 MHz – 3700 MHz frequency band is used by satellite earth stations (cf subsection Re III.4.1). However, satellite earth stations only need to be protected locally and are generally located in rural areas. In addition, the frequency usage conditions provide for a coordination zone around the respective earth stations (cf Annex 3). In view of this, the use of frequencies in the 3420 MHz – 3690 MHz band is not ruled out even in the vicinity of the earth stations.
- 685 To the extent that the individual frequency blocks awarded in abstract form may be subject to limited different restrictions, these are considered to be low compared to the advantages of abstract award and the assignment of contiguous spectrum.
- 686 The largely abstract assignment of the 3.6 GHz band takes into account the above-mentioned objective of ensuring efficient use of spectrum within the meaning of section 52 in conjunction with section 2(2) para 7 TKG by assigning contiguous spectrum.

Re IV.1.5 Restrictions on bidding entitlements

The Chamber has ruled as follows:

- 687 A restriction of bidding rights in the 2 GHz and 3400 MHz – 3700 MHz frequency bands is not specified (cf subsection III.3.2 for details).
- 688 However, the Chamber points out the following:
- There is an upper limit on exercising the number of bidding entitlements imposed following examination of the admission application by the President's Chamber in the qualification notice (cf subsection III.1.5) and by the corresponding deposit of securities (cf subsection IV.1.3). The number of bidding entitlements bidders can exercise must therefore correspond to their security. With regard to these fixed bidding entitlements, bidders are limited with regard to the quantity of spectrum for which they can submit bids.

Re IV.2 Power of attorney and auction tutorial

Re IV.2.1 Power of attorney

The Chamber has ruled as follows:

- 689 In the interest of conducting the auction in a swift and orderly manner, the applicants must be represented at auction by competent persons who have familiarised themselves with the auction rules and the arrangements of the IT-supported execution of the auction before the auction begins.
- 690 In order to ensure this, applicants must confer a power of attorney on the persons who will participate in the auction tutorial prior to commencement of the latter.
- 691 During the auction, bidders must be represented by at least two trained persons with power of attorney who are authorised in accordance with subsection IV.2.2 of this Decision in order to ensure that the auction can proceed quickly and smoothly.

Re IV.2.2 Auction tutorial

The following comments were made:

- 692 It was suggested that in justified exceptional cases, such as cases of illness or force majeure, the Bundesnetzagentur should provide additional tutorials for individuals.

The Chamber has ruled as follows:

- 693 In addition to clear auction rules, the practical conduct of an open ascending simultaneous multiround auction requires, above all, software that specifically implements the auction rules and thus enables the proceedings to be carried out. The persons to be authorised to participate in the auction must be able to familiarise themselves with the auction rules and the software to be used prior to commencement of the auction. In addition to the hearing on the auction rules, the training of bidders also serves this purpose. Since the auction tutorial is an indispensable part of a smooth auction process, participation in this training is mandatory. The invitation to the auction tutorial is issued by section 215 of the Bundesnetzagentur.
- 694 After completing the auction tutorial, the persons to be authorised to participate in the auction must submit a written declaration to the Bundesnetzagentur, indicating that they have understood and will comply with the auction rules and the electronic bidding procedure. Only then will the persons authorised by the undertakings be authorised to participate in the auction. Authorisation clearly regulates responsibilities and avoids legal uncertainties.
- 695 Insofar as there is sufficient capacity available, the Bundesnetzagentur will train up to twelve persons from one undertaking simultaneously. The tutorial will be held once only. As far as the request is concerned that in justified exceptional cases, the Bundesnetzagentur should provide additional tutorials for individuals, the Chamber will use its due discretion in such cases.
- 696 The bidders will be given the opportunity to test the software themselves immediately after the auction tutorial. In addition, they will receive written information in the form of a manual. The auction tutorial is carried out shortly before the auction commences.
- 697 In the course of the auction tutorial, bidders will also be informed how the auction will proceed and of the equipment and facilities available in the bidding rooms.

Re IV.3 Conduct of the auction

Re IV.3.1 Form of auction

The Chamber has ruled as follows:

- 698 The auction will be held as an open simultaneous multiround ascending auction.
- 699 All frequency blocks in the respective frequency bands are offered at the same time (simultaneously) during each auction round. The auction is conducted as an open auction, ie the bidders are informed of the bids made by the other bidders for each auction round. This makes it possible for bidders to assess other bidders' valuation of the frequency blocks during the auction. Since the latest auction result is visible to all bidders after each auction round, they can adapt their bidding behaviour accordingly. This reduces the risk of unrealistically overestimating the actual value of the frequency blocks and thus of paying excessively high prices for the frequency blocks (risking winner's curse – the tendency to bid too high in order to be sure of winning). The auction is carried out as an ascending multiround auction, ie the auction continues until no higher bid is placed for any of the frequency blocks. Until then, bids may be submitted for all frequency blocks. The number of rounds is unlimited.
- 700 In an open ascending simultaneous multiround auction, bidders can decide, depending on the respective price level, which frequency blocks they want to place bids for in which frequency bands, taking into account their respective bidding entitlements. The simultaneous feature of the auction also enables bidders to express implicit value interdependencies between the frequency blocks in the various frequency bands. In the context of a simultaneous multiround auction, these options exist until the auction ends. Due to the bidding possibilities, it is to be expected that by the end of a simultaneous multiround auction, the prices to be paid for equivalent frequency blocks will be more or less identical.
- 701 The simultaneous multiround auction is a well-established type of auction that is also suitable for the initial situation in this case. All frequency auctions conducted so far in Germany (ERMES in 1996, GSM in 1999, UMTS in 2000, BWA in 2006 and MFCN in 2010 and 2015) were conducted as simultaneous multiround auctions. From a regulatory point of view, there is no apparent reason why a simultaneous multiround auction should not be held in this case. Such auctions have been sufficiently tried and tested, are comprehensible, transparent and non-discriminatory.
- 702 Potential risks with regard to the expediency of the procedure can be mitigated, by and large, by specific rules in a simultaneous multiple-round auction.
- 703 When comparatively small frequency blocks are to be auctioned off, there is a fundamental risk, especially for new entrants who require a certain minimum volume of spectrum in order to implement their business model, that they will fail to acquire their minimum spectrum requirements at auction (this is referred to as the aggregation risk). This risk is minimised in the auction design provided for here, as bidders are given the opportunity before the start of the auction to request a minimum essential spectrum package in accordance with the provision set forth in subsection III.1.4. If bidders fail to achieve the minimum essential spectrum package specified during the auction, they are not awarded the spectrum and are not subject to any payment obligation (see subsections III.1.4, IV.3.9 and IV.3.15 for details). This means bidders no longer face the aggregation risk with regard to a required minimum number of frequency blocks.
- 704 In addition, it should be noted that the acquisition of contiguous spectrum in the same frequency band is not initially ensured when small frequency blocks are up for auction, even though it is necessary for the efficient use of spectrum. Special provisions therefore need to be issued within the framework of the auction rules to minimise this risk.

- 705 This risk exists if spectrum from different bands or specific frequency blocks is auctioned off in a specific range. In order to avoid inefficient allocation of the individual frequency blocks, bidders are given the opportunity in this auction to withdraw their bids (cf subsection IV.3.11 for details). This enables bidders to switch all their bids to frequency blocks that are grouped together. It also needs to be emphasised that the frequencies available are generally offered in abstract frequency blocks. This risk is minimised for the frequency blocks subject to abstract award, since the aim of the allocation procedure pursuant to subsection IV.4.2 is for the Bundesnetzagentur to assign the frequency blocks auctioned in an abstract manner as contiguous spectrum.
- 706 The open ascending simultaneous multiround auction can be described as a procedure that promotes competitive market structures and a "broad spread" of available frequency blocks.

Re IV.3.2 Organisation

The following comments were made:

- 707 The restrictions on communications by bidders at the auction site should be significantly relaxed.

The Chamber has ruled as follows:

- 708 The auction takes place via locally networked computers. In order to ensure that bidders can participate in the auction without disruption and can engage in internal consultations, a separate room (bidders' room) is made available to each bidder. This room has an auction PC for the submission of bids as well as a telephone that will enable calls to be made exclusively to the auctioneer as well as one additional telephone, a fax machine and an internet connection to facilitate communication exclusively with the decision-makers of the qualified undertaking.
- 709 The means of communication available are provided exclusively for communication with the auctioneer and the undertakings' decision-makers. Before the auction tutorial commences at the latest, bidders are required to provide two telephone and two fax numbers and two destination addresses for the internet connection, which can be used exclusively for communication with the undertakings from the bidding rooms. No additional telephone numbers will be activated.
- 710 No other telecommunications terminal equipment (eg mobile telephones) is permitted in the auction/bidding area. This regulation is not intended to restrict communication between individuals, but is essential for reasons of confidentiality and security in the bidding area. In order to ensure this, all radio communication is prohibited in the bidding area. It is not possible to accede to the request to significantly relax the restrictions on communications by bidders at the auction site. The use of mobile phones would make it much more difficult to monitor radio communications. The Chamber takes the view that the related security risk, and in particular the need to maintain the confidentiality of the submitted bids by each bidder before the auction round has been evaluated, take priority. In previous auctions, participating bidders asked for, and took a positive view of, this process. The Chamber highlights the fact that bidders are not subject to any restrictions with regard to individual communication outside the bidding area, which bidders may leave at any time provided that at least two bidder representatives are present (cf subsection IV.2.1).
- 711 Independent of the communication infrastructure provided by the Bundesnetzagentur, the software enables bidders to produce paper printouts of each image setting on the bidder's screen at any time, as well as printouts of the results after evaluation of each auction round. These documents can be sent to the undertakings at any time to inform them almost immediately how the auction is progressing. However, undertakings are not given direct electronic access to data in the auction network in

the bidding rooms, for instance, the results of the auction rounds, for security-related reasons.

- 712 In addition, bidders have the option of using encryption devices in order to communicate with decision-makers. If they wish to use encryption devices, bidders must supply these devices themselves. Since the Bundesnetzagentur provides analogue switched connections in the bidding rooms in addition to internet access during the auction, suitable encryption devices can be used, if required.
- 713 Please note that technical defects in encryption equipment or other technical devices used by bidders will not cause the auction to be interrupted. In light of the fact that the bidding teams on site are able to communicate with their headquarters via telephone, fax and internet, the Chamber does not consider that links between the teams and their undertakings would be significantly obstructed.
- 714 It is planned that the approved bidders can, upon request, test their encryption devices on site prior to the auction, after making advance arrangements to do so.
- 715 In addition, bidders are free to use or keep available their own terminal equipment (eg laptops, printers) during the auction. However, bidders must ensure that existing radio interfaces of their devices are deactivated in the bidding area.
- 716 Furthermore, it is envisaged that not only the final result of the auction, but also the round results will be published promptly on the internet after each round evaluation in order to meet the information needs of the general public. It is envisaged that only the applicable highest bids and the names of the respective highest bidders will be made known.
- 717 In the course of the auction tutorial, bidders will also be informed about how the auction will proceed and the equipment and facilities available in the bidding rooms.

Re IV.3.3 Bidders

The Chamber has ruled as follows:

- 718 The bidder in the auction is the qualified undertaking. It is represented by the appointed and authorised persons who have undergone the auction tutorial prior to the auction in accordance with subsection IV.2.2.

Re IV.3.4 Bid submission

The Chamber has ruled as follows:

- 719 The bids submitted by bidders are placed via locally networked computers using special auction software.
- 720 A distinction is made between the entry and submission of bids/withdrawals. In an ongoing round, each auction participant first enters all the bids they intend to place for the corresponding frequency blocks as well as the intended withdrawals using the auction software (entry). They submit all these intended bids/withdrawals at once by activating a corresponding button provided in the software (submission), having had the opportunity to check them prior to submitting. Bidders can change their entries at any time during the current round before submitting all their bids or withdrawals at once.
- 721 Bids are processed automatically by the software. The results (cf subsection IV.3.13) of an auction round are transmitted to each bidder's computer. Electronic processing reduces the susceptibility to errors and the time required for the procedure. Should a technical defect nevertheless occur, the auctioneer can decide whether the auction is to be suspended while the fault is quickly resolved and the auction is then resumed, or whether the auction is to be discontinued and conducted again at a later point in time (cf subsection IV.3.12).

722 The auction software provides all possible bids for the current round in a so-called click box, so that only valid bids can be submitted (cf subsection IV.3.5). There is an upper limit on exercising the number of bidding entitlements imposed following examination of the admission application by the President's Chamber in the qualification notice (cf subsection III.1.5) and by the corresponding deposit of securities (cf subsection IV.1.3). The individual bidding entitlements for each bidder are activated in the auction software, taking subsections III.1.5 and IV.1.3 into account. The number of bidding entitlements bidders can exercise must therefore correspond to their security.

Re IV.3.5 Valid bids

The Chamber has ruled as follows:

- 723 A valid bid for a frequency block in an auction round must exceed the current highest bid by at least the minimum increment (cf subsection IV.3.6). If no valid bid has been submitted for a frequency block in the previous auction rounds, the minimum bid is also deemed valid.
- 724 If the highest bid in an auction round has been withdrawn (cf subsection IV.3.11) and no new valid bid has been placed for this frequency block in this auction round, the new minimum valid bid is calculated from the highest bid amount withdrawn plus the applicable minimum increment. This also applies in the event that a bidder is eliminated for actively bidding for less than its essential spectrum package (cf subsection IV.3.9) for the frequency blocks for which it had been the highest bidder and had not been outbid by another bidder.
- 725 The auction software provides the bidder with the full range of valid bids for each frequency block with a click box for each round. Click-box bidding simplifies the procedure since bidders cannot enter any amounts manually. One intention of this is to prevent incorrect entries and thus ensure that the auction can proceed quickly.
- 726 Moreover click-box bidding is intended to prevent bidders from using their bids to convey signals to other bidders (a practice known as code bidding or signalling), for example using the final digits of the bid, thereby coordinating their behaviour with other bidders.
- 727 The Chamber points out the following with regard to the calculation of new valid bids after the highest bid has been withdrawn and in the event that a bidder is eliminated from the auction for bidding for less than the essential spectrum package: the auctioneer determines the minimum increment in each auction round. If the auctioneer, after due consideration of the circumstances, comes to the conclusion that the percentage determination of the minimum increment is reasonable, he determines the percentage of the minimum increment in order to ensure that the auction can proceed swiftly. However, the auctioneer may also determine the minimum increment individually for each frequency block. If a higher or lower minimum increment than the percentage determined seems appropriate in view of the bidding behaviour, the auctioneer will determine a suitable minimum increment for this frequency block, the minimum amount being €1000.

Re IV.3.6 Minimum increment

The following comments were made:

- 728 The minimum increment should be reduced and set uniformly. It was stated that if the minimum increments are high, a bidder could lose despite having a higher valuation than a competitor, because another bid would take the price over the valuation due to the minimum increment. Minimum increments could therefore theoretically lead to strategic bidding and lower returns. It was said that the minimum increment phases should be set at 5%, 3% and 1% in all frequency bands. However, it was also said

that the minimum increment phases should be set at 10%, 5% and 2% in all frequency bands.

The Chamber has ruled as follows:

- 729 The current highest bid must be outbid by at least a certain sum of money, which is the minimum increment. The auctioneer determines the applicable minimum increment during the auction. In determining the minimum increment, the auctioneer must essentially take two aspects into account:
- 730 The higher the minimum increment, the shorter the duration of the auction. The lower the minimum increment determined, the less likely it is that the auction result will deviate from the bidders' actual valuation.
- 731 The Chamber has followed the suggestion to make the increment phases the same for the 2 GHz and 3.6 GHz bands. Three different increment phases of 10%, 5% and 2% will be determined for both the bands up for award.
- 732 There will, however, be no further reduction in the percentage values in the increment phases. The lowering of the minimum bids (cf subsection III.5) in both the 2 GHz and 3.6 GHz bands will also lead to the absolute minimum increments at the beginning of the auction being smaller. The determination of increment phase 1 must take account of this circumstance and will therefore be set at 10%. Further lowering the percentage of the increment phases would also hinder the swift progression of the auction with regard to the altered determination of the lots pursuant to subsection IV.1.4 because of the many abstract frequency blocks in the 3.6 GHz band.
- 733 The specified increment phases apply to all frequency blocks in both bands, irrespective of different minimum bids.
- 734 The auctioneer's determination of the increment phases is based on the following guidelines:
- 735 In the first phase of the auction the minimum increment is calculated as 10% of the highest valid bid (incremental phase 1). It is reduced to 5% of the highest bid for the next increment phase (increment phase 2) and then to 2% (increment phase 3).
- 736 It is at the discretion of the auctioneer to decide – depending on the course the auction takes – when the move is made from one phase to the next. In order to take how the particular auction is progressing into account, the auctioneer may set the minimum increments individually for each frequency block as an absolute (non-negative) amount at his own discretion, deviating from the above-mentioned rule.
- 737 The minimum increments, which may result in uneven totals according to the above percentages, are rounded down to the next whole multiple of €1000.

Re IV.3.7 Highest bids

The Chamber has ruled as follows:

- 738 With regard to the distinctiveness of abstract frequency blocks, the Chamber wishes to clarify the following: all frequency blocks – including abstract frequency blocks – are individually designated in the auction software (cf Annex 9). In each round of the auction, auction participants place bids for such individually designated frequency blocks and not just for a frequency band in which abstract frequency blocks are awarded. This means it is possible to distinguish between abstract frequency blocks, even though the specific location in the frequency spectrum is not determined until the auction has ended.
- 739 In the event that highest valid bids placed are identical, the bidder that submitted first will be deemed to hold the highest bid. This selection rule has proven to be successful in the past and helps to speed up the proceedings as it creates an incentive for bidders to submit their bids as quickly as possible. In addition, this

selection rule is transparent, comprehensible and also verifiable for all participants. Since bidders can view all active bids placed by all bidders via the auction software (see subsection IV.3.13), when bids are the same it is possible to see the same parallel bid next to the faster bid (highest bid).

- 740 For the sake of completeness, the Chamber wishes to draw attention to the following. Each bidder is able to choose a bid amount from a click box list of valid bids; this minimises the probability of identical valid bids being made for the same frequency block. Highest bidders have the option of outbidding/increasing their current highest bid in the same way.
- 741 Bidders will be held to be active in the following round to the volume of the highest bids they hold.

Re IV.3.8 Lot ratings

The following comments were made:

- 742 There was some support for the determination of equal lot ratings for the same amounts of spectrum.
- 743 However, there were also calls for lot ratings per MHz in the 2 GHz band to be twice as high as those in the 3.6 GHz band. This would ensure that the auction proceeded efficiently, prevent strategic behaviour and reflect the differences in the minimum bids.

The Chamber has ruled as follows:

- 744 The lot ratings are standardised measures reflecting the amount of spectrum that is available in the individual frequency blocks. Due to the fact that the frequency blocks made available for award differ in terms of spectrum (paired 5 MHz blocks, unpaired 10 MHz blocks or the unpaired 20 MHz block), the standardisation of the bidding entitlements to 1 or 2 lot ratings increases the clarity of the auction, particularly for bidders, thus simplifying the bidding process. A frequency block of 1 x 10 MHz (unpaired) and a frequency block of 2 x 5 MHz (paired) are each assigned a lot rating of 1. The frequency block of 1 x 20 MHz (unpaired) is given a lot rating of 2. The lot ratings thus reflect the bandwidths of the frequency blocks through their standardisation of 1 and 2. Details are outlined in Annex 9.
- 745 It can be assumed that frequency blocks comprising the same amount of spectrum are, to a certain degree, substitutes, irrespective of the specific location and the frequency band. This lot rating system makes it possible to switch between such blocks regardless of their specific location. Only in this way can the lot ratings give bidders the necessary flexibility as to which frequency blocks and in which frequency bands they wish to submit bids. The Chamber is aware of the fact that this may ultimately mean that very different highest bids are submitted for frequency blocks in the individual frequency bands – irrespective of the lot rating. The Chamber has therefore not followed the call for different lot ratings to be determined for frequency blocks with the same amount of spectrum, even if the frequency bands are associated with different valuations.
- 746 The determination of lot ratings enables active bids to be switched between the individual frequency blocks in all frequency bands at any time, even towards the end of the auction when activity levels are high (cf subsection IV.3.9). It should be noted that one of the Chamber's objectives in setting the activity phase and the option to withdraw bids without restriction was to provide bidders with the greatest possible leeway when changing frequency bands. The Chamber therefore sees no reason why determining lot ratings based on the spectrum would jeopardise the efficient running of the auction or support strategically abusive behaviour.

- 747 At the beginning of the auction, a bidder's bidding entitlements correspond to the total lot ratings and is linked to the application for the volume of frequency blocks which can be won at auction from the total frequency spectrum available for award.

Re IV.3.9 Activity rules

The Chamber has ruled as follows:

- 748 Activity rules in a multiround auction lay down the extent to which active or new valid bids must be made by bidders, with due consideration for the highest bid held by them, if they are not to lose any bidding entitlements for the remainder of the auction. On the one hand, the activity rule should be designed to ensure the auction can proceed swiftly. Furthermore, the activity rule is intended to prevent a wait-and-see attitude and thus discourage bidders from withholding information regarding their valuation of the frequency blocks. On the other hand, it should be flexible enough to give bidders sufficient time to take appropriate bidding decisions in order to ultimately achieve efficient frequency assignment.
- 749 When frequency blocks are being auctioned off in different frequency bands, flexibility for bidders is increased by the fact that 100% activity is not required. That is why different minimum activity levels have been defined in activity phases depending on how the auction is progressing. The minimum activity level starts at 65% and is increased to 100% in the last activity phase. If the corresponding minimum activity level is not reached, the bidding entitlements are reduced.
- 750 The Chamber is of the opinion that two activity phases (65% and 80%) would, in principle, be sufficient to afford bidders maximum flexibility when changing frequency bands on the one hand and to ensure that the auction can progress quickly on the other. The Chamber does not consider a third activity phase of 100% to be absolutely necessary. Nevertheless, the Chamber will follow its previous practice of providing for a 100% activity phase in order to give bidders the greatest possible certainty as to the predictability of the end of the auction.
- 751 Where bidders have designated a minimum essential spectrum package, they must always submit bids to the full extent of their entitlements for the said package, regardless of the current minimum level of activity.
- 752 Depending on how the auction is progressing, the auctioneer can decide, after due consideration of the circumstances, when to move on to the next activity phase in order to ensure that the auction can proceed swiftly.
- 753 If no new valid bid has been placed in an auction round, no active exemption from bidding has been used and the auctioneer does not consider it necessary to end the auction prematurely (cf subsection IV.3.16), he will proceed to the next activity phase.
- 754 If bidders do not meet the required minimum level of activity, their bidding entitlements for the following auction rounds will be reduced. The bidding entitlements for the following round are calculated from the product of the activity in the previous round and the minimum activity level in the respective activity phase, rounded up to the next whole number. For example: the bidding entitlements of a bidder that exercised an activity of 4 lot ratings in activity phase 1 of 65%, thus remaining below its minimum activity, would be calculated as follows for the next round: 4 lot ratings (activity) \times 100/65 = 6.15 lot ratings; rounded up to 7 lot ratings.
- 755 A bidder that does not submit a new valid bid in a round, does not hold a highest bid and does not use a waiver (active or passive) will lose all its bidding entitlements and be eliminated from the auction. The only conclusion to be drawn from such bidding behaviour is that the bidder is no longer interested in acquiring a frequency usage right. The same applies to bidders that have been assigned a minimum essential spectrum package if they do not actively bid for the minimum essential spectrum package in an auction round and do not utilise any exemption from bidding either.

Re IV.3.10 Waivers

The Chamber has ruled as follows:

- 756 The use of waivers is intended to enable bidders to take a longer period of reflection during the auction. In the auction round in which a bid waiver is used, bidders do not lose any bidding entitlements regardless of their bidding behaviour. Bidders may require time to think if, for example, they feel that the auction has taken an unexpected turn, requiring them to revise their bidding strategy. However, the number of waivers must be limited, as the auction might otherwise be significantly delayed for strategic reasons, thus pushing up the administrative costs.
- 757 Specifying five waivers per bidder seems appropriate in order to provide bidders with sufficient protection against the loss of bidding entitlements on the one hand and to avoid delaying the procedure unnecessarily on the other.
- 758 It needs to be emphasised that only the use of an active waiver will impact the termination rule of the auction. This means that the auction cannot end if a participant uses an active waiver because this signals that the participant is considering submitting new valid bids in a subsequent round. The following is highlighted with regard to the significance of passive waivers: bidders can dispense with passive waivers by taking action, for example by submitting a bid, confirming existing highest bids or using an active waiver.
- 759 In the event that the bidder deliberately or unintentionally allows the time during which bids may be submitted to elapse, a clear rule is required in the auction software. The planned automatic activation of a passive waiver in this case protects bidders from losing bidding rights or, in the worst case scenario, from being eliminated (taking into account the termination rule under subsection IV.3.16). This only applies as long as the bidder still has bid waivers to use.

Re IV.3.11 Withdrawal of highest bids

The Chamber has ruled as follows:

- 760 As spectrum is offered in relatively small blocks from different bands, bidders are, in principle, at risk of acquiring non-contiguous frequency blocks. This risk arises if a bidder that is the highest bidder for one or more specific frequency blocks wishes to switch its remaining bidding entitlements to another band due to the emerging price level. Since the bidder is bound by its highest bids (lock-in effect), the result would be that the bidder would acquire non-contiguous frequency spectrum.
- 761 In order to promote efficient allocation of the individual frequency blocks, bidders are given the opportunity to withdraw highest bids. Having freed up the bidding entitlements, they can bid on other frequency blocks. Each bidder is entitled to partially or fully withdraw highest bids held and to use the bidding entitlements they have freed up in the same auction round to submit new valid bids.
- 762 There is no limit to the number of withdrawals. In view of the different block sizes and durations of the frequency blocks, the Chamber considers it appropriate to afford bidders the greatest possible flexibility in switching their bids in order to take the differences in valuation between these blocks emerging during the auction into account.
- 763 It is true that the possibility of withdrawing bids could, in principle, lead to strategically abusive bidding behaviour. A bidder could, for example, drive up the price level for frequency blocks without risk in order to prevent, for example, other bidders from acquiring a spectrum usage right for these frequency blocks. In order to prevent such bidding behaviour, however, the rule of payment obligation when a bid is withdrawn has been introduced. Accordingly, the withdrawal of a bid for a frequency block results in a payment obligation for bidders unless a new valid bid for the

corresponding frequency block is submitted in the further course of the first stage of the auction. In this case, the payment obligation remains equivalent to the amount of the withdrawn bid. If the frequency block is awarded in a second stage of the auction, the bid price then obtained for the corresponding frequency block is credited to the bidder that withdrew its bid. If the price for the corresponding frequency block in the second stage of the auction is higher than or equal to the highest bid of the first stage of the auction, the bidder that withdrew its bid is not obliged to pay.

- 764 The following rule, which applies to bidders with a set minimum essential spectrum package, is also intended to prevent abusive bidding behaviour. If such a package has been determined for a bidder, the withdrawal of one or more highest bid(s) will only be possible if the bidder has submitted an active bid in at least the volume of its package in the round concerned. This means that the sum of the frequency blocks for which it holds the highest bids and the frequency blocks for which it submits new valid bids must correspond to at least the minimum essential spectrum package. The withdrawal of a highest bid and the use of an active waiver (second option of the active waiver pursuant to subsection IV.3.10) do not release the bidder from the obligation to submit active bids amounting to the minimum essential spectrum package.
- 765 The Chamber is convinced that the two obligations – an obligation to pay, on the one hand, and the obligation to submit active bids corresponding to the minimum essential spectrum package, on the other, if a bidder wishes to withdraw a bid – provide sufficient protection against abusive bidding.
- 766 Bids may not be withdrawn after the results of the auction or the stages of the auction have been announced.

Re IV.3.12 Time of a round, completion of a round, discontinuation of a round and suspension of the auction

The following comments were made:

- 767 It was suggested that to speed up the auction, a round should last no more than 45 minutes. The large number of lots could lead to a very large number of rounds in this auction format. Experience from previous auctions has shown that the round duration of 60 minutes is somewhat too long.

The Chamber has ruled as follows:

- 768 In an open ascending simultaneous multiround auction, it must be decided how much time the bidders have in an auction round to submit their bids. The time period must be sufficiently long to allow bidders to make their bid decisions and submit their bids. On the other hand, it must not be too long as this could draw out the auction process unnecessarily. In view of these considerations, and taking into account the degree of complexity of the auction, a period of 60 minutes within which the bids are to be submitted appears to be appropriate in the initial phase.
- 769 However, in order to take into account the requirements of the auction as it progresses, the auctioneer may also change the length. This ensures that the auctioneer can take sufficient account of any unforeseen development the auction is taking in a particular situation. If, in the course of the auction, the auctioneer comes to the conclusion that a shorter length of rounds is sufficient, he will also shorten the length of rounds in the interest of bringing the auction to a swift conclusion. Similarly, it cannot be ruled out that the length of rounds may be extended depending on how the auction is progressing.
- 770 The Chamber has decided not to follow the suggestion, in view of the large number of lots and possibly large number of rounds, to reduce the round duration to no more than 45 minutes. In fact, the Chamber would like to point out that it is up to bidders to speed up the auction. If they submit their bids early, the auction round can be ended

swiftly. A round is completed after the bids from all the bidders have been received by the auctioneer, even if the end of the specified time period for the submission of bids has not been reached. In addition, the auction can be speeded up if bidders use click box bidding (cf subsection IV.3.5) to submit alternative, higher bids. Bidders are able to submit certain higher bids than the respective minimum increment and thus speed up the process of reaching a conclusion on the willingness to pay.

- 771 Ten minutes before the end of each auction round, an automatic reminder is activated to ensure bidders do not miss out by inadvertently failing to submit a bid.
- 772 In order to avoid prolonging the auction unnecessarily, it is determined that the auction rounds will be evaluated as soon as possible after all bidders have submitted their bids. In this context, however, the Chamber wishes to clarify the following two points:
- 773 As soon as the last bidder has submitted its bid, has used an active waiver or has confirmed its highest bid held at the beginning of the auction round, the auctioneer will start evaluating the round and will conclude the auction round without waiting for the auction round to time out.
- 774 After the auction round has been evaluated, the next round is not started automatically, for example by the software after a logical second. Instead, the auctioneer starts the new round manually as soon as he has analysed the result of the auction round and has made the necessary decisions in relation to the new round. How long this takes depends on how the auction is progressing and cannot be determined in advance.
- 775 Each bidder is given one opportunity during the whole auction to request the auctioneer to suspend the auction. The auctioneer must be notified of this request, which is placed on record. The auctioneer then suspends the auction, and it is resumed at 1 pm the following working day. This gives bidders sufficient time to make the necessary decisions, irrespective of when the auction was suspended during the course of the day. If the suspension of the auction is requested during an ongoing auction round, the next round will be based on the result of the previously concluded round.
- 776 The Chamber assumes that this one opportunity per bidder of having the auctioneer suspend the auction is sufficient, as there would otherwise be a risk of abusive behaviour and unnecessary delays in the course of the auction. The Chamber assumes that a bidder will only make use of this option if, from the bidder's point of view, there are serious reasons justifying an extended suspension.
- 777 Should there be a technical or other similar defect which jeopardises the proper conduct of the auction round, it is incumbent on the auctioneer, after due consideration, to dispense with the evaluation and discontinue the round. In this case, the result of the previous round is taken as a basis and the auction is resumed. In the interests of a transparent procedure, bidders will be informed accordingly.

Re IV.3.13 Provision of information to bidders

The following comments were made:

- 778 It was requested that the applicable highest bid and the active bids of all bidders for each frequency block should be revealed after a round is completed, but not the bidders' identities. Revealing the bidders' identities as planned would make it possible to crowd out the competition in an abusive manner, jeopardising the non-discriminatory access to spectrum. Existing mobile network operators would be able to specifically bid against new entrants. Moreover, announcing identities and bidding decisions would allow conclusions to be drawn about individual bidding rights, which are supposed to be confidential. It is not clear how the intended transparency would reduce the risk of court cases over the auction results.

The Chamber has ruled as follows:

- 779 At the beginning of each auction round, the auctioneer will provide all bidders with the relevant parameters for the current auction round. This procedure ensures maximum information and transparency and enables bidders to bid appropriately.
- 780 At the end of each auction round, the active bids (all the highest bids and new valid bids) of all bidders are announced to the bidders. Because every bidder can keep the bidding activity of all the others under comprehensive observation with reference to active bids, they have the means of correcting their own valuation of the frequency blocks. This makes it possible to reduce the risk of "winner's curse".
- 781 The procedure involved in open and transparent auctions has proven its worth in the past. Due to the amount of spectrum to be awarded and the measures listed elsewhere (eg possible withdrawals), potential new entrants also have ample opportunity to acquire spectrum at auction. In the course of an open and transparent procedure without anonymisation, potential new entrants are also able to respond to bids and consider their individual valuation, given that they know how other bidders value the spectrum. The Chamber firmly believes that only a transparent procedure can lead to a stable auction result. By choosing not to place any further valid bids in the last round, the bidders accept the full (potential) auction results disclosed to them at that point in time, which include their own total amount of spectrum and the total amount of spectrum of their (future) competitors.
- 782 The above explanations show why the Chamber has decided not to follow the suggestion to reveal the applicable highest bid and the active bids of all bidders for each frequency block, but not the bidders' identities. This would remove the completely transparent negotiation mechanism, which could lead to an inefficient result. It may be assumed that bidders would then anticipate their competitors' behaviour when submitting their own bids and work on the basis of a worst-case scenario (eg that another bidder/competitor would bid on a disproportionately large amount of spectrum). The Chamber believes that this could lead to more aggressive auction strategies which would ultimately have a negative effect especially for new entrants or "weaker" bidders. Contrary to the concerns expressed in the responses, the largely abstract provision of frequency blocks means that it is not possible to bid against specific bidders. New entrants and "weaker" bidders are also protected by the demand reduction effect inherent to this auction format, ie that higher bids for additional frequency blocks also raise the prices for the frequency blocks that a bidder considers absolutely necessary.
- 783 It is not necessary to expressly inform bidders when highest bids are withdrawn since the display of all active bids of all bidders implicitly includes this information. In the opinion of the Chamber, there is no need to provide additional information (eg waivers used by other bidders). Bidders do not require any additional information based on their own valuation of the spectrum. What is more, any such information could potentially be used for strategically abusive bidding behaviour.
- 784 Due to the complexity of the simultaneous multiround auctions, it is in bidders' interests to be able to further process certain data electronically (all valid bids of the previous round of auctions and the applicable highest bids as well as the identity of the respective bidders) so that they can obtain an overview of how the auction is progressing in the shortest possible time and make their resulting further bidding decisions on the basis of this information.
- 785 The Bundesnetzagentur will therefore see to it that this information is, in addition, made available to bidders at the auction by electronic means for further processing.
- 786 It is planned for the said information to be supplied to authorised persons in the form of a file with a clear-cut summary. The Bundesnetzagentur will inform the authorised undertakings of the format and syntax in good time.

Re IV.3.14 Exclusion of bidders/collusion

The Chamber has ruled as follows:

- 787 The exclusion of a bidder in the event of irregular behaviour serves to ensure that the auction can proceed swiftly and smoothly and to prevent cooperation between bidders or authorised persons (cf subsections IV.2.2 and IV.3.3) for the purpose of influencing the course of the auction or the auction result (collusive behaviour).
- 788 Reasons for exclusion not only involve collusive behaviour, but also other behaviour which jeopardises the smooth running of the auction or other behaviour in contravention of the rules. Exclusion can also be justified if there are clear signs that a bidder is deliberately trying to hinder the proper conduct of the auction.
- 789 The rule according to which bidders excluded from the auction remain liable for bids placed is necessary in order ensure the auction procedure is objective and non-discriminatory, to counter collusive behaviour with tangible sanction mechanisms and to ensure the prohibition of irregular behaviour is adhered to.

Re IV.3.15 Elimination from the auction

The Chamber has ruled as follows:

- 790 This rule serves to clarify that the loss of all bidding entitlements in accordance with the activity rule (cf subsection IV.3.9) will lead to elimination from the auction.
- 791 A bidder will be eliminated from the auction proceedings as a whole if it does not submit active bids to the full extent of the minimum essential spectrum package it has been granted (cf subsections III.1.4 and IV.3.9). Bidders that have been granted a minimum essential spectrum package in the notice of admission must therefore always be active to the full extent of their bidding entitlements for the minimum essential spectrum package in accordance with the activity rule (cf subsection IV.3.9). For clarification purposes, the Chamber refers here to the regulation on the minimum essential spectrum package under subsection III.1.4.

Re IV.3.16 End of the auction (termination rule)

The Chamber has ruled as follows:

- 792 The auction ends automatically if, in the last activity phase of the auction, no valid bid has been submitted for any of the frequency blocks available in the expired auction round and if none of the bidders has used an active exemption from bidding.
- 793 In this case, it must be assumed that all bids submitted fully reflect the bidders' individual valuations of the frequency blocks. As long as a new valid bid is placed for at least one frequency block, valid bids may continue to be placed for the other frequency blocks throughout the auction, taking the activity rule into account (cf subsection IV.3.9).
- 794 It should be noted that a third phase of 100% activity is foreseen (subsection IV.3.9) in which bidders are obliged to use all their bidding rights for the frequency spectrum they wish to acquire. By submitting new valid bids or active waivers, bidders determine whether or not the auction will come to an end.

Re IV.3.17 Award

The Chamber has ruled as follows:

- 795 In open, simultaneous, multiround auctions, the respective frequency block is awarded to the highest bidder at the end of the auction. A frequency block for which
- a) no valid bid has been placed by the end of the auction,
 - b) no new valid bid has been placed after withdrawal,

- c) the award has been refused; or
- d) a bid has been placed, but the highest bidder has not acquired the minimum essential spectrum package,

is not awarded within the framework of the auction.

796 In this context, the Chamber wishes to clarify the following: c) applies to scenarios in which bidders are excluded from further auction rounds pursuant to subsection IV.3.14.

797 The award goes to the highest bidder for the respective frequency block. This means that the bidder that has acquired the frequency block has to pay the price it offered. It is therefore a so-called highest bid auction.

Re IV.3.18 Second stage of the auction

The Chamber has ruled as follows:

798 If there are frequency blocks that have not been awarded at the close of the first stage of the auction ("stranded blocks"), the President's Chamber will take a decision on whether, and if so when, these blocks should be auctioned in full or in part in a second stage. This is particularly expedient if the blocks in question were not awarded in the first stage of the auction because bids were withdrawn or because a bidder failed to reach the volume of the individual minimum essential spectrum package. It is also conceivable that no bids were submitted for certain frequency blocks during the entire first stage of the auction.

799 In order to ensure the rapid provision of available spectrum, the second stage of the auction should, in principle, be held soon after the first stage. However, the result of the first auction stage may be such that it does not seem appropriate for a further auction to take place immediately. This may be the case in particular if, contrary to expectations, a comparatively large number of frequency blocks were not awarded or only a comparatively small number of bidders acquired spectrum usage rights in the first stage. The Chamber reserves the right to defer the award of the stranded frequency blocks until further notice in order to then, if necessary, develop specific rules it deems appropriate for these blocks.

800 From the Chamber's point of view, the following rules are planned for the second stage of the auction:

801 In the second stage of the auction, the stranded frequency blocks are offered again for minimum bids.

802 In addition, eligibility to participate is limited. Only those bidders that successfully bid in the first stage of the auction are allowed to participate. This provision creates an incentive for bidders to bid for spectrum usage rights in the first stage rather than speculating on a second stage for strategic reasons.

803 The number of maximum bidding entitlements in the second stage of the auction is determined by the balance between the number of bidding entitlements specified on the basis of the application and the bidding entitlements successfully used in the first stage of the auction. Bidders may also bid for frequency blocks for which they exercised a withdrawal in the first stage of the auction (cf subsection IV.3.11). Bidding entitlements that were "lost" in the first stage of the auction because of the activity rule pursuant to subsection IV.3.9 may also be exercised.

804 Bidders that did not acquire their minimum essential spectrum package, if any, in the first stage of the auction have already been excluded from the auction and are no longer entitled to participate (cf also subsection IV.3.15). Bidders must fulfil their individual frequency requirements for the implementation of their business model in the first auction stage. The reason why bidders can specify an essential minimum

spectrum package is precisely to ensure that bidders requiring more than one frequency block to implement their business model either acquire the essential minimum spectrum by the end of the first auction stage or no frequency spectrum at all. The second stage of the auction therefore only takes place if frequencies were not awarded in the first stage.

805 In contrast to the first stage of the auction, bidders cannot withdraw their bids in the second stage. This ensures that stranded frequency blocks only occur in the second stage if no bid is placed for a specific frequency block.

Re IV.4 Auction close

Re IV.4.1 Obligation to pay

The following comments were made:

806 Respondents called for investment-friendly payment conditions, arguing that payment obligations should only arise once the spectrum is actually available and it should be possible to pay in instalments. The "pay when available" and "pay as you use" principles should be taken into account, partly with a view to Article 42 EEC.

807 A payment obligation in the short term for the 2 GHz spectrum that is available from 2026, in particular, is not acceptable and could have a discriminatory effect.

808 Respondents further maintained that network operators should be refunded all expenses for 5G expansion in order to promote network rollout in rural areas. The upper limit should be the amount that the network operator had spent in the auction (cash back).

809 It should also be possible for potential new entrants to pay in instalments and pay when available. New entrants should also only have to pay once an agreement on national roaming and infrastructure sharing has been concluded, if necessary with the Bundesnetzagentur acting as arbitrator. Payment should also only be due for spectrum in litigation once there is a final and absolute ruling on the spectrum.

The Chamber has ruled as follows:

810 The bidder awarded a frequency block at the close of the auction must pay the amount of its highest bid.

811 A bidder that has withdrawn a current highest bid must likewise pay the amount of this highest bid if no new valid bid is made for the frequency block in question in the course of the first stage of the auction. If the frequency block is awarded in a second stage of the auction, the bid price then obtained for the corresponding frequency block is credited to the bidder that withdrew its bid.

812 This payment obligation is both necessary and appropriate in order to prevent strategically abusive bidding behaviour involving the withdrawal of bids. Otherwise, bidders could drive up the price level for frequency blocks without any risk to themselves in order to prevent other bidders from acquiring a right to use the frequency for these frequency blocks. The payment obligation in the event that no higher valid bids are submitted reduces the risk of strategically abusive bidding behaviour. The payment obligation is also proportionate as bidders can incorporate the risk of a payment obligation into their bidding behaviour, especially in a late activity phase.

813 Payment of the award price less any security deposited as a sum of money (cf subsection IV.1.3) is due within 65 banking days of the award and is payable to the account specified by the Bundesnetzagentur.

814 In derogation of this, payment of the award price for frequency blocks in the 2 GHz band that are available from 2026 is due by 30 June 2024 at the latest. This spectrum

must therefore be paid for a year and a half before it becomes available, which generally corresponds to the time between payment due and availability that also applies to the 2 GHz frequency blocks available from 2021.

815 The Bundesnetzagentur is obliged to ensure that any payments due are made in full and on time. They must therefore fall due when this is legally possible, ie immediately after the award is made.

816 However, the Chamber does believe it appropriate to order payments for spectrum 65 banking days after award for the following reasons:

817 This due date of 65 banking days is transparent, non-discriminatory and proportionate and in particular helps to achieve the legal objective of efficient use of spectrum.

818 In a joint declaration on the mobile communications summit of 12 July 2018 (available at www.bmvi.de), it was stated that

"The federal, state and local authorities undertake to create conditions for the rollout of the mobile networks that promote and secure investment and to create effective incentives for a faster, efficient rollout of mobile networks.

This includes, among other things...

for the federal government

1. ...the further deferment of the start of payment and the payment by instalment of the auction proceeds for network operators that submit binding cooperative commitments to roll out networks within 65 banking days following the award.

819 From this joint declaration on the mobile communications summit, it follows that the further deferment of the start of payment and the payment by instalment of the auction proceeds for network operators – in addition to the 65 banking days – is linked to the submission of binding cooperative commitments to roll out networks by the network operators.

820 As far as the call for network operators to be refunded all expenses for 5G expansion in order to promote network rollout in rural areas is concerned, the Chamber wishes to point out that it took the costs to be incurred by network operators for the expansion in rural areas into account when setting the minimum bids and the increment phases. The Bundesnetzagentur does not have the responsibility to take decisions on refunds of auction proceeds affecting the budget. In the joint declaration on the mobile communications summit, the federal, state and local authorities pledged to create conditions for the rollout of the mobile networks that promote and secure investment, if commitments to roll out networks are made.

821 In response to respondents' calls to lay down further-reaching investment-friendly payment conditions, such as payment by instalment, in the auction rules, the Chamber draws attention to the following:

822 It is the legal objective of the award proceedings to select the applicant most suited to use the spectrum efficiently. The explanatory notes to section 61(5) TKG (section 59(5) of the government draft of 2004, Bundesrat printed paper 755/03, page 109) state the following:

"The successful bid typically demonstrates the willingness and ability to make optimal use of the spectrum to be assigned in providing services in a competitive environment and to strive for efficient and economical use of the spectrum."

823 Given this legal objective, it cannot be ruled out that any possibility of deferring payment or paying by instalment laid down in the auction rules could have an influence on bidding behaviour that would be contrary to the aim of selecting the most efficient user of spectrum. For example, as far as the willingness to use spectrum is concerned, it is likely that the requirement for immediate payment would create a

particularly high economic incentive on the part of the assignment holder to support the development of technology and start using the spectrum as soon as possible. By contrast, a later payment obligation could reduce the willingness to use spectrum promptly. Moreover, it cannot be ruled out that a later payment obligation would lead to strategically abusive bidding behaviour among the competitors participating in the auction.

- 824 These explanations also apply to new entrants. In response to the calls to oblige new entrants to pay only when an agreement on national roaming and infrastructure sharing has been concluded, the Chamber draws attention to the fact that new entrants are also obliged to start using their spectrum as soon as possible. A rule that new entrants only had to pay once national roaming or infrastructure sharing agreements had been successfully concluded could create an incentive for such entrants to impede or draw out negotiations so as to avoid the payment obligation. There would also be a risk of strategically abusive bidding behaviour in which a new entrant could drive up the bidding to the disadvantage of all bidders without intending to actually pay its highest bid. This could then lead to the prices for all packages of spectrum exceeding their actual economic value for the other bidders in the auction as well. There could be inefficient frequency assignments resulting in the other bidders not acquiring the amount of spectrum they require for their planned network build. Bidders without a specific payment obligation could have less of an incentive to use the spectrum as quickly as possible. At the same time, the spectrum would not be available for other bidders to roll out their networks, thus thwarting the objective of introducing 5G. In the worse-case scenario, spectrum could remain unused for years, at a significant loss to the economy. Such a rule would be contrary to the statutory aim of award proceedings, ie to select those bidders best suited to using the spectrum efficiently.
- 825 The Chamber does not agree with the suggestion that spectrum in litigation should only become due for payment when a final and absolute ruling has been issued on it. Spectrum in litigation is still available and can be used for network build and rollout once it has been assigned. Any other solution would contradict the statutory objective of the auction proceedings. Besides, bidders can take the risk of litigation into account when deciding on the height of their bids at auction.
- 826 However, the situation with the 2 GHz spectrum whose usage rights do not run out until 2025 is different. Regarding the comments that payment obligations should only arise once the spectrum is actually available, the Chamber views the following rule for the 2 GHz spectrum with an availability from 2026 as appropriate:
- 827 For frequency blocks in the 2 GHz band with availability as of 2026, the payment of the award prices is to be made no later than 30 June 2024.
- 828 This spectrum must therefore be paid for a year and a half before it becomes available, which largely corresponds to the time between payment due and availability that also applies to the 2 GHz frequency blocks available from 2021.
- 829 This is necessary, proportionate and appropriate, since the award in 2019 is a long time away from the availability in 2026.
- 830 When awarding the 700 MHz spectrum that became available successively, the Chamber ordered that the award prices would fall due at a later date. It is now also appropriate in the award of the 2 GHz spectrum that is only available in 2026 to order a different due date.
- 831 There is no risk that the spectrum would not be used immediately because the award prices only fall due at a later date, since this spectrum is not available until 2026 in any case.
- 832 The setting of a payment deadline of 30 June 2024 is also appropriate, as the award is thus due about a year and a half before the spectrum becomes available. This

applies both to spectrum that is available in 2021 and spectrum that becomes available in 2026. The Chamber is of the view that the risk of abusive bidding behaviour caused by the later due date is low.

- 833 Regarding some respondents' view that the payment obligation for 2 GHz spectrum with availability from 2026 is discriminatory, the Chamber wishes to point out that the payment obligation applies to all bidders acquiring this spectrum equally.
- 834 From the Chamber's perspective, bidders can incorporate into their bids the terms of payment known to bidders prior to bidding.
- 835 Payment in the amount of the award price must be made less any security deposited as a sum of money. Allowance is also made for the security deposit if a payment obligation exists even though the highest bid was withdrawn. After receipt of the full payment, the surety bonds will be returned. No interest is paid on the security deposit.
- 836 If a bidder has not been awarded any frequency blocks and is not subject to any other payment obligation, the security is returned or the surety bonds are returned without delay after the entire auction has ended.
- 837 Frequencies are assigned once the bidder has met all payment obligations.

Re IV.4.2 Allotment of the abstract frequency blocks won

The following comments were made:

- 838 It was argued that the top block in the 3.6 GHz band should not only be allotted after the auction (by lot), since this would incur the risk of inefficient assignment. This block should be awarded specifically because it has a different value. This would also simplify the allotment process, when contiguous spectrum is assigned. The allotting by lot was rejected in particular for the allotment in the 3.6 GHz band with regard to the position at the upper end of the band.

However, one respondent rejected the lot process in general, claiming it could lead to inefficient assignments. Moreover, the inefficiency of the lot process could create an incentive for bidders to allow planned negotiations to fail if they would benefit from an inefficient assignment. A Vickrey auction, which is a type of sealed bid auction, was suggested as an alternative to the lot process and was said to be efficient.

The Chamber has ruled as follows:

- 839 In accordance with the determinations in subsection IV.1.4, frequency blocks are to a large extent awarded in an abstract manner, ie bidders initially acquire the desired number of frequency blocks in the respective band without knowing where exactly the blocks are located in the spectrum. After the auction, the frequency blocks auctioned in an abstract manner are allotted specifically to the respective highest bidders. The allotment procedure is carried out objectively, transparently and in a non-discriminatory manner in accordance with the following rules.
- 840 First, the abstractly acquired frequency blocks in the 3.6 GHz band are allotted to those bidders that have acquired a specific block. The frequency blocks are allotted in such a way that contiguous spectrum can be assigned. The position of the abstractly acquired frequency blocks is based on the position of the specific frequency blocks. If a bidder has acquired the specific frequency block at the bottom of the 3.6 GHz band (3400 MHz – 3420 MHz), further abstractly acquired frequency blocks will be allotted directly above 3420 MHz. If a bidder has acquired the specific frequency block at the top of the 3.6 GHz band (3690 MHz – 3700 MHz), further abstractly acquired frequency blocks will be allotted directly below 3690 MHz.
- 841 As far the further allotment is concerned, the successful bidders have the opportunity to reach mutual agreement on the specific location of the blocks auctioned in the

- respective frequency bands after the auction has ended. They must do so within one month.
- 842 If no agreement has been reached between all the successful bidders concerned within the specified period, the Bundesnetzagentur may allot the abstractly auctioned frequency blocks separately according to frequency bands, taking into account the aspect of contiguous spectrum, existing usage, and the preferences expressed.
- 843 In the context of efficient spectrum usage under section 52 TKG, the allotment procedure must take into account the aspect of allotting contiguous spectrum. The allotment procedure is thus intended specifically to achieve the regulatory objective of ensuring efficient spectrum usage under section 2(2) para 7 TKG.
- 844 If the abstract blocks won cannot be allotted after the auction in accordance with the principles above, they will be allotted by lot. In the Chamber's view, this procedure is the most appropriate procedure for rapid allotment if the successful bidders have failed to reach agreement on the specific allotment of individual frequency blocks and if the Bundesnetzagentur is unable to make the allotment unequivocally after weighing up the abovementioned principles. In response to comments that the lot process per se would lead to inefficient assignments, the Chamber notes that only those variants that fulfil the abovementioned objectives to the greatest possible extent will be included in the lot process. Therefore the Chamber does not agree that an alternative to the lot process is necessary.
- 845 Existing nationwide spectrum usage rights at 2 GHz and 3.6 GHz may be reassigned for the allotment and assignment of contiguous spectrum.

Re IV.4.3 Reassignment of existing assignments

The Chamber has ruled as follows:

- 846 Existing nationwide spectrum usage rights may be reassigned for the assignment of contiguous spectrum.
- 847 In the frequency band at 2 GHz, spectrum usage rights currently exist in the form of four blocks of 2 x 4.95 MHz each (paired), which are limited until 31 December 2025. In the course of the allotment procedure, these frequency blocks are to be reassigned in such a way that, on the one hand, contiguous spectrum can be used at an early stage and, on the other hand, the band as a whole can be converted to a 5 MHz channel grid (cf Decision on the order for and choice of proceedings of 14 May 2018; subsection 2.1.2.1).
- 848 In the 3400 MHz – 3700 MHz band, too, future assignment holders should be able to start using the 3.6 GHz frequencies efficiently as soon as possible. If an existing assignment holder successfully acquires more spectrum at auction than it currently has frequency assignments, it is expedient to transfer the assignments to the target band position before the current assignments expire (cf Decision on the order for and choice of proceedings of 14 May 2018; subsection 2.1.2).
- 849 With the application for admission to the auction procedure, current assignment holders give their consent to a possible reassignment. If an assignment holder objects to the reassignment, the Bundesnetzagentur will examine the reassignment ex officio in order to ensure that the regulatory objectives are achieved for the benefit of all assignment holders.
- 850 A reassignment in the 3.6 GHz band would need to be carried out shortly after completion of the allotment procedure in view of the planned early availability of this band. In the 2 GHz band, a reassignment would need to be carried out by the end of 2020 at the latest with regard to the availability of this band.
- 851 If an existing assignment holder fails to acquire any 3.6 GHz spectrum or less than its current amount of spectrum, it may be expedient to revoke the assignment. To this

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end, the Bundesnetzagentur will examine whether efficient frequency use can be expected in view of the network rollout to date and the remaining assignment period. A mere hoarding of spectrum is to be prevented in order to ensure that the regulatory objectives are achieved for the benefit of all assignment holders.

Information on legal remedies

Actions against this notice may be filed with the administrative court in Cologne, Appellohofplatz, 50667 Köln, Federal Republic of Germany, within one month of its announcement. Under section 137(1) TKG legal actions do not have suspensory effect.

Bundesnetzagentur für Elektrizität, Gas,
Telekommunikation, Post und Eisenbahnen

The President's Chamber

Bonn, 26 November 2018

Dr Eschweiler

Committee member

Homann

Chairperson

Franke

Committee member

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Annex 1 – Requirements to qualify for the auction proceedings

Applications to qualify for the auction should be submitted in writing, in German, in one original and two copies, and electronically on a data carrier (in Word or PDF format), to

Bundesnetzagentur
Referat 212
Kennwort: Versteigerungsverfahren
Tulpenfeld 4
53113 Bonn

The closing date for applications is 3.00 pm on 25 January 2019.

The application is to be structured as follows:

A. Applicant details

Applicants must start by providing the following data on themselves and their authorised agents:

1. The applicant's name and address
2. Legal form of the applicant
3. Applicant's registered office
4. Extract from the commercial register
5. Authorised representative including telephone and fax number as well as e-mail address
6. Designation of a person authorised to take delivery, including an address enabling service (street, house number, place)

B. Participation structure of the applicant

In the application, the ownership structure – including indirect ownership – of the applicant's undertaking must be described. This applies in particular to the description of the participation structure and any voting rights of an undertaking that has a controlling influence on the applicant. In the event that an application is filed by a consortium, the obligation to present the facts applies to all members of the consortium. The description must include the shares in the consortium.

C. Information on reliability

Applicants must indicate whether

- a frequency assignment they had in the past has been revoked,
- conditions have been imposed on them for failure to comply with obligations arising from frequency assignments,
- they have been prosecuted for a violation of telecommunications or data protection laws, or
- proceedings are currently pending against them in the aforementioned cases and, if applicable, with which authority.

D. Information on financial capacity

Applicants must demonstrate and prove that they have the financial resources available to acquire the spectrum at auction.

In addition, applicants must demonstrate and prove that they have sufficient financial resources at their disposal on a permanent basis in accordance with the investments in the build, rollout and operation of the radio network provided for in the frequency usage concept, or how financing is to be provided.

Proof that financing is in place must be furnished by supporting documents, eg written financing declarations of the parent undertaking, other affiliated undertakings or credit institutions. Mere declarations of intent or commitments to undertake efforts are not recognised as evidence of security. Where financing commitments are given by parent undertakings or other affiliated undertakings, they must be made in the form of "hard letters of comfort". Such letters of comfort must in particular contain declarations by the parent company that it accepts an unlimited obligation to ensure that the applicant is capitalised to the extent that it

- will have access to all the financial means needed to pay the amount of bids submitted with a view to acquiring spectrum at auction;
and
- it will have access to all the financial means needed for the investments in network build and rollout and for operation of the radio network included in the application to qualify for the auction.

The submission of a balance sheet does not release applicants from their obligation to present the facts.

Applicants are obliged to present a conclusive and comprehensible statement of their financial capacity in relation to their business plan (medium-term business planning). Proof of the financial resources required for network build must be based on the planning and construction costs and on the coverage obligation and the timeframe thereof as well as on the costs of ongoing operation.

The following should also be noted:

Approved applicants must lodge a security deposit into an account to be determined by the Bundesnetzagentur no later than 14 days before the auction begins.

The security can also take the form of an unconditional, continuing, irrevocable, absolute bank guarantee for the amount of the security payable, issued by a domestic financial institution or a financial institution authorised as a customs and tax guarantor.

E. Information on expertise

Proof must be furnished that the persons involved in the construction and operation of the radio network have the required knowledge, experience and skills. Applicants must demonstrate the existence of this expertise in a conclusive and comprehensible manner.

In this regard, applicants can submit CVs along with certificates and final certificates or evidence of previous activities (references) in the field of telecommunications. With regard to the planned technology, applicants must demonstrate that the persons operating the transmission paths have the required knowledge, experience and skills.

If a consortium submits an application, corresponding information about the relevant expertise of the members of the consortium must be provided. In addition, it must be

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explained how the expertise of the members of the consortium is to be transferred to the applicant.

E.1. Expertise in the field of radio technology

Applicants must demonstrate the knowledge, experience and skills necessary for the establishment and operation of their radio network and the marketing of the relevant services which enable them to exercise the spectrum usage rights.

E.2. Expertise in other areas of telecommunications

Applicants must demonstrate experience concerning the planning and construction of networks and services in other areas of telecommunications.

F. Frequency usage concept

Applicants must describe how they intend to ensure efficient and interference-free frequency usage by submitting a frequency usage concept. In particular, they must describe how they intend to fulfil the coverage obligations.

The frequency usage concept must be conclusive and comprehensible. Assumptions and forecasts must be based on verifiable facts.

F.1. Technical planning procedure

The information on the technical planning should demonstrate that applicants are familiar with the planned procedure and are able to use the planning instruments at their disposal. Applicants must provide information about the following:

- the specific procedure (eg system concept, network structure)
- planning instruments (individual execution of network rollout planning, timeframe for network rollout)
- area and population coverage
- network optimisation
- the subscribers and traffic forecast
- the operating and maintenance plan (eg network performance, reliability, network and error management).

The assumptions on which the technical planning is based must be conclusive and comprehensible.

In addition, applicants must identify planned focal points of coverage. The coverage requirements laid down in the procedural regulations on the award of spectrum for MFCN must be attained at least within the periods specified for this purpose.

The forecast of subscriber development must be presented in the form of a diagram covering the next five years. Theoretical assumptions on traffic and planned traffic management must be presented within the framework of the traffic forecast.

F.2. Presentation of spectrum requirements in relation to business model

Applicants must demonstrate within the framework of the application for admission that they will make efficient use of the spectrum applied for on the basis of their business model. This applies in particular to scenarios where the applicant already has suitable spectrum. With

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regard to the planned technology, applicants must describe how they intend to use the spectrum.

F.3. Planned services concept

Applicants must indicate what type of services they plan to offer on the basis of the radio technology selected and the timeframe within which they intend to provide such services.

F.4. Business planning and its implementation

Business planning must be set out in an investment plan covering the next five years. Applicants should indicate which target group and which market potential they are expecting for the competing radio networks.

F.5. Individual minimum spectrum requirement

Applicants are entitled to claim individual minimum spectrum requirements, which they consider to be absolutely essential for their business model for reasons of efficient use of spectrum and business management (essential minimum spectrum package, cf subsection III.1.4 of the decision taken by the President's Chamber).

If applicants claim they need an essential minimum spectrum package, this must be presented in a coherent and comprehensible manner in the frequency usage concept as outlined in F.1. to F.4 above.

G. Declaration of consent for publication

Furthermore, applicants must declare in their application that they agree to the public announcement of their admission to the auction proceedings and to the publication of any decision awarding spectrum to them.

Annex 2 – Frequency usage conditions for the 2 GHz frequency band

The purpose of the usage conditions in this Annex is to safeguard the interference-free coexistence of different applications in the frequency bands listed below and those adjacent to them. In order to ensure interference-free coexistence, the spectrum and frequency block edge masks attached in point 5 of this Annex must be observed. These are based on broadband radio applications intended for use in this frequency band. If radio applications with a smaller channel bandwidth are used, deviations may be necessary.

The European harmonised regulations are currently under review to determine whether updates are necessary with regard to the technologies envisaged in this frequency band in the future, such as the use of AAS antennas. It is anticipated that the decision-making situation will be stable by mid-2019. If necessary, the frequency usage conditions will be amended and updated accordingly.

Furthermore, the regulations listed below may be amended if the various spectrum users conclude agreements to the contrary for the duration of these operator agreements.

In the event that agreements deviating from the arrangements made within the framework of border coordination are concluded, they must be approved by the competent regulatory authorities.

1. Frequency bands

The frequency usage conditions set out in this Annex apply to the following frequency band:

Frequency band	Frequency spectrum available	Frequency blocks
2 GHz	1920 MHz – 1980 MHz and 2110 MHz – 2170 MHz	12 blocks of 2 x 5 MHz (paired)

The use of these frequencies for MFCN is based on the provisions set out below and set out in the attached channel plans. The channel plans correspond to the relevant decisions of the European Commission (eg Commission Implementing Decision 2012/688/EU) and the ECC Committee of CEPT (eg CEPT Report 39 and ECC Decision (06)01) and are intended to ensure efficient use is made of the available spectrum. Where ECC decisions differ from those adopted by the European Commission, the decisions adopted by the European Commission will apply. The use of different radio systems and access procedures is possible provided that the channel plan and the associated frequency usage conditions are adhered to.

The use of the fundamental framework conditions of the relevant decisions handed down by the European Commission and the ECC form the necessary basis for efficient cross-border use of the available spectrum. The aim is to adopt a uniform European regulation based on harmonised framework conditions with a view to safeguarding user-friendly Europe-wide availability of spectrum for MFCN.

The frequency usage conditions will be updated within the framework of European harmonisation.

2. Channel plans

The channel plans for the 2 GHz band and for other bands are outlined in Annex 8.

3. Description of the channel plan (1920 MHz – 1980 MHz and 2110 MHz – 2170 MHz)

The frequencies are assigned in integer multiples of 2 x 5 MHz (paired). Guard bands will not be stipulated. The lower band limits are 1920 MHz and 2110 MHz, respectively. For the

upper band limits (1980 MHz or 2170 MHz), the protection of adjacent applications – such as satellite radio services (MSS) – must be implemented without guard bands.

4. Additional conditions

4.1 Permissible out-of-block emissions

The specifications (spectrum masks or block edge masks) attached in point 5 of this Annex are also binding for out-of-block emissions for the use of the spectrum by FDD (Frequency Division Duplex) terminals and base stations. Deviations from this are subject to bilateral or multilateral agreements between the frequency users concerned. The Bundesnetzagentur must be notified of any such agreements prior to commissioning.

4.2 HAPS platforms as base stations

The use of High Altitude Platform Stations (HAPS) as base stations offering MFCN is only possible if unequivocal proof has been furnished of radio compatibility with the radio networks and services adjacent in the spectrum. This requires prior adjustment of frequency usage conditions and location-based frequency assignments based on them.

4.3 Frequency coordination for radio stations in border areas

The availability of spectrum for MFCN is limited in border areas and some other geographical regions of the Federal Republic of Germany due to the need for spectrum coordination with neighbouring countries.

Restrictions vary in terms of frequency and scope from area to area, depending on whether two, three or possibly four countries need to be included in the coordination process. Restrictions also depend on the transmission methods in use either side of the borders.

4.4 Protection of stationary receivers used by the Bundesnetzagentur's radio monitoring and inspection service

To secure the aims of frequency regulation in accordance with section 64 TKG, frequency usages cannot cause interference to the Bundesnetzagentur's radio monitoring stations. Electromagnetic fields from transmitters operated in the vicinity of the receiving equipment of the Bundesnetzagentur can lead to desensitisation and overloading effects, thus impairing the reception of the Bundesnetzagentur's measuring equipment (cf Official Gazette of the Bundesnetzagentur 17/2012, Communication No 613/2012).

In the Bundesnetzagentur's opinion, its current administrative practice in the parameter-setting procedures for MFCN, further developed by the regulation cited above, will continue to provide a balanced framework for reconciling the interests of mobile network operators in individual cases. This involves weighing up the interests of mobile network operators in further expanding their networks and the Bundesnetzagentur's statutory mandate.

In order to protect the stationary radio measuring stations used by the Bundesnetzagentur's radio monitoring and inspection service and the planned radio measuring stations in Germany, the maximum permissible field strength caused by emissions in the frequency band above 694 MHz is 90 dB μ V/m (cf Official Gazette of the Bundesnetzagentur 3/2016, Communication No 35/2016).

4.5 Satellite radio protection in the 2200 – 2290 MHz band

The 2200 – 2290 MHz frequency band is currently used locally to receive satellite radio signals (space research service, space operation service, earth exploration service). Satellite applications (EES, SRS and SOS) in the 2200 MHz – 2290 MHz band are to be protected by the assignment holder. Future MFCN applications, such as the use of active antenna systems (AAS), could potentially interfere with satellite communications in this band. Depending on the results of European harmonisation, further parameter-setting measures may be necessary to protect existing and future earth stations receiving in the 2200 – 2290 MHz frequency band.

5. Frequency usage conditions for the operation of FDD terminals in the 1920 MHz – 1980 MHz frequency band and base stations in the 2110 MHz – 2170 MHz frequency band

5.1. General parameters

1. The frequency blocks assigned will comprise integer multiples of 2 x 5 MHz (paired).
2. Duplex operation is performed in frequency division duplex mode (FDD). The duplex spacing is 190 MHz, with the terminal (FDD uplink) emitting in the lower part of the 1920 MHz – 1980 MHz band and the base station (FDD downlink) emitting in the upper part of the 2110 MHz – 2170 MHz band.
3. Operation may be performed using both passive antenna systems (non-AAS) and active antenna systems (AAS).
4. For use of the spectrum by FDD terminals and base stations, the following provisions are also binding for out-of-block emissions. Any deviations from this require the conclusions of bilateral or multilateral agreements between the frequency users concerned. The Bundesnetzagentur must be notified of any such agreements prior to commissioning.

5.2. Technical requirements for FDD base stations

5.2.1 Requirements for in-block transmissions

No in-block EIRP limits have been specified for base stations.

5.2.2 Basic requirements for out-of-block emissions

Table 1

**Basic requirements
BEM for out-of-block EIRP limits for non-AAS base stations per antenna⁽¹⁾**

<i>Frequency band of out-of-block emissions in the FDD downlink</i>	<i>Maximum mean out-of-block EIRP</i>	<i>Measurement bandwidth</i>
Frequency separations of more than 10 MHz from the lower or upper block edge	9 dBm	5 MHz

⁽¹⁾ The BEM is defined per antenna and applies to base stations with up to four antennas per sector.

Table 2

BEM for out-of-block EIRP limits for AAS base stations per antenna⁽¹⁾

<i>Frequency band of out-of-block emissions in the FDD downlink</i>	<i>Maximum mean out-of-block TRP</i>	<i>Measurement bandwidth</i>
Frequency separations of more than 10 MHz from the lower or upper block edge	1 dBm	5 MHz

(*) In a multi-sector base station, the radiated power value applies to each one of the individual sectors.

5.2.3 Transition requirements for out-of-block emissions

Table 3

BEM for out-of-block EIRP limits for non-AAS base stations per antenna⁽¹⁾

Frequency band of out-of-block emissions in the FDD downlink	Maximum mean out-of-block EIRP	Measurement bandwidth
-10 to -5 MHz (from the lower edge of the block)	11 dBm	5 MHz
-5 to 0 MHz (from the lower edge of the block)	16.3 dBm	5 MHz
0 to +5 MHz (from the upper edge of the block)	16.3 dBm	5 MHz
+5 to +10 MHz (from the upper edge of the block)	11 dBm	5 MHz

⁽¹⁾ The BEM is defined per antenna and applies to base stations with up to four antennas per sector.

Table 4

BEM for out-of-block EIRP limits for AAS base stations per antenna⁽¹⁾

Frequency band of out-of-block emissions in the FDD downlink	Maximum mean out-of-block TRP	Measurement bandwidth
-10 to -5 MHz (from the lower edge of the block)	3 dBm	5 MHz
-5 to 0 MHz (from the lower edge of the block)	8 dBm	5 MHz
0 to +5 MHz (from the upper edge of the block)	8 dBm	5 MHz
+5 to +10 MHz (from the upper edge of the block)	3 dBm	5 MHz

(*) In a multi-sector base station, the radiated power value applies to each one of the individual sectors.

5.3. Technical requirements for FDD terminals

Table 5

In-block requirements BEM for the limit values of in-block emissions by terminal equipment using FDD uplink frequencies

Maximum mean in-block transmitter power ⁽¹⁾	24 dBm ⁽²⁾
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⁽¹⁾ This power limit is specified as the EIRP for fixed or built-in terminals or as TRP for mobile or locality-independent terminals. For isotropic antennas, EIRP and TRP are equivalent. This value may be subject to a tolerance specified in the harmonised standards to take extreme environmental conditions and specimen scattering into account.

⁽²⁾ In order to determine the out-of-block emissions by terminal equipment, the CEPT Report 39 defines a maximum line-conducted transmitter power of 23 dBm as the basis.

For specific applications such as fixed terminal equipment in rural areas, the limits set out in Table 3 may be relaxed provided this does not compromise the protection of other services, networks and applications or the fulfilment of cross-border obligations.

5.4 Further requirements

The frequency band for unwanted emissions starts from a frequency separation of 10 MHz to the band edge and the unwanted emissions have to conform to the limits in ERC Recommendation 74-01.

Furthermore, MFCN may not demand stricter protection requirements for telecommunication services that use active antennas than for those using non-active antenna systems.

Annex 3 – Frequency usage conditions for the 3400 MHz – 3700 MHz frequency band

The purpose of the usage conditions in this Annex is to safeguard the interference-free coexistence of different applications in the frequency bands listed below and those adjacent to them. In order to ensure interference-free coexistence, the spectrum and frequency block edge masks attached to this Annex must be observed. These are based on broadband radio applications that are under discussion in connection with these frequency bands. If radio applications with a smaller channel bandwidth are used, deviations may be necessary. Furthermore, the regulations listed below may be amended by deviating agreements between the various frequency users concerned for the duration of these operator agreements. Any agreements that deviate from the arrangements made within the framework of border coordination are subject to approval by the competent regulatory authorities.

1. Frequency band

The frequency usage conditions set out in this Annex apply to the following frequency band:

Frequency band	Frequency spectrum available
3.6 GHz	3400 MHz – 3700 MHz

The use of these frequencies for MFCN is based on the provisions set forth below and in the attached channel plans. The channel plans correspond to the relevant decisions of the European Commission and the ECC Committee of the CEPT. Where there are differences between ECC decisions and those of the European Commission, those of the European Commission will apply, ensuring efficient use is made of the available spectrum. The use of different radio systems and access procedures is possible provided that the channel plan and the associated frequency usage conditions are observed.

The use of the fundamental framework conditions of the relevant decisions handed down by the European Commission and the ECC form the necessary basis for efficient cross-border use of the available spectrum. The aim is to adopt a uniform European regulation based on harmonised framework conditions with a view to safeguarding user-friendly Europe-wide availability of spectrum for MFCN.

The frequency usage conditions will be updated within the framework of European harmonisation.

2. Channel plans

The channel plans for the 3.6 GHz band and for other bands are outlined in Annex 8.

3. Description of the channel plan (3400 MHz – 3700 MHz)

The frequencies are assigned in integer multiples of 10 MHz (unpaired). Guard bands will not be stipulated.

For the lower band limit (3400 MHz), regionally limited additional requirements apply in individual cases in order to protect the military radar systems adjacent to the spectrum as well as the Effelsberg radio astronomy station. In addition, in individual cases, regionally limited additional requirements apply to the protection of the Geodetic Observatory Wettzell in the entire 3400 MHz – 3700 MHz band.

Nationwide assignment holders do not have to observe a guard band between the adjacent applications above 3700 MHz. Rather, the local assignment holders have to comply with a potential guard band to the adjacent national usage.

In addition, no interference may be caused to existing, coordinated receiving stations of the fixed-satellite service in the sub-band 3600 – 3800 MHz. However, reception at newly established sites for earth stations in the 3600 MHz – 3700 MHz frequency band does not require protection.

In the Frequency Plan, the 3400 MHz – 3600 MHz band is allocated to the fixed-satellite service (space-to-earth) but is not designated for a specific application (see Frequency Plan, April 2016, entry nos 315003 and 316002). In light of this, the reception of satellite communications in the 3400 MHz – 3600 MHz band is in principle possible, but no protection from interference can be claimed.

In general, no guard band needs to be maintained between a frequency block of a network operator using TDD technology and the frequency block of an adjacent network operator in synchronised networks. For unsynchronised and semi-synchronised networks, the international studies on the synchronisation of the 3.6 GHz band can be taken into account. Any deviations from this are subject to bilateral or multilateral agreements between the radio network operators concerned. The Bundesnetzagentur must be notified of any such agreements prior to commissioning.

4. Further/technical regulations

The frequency band 3400 MHz – 3700 MHz is part of the European harmonised band 3400 MHz – 3800 MHz. In this, the conditions for the use of the radio spectrum laid down in the Commission Decision of 21 May 2008 on the harmonisation of the 3400 – 3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community (2008/411/EC) apply in principle as most recently amended by the Commission Implementing Decision of 2 May 2014 amending Commission Decision 2008/411/EC on the harmonisation of the 3400 – 3800 MHz frequency band for terrestrial systems capable of providing electronic communications services in the Community (2014/276/EU).

In 2016, the European Commission issued a mandate to the CEPT to review the technical parameters and their suitability for 5G technology. CEPT responded to this by issuing CEPT Report 67 in July 2018. CEPT Report 67 contains the necessary amendments to the above-mentioned European harmonisation measures. It is anticipated that the modified implementing decisions of the Commission will be adopted in the first quarter of 2019. The revised ECC Decision (11)06 with identical content was adopted in October 2018.

The Bundesnetzagentur thus assumes that the decision-making process will be consistent with regard to the frequency usage conditions. It intends to apply the modified frequency usage conditions exclusively in accordance with CEPT 67, also in the interest of 5G technology deployment and in view of the foreseeable change in the Commission's implementing decisions. This means, for example, that only TDD deployment is possible.

When applying the frequency usage conditions, the Bundesnetzagentur intends to explore not only the possibility of operator agreements, but also potential simplifications depending on specific implementation cases (eg indoor deployment).

The frequency usage conditions may also be subsequently amended, in particular if this is necessary to ensure efficient and interference-free use or owing to international harmonisation agreements.

4.1 Permissible block emissions (in-block and out-of-block)

4.1.1 General parameters

1. The frequency blocks assigned comprise integer multiples of 10 MHz.
2. Duplex operation is performed in time division duplex (TDD) mode.
3. The frequency block edge masks listed below for semi- and unsynchronised networks assume a guard band is maintained between blocks of one TDD network and blocks of another TDD network. This guard band needs to be implemented by the assignment holders in their own spectrum.

4. Operation may be performed using both passive antenna systems (non-AAS) and active antenna systems (AAS).
5. The following technical parameters for base stations, also referred to as block edge masks (BEM), are fundamental components of conditions to ensure the simultaneous operation of adjacent networks, unless bilateral or multilateral agreements exist between the network operators. Any deviations from this are subject to bilateral or multilateral agreements between the frequency users concerned. The Bundesnetzagentur must be notified of any such agreements prior to commissioning.

4.1.2 Technical requirements for TDD base stations

4.1.2.1 Requirements for in-block emissions for non-active (non-AAS) and active (AAS) antenna systems

No in-block EIRP limits have been specified for base stations.

For Femto base stations, power must be selected to minimise interference to adjacent channels.

4.1.2.3 Requirements for out-of-block emissions for non-active (non-AAS) and active (AAS) antenna systems in synchronised networks

A) Basic requirements – BEM for out-of-block EIRP limits /TRP base station limits per antenna/cell

Frequency band	Maximum permissible equivalent radiated power (EIRP) non-AAS	Maximum permissible TRP value AAS
10 MHz or more separation from lower block edge Within 3400-3700 MHz	Min(PMax-43, 13) dBm/ (5 MHz) per antenna	Min(PMax'-43, 1) dBm/(5 MHz) per cell (*)
(*)In a multi-sector base station, the radiated power value applies to each one of the individual sectors.		

B) Transition requirements – BEM for out-of-block EIRP/TRP base station limits per antenna/cell

Frequency band	Maximum permissible equivalent radiated power (EIRP) non-AAS	Maximum permissible TRP value AAS
-5 to 0 MHz separation from lower block edge or 0 to 5 MHz separation from upper block edge	Min(PMax-40, 21) dBm/ (5 MHz) per antenna	Min(PMax'-40, 16) dBm/(5 MHz) per cell (*)
-10 to -5 MHz separation from lower block edge or 5 to 10 MHz separation from upper block edge	Min(PMax-43, 15) dBm/ (5 MHz) per antenna	Min(PMax'-43, 12) dBm/(5 MHz) per cell (*)
(*)In a multi-sector base station, the radiated power value applies to each one of the individual sectors.		

Less stringent technical parameters can be agreed between the different frequency users concerned.

4.1.2.2 Restricted basic requirement for out-of-block emissions for non-AAS and AAS for base stations in non-synchronised and semi-synchronised networks

Frequency band	Maximum permissible equivalent radiated power (EIRP) non-AAS	Maximum permissible TRP value AAS
Unsynchronised and semi-synchronised blocks Below lower block edge Above upper block edge Within 3400-3700 MHz	-34 dBm/(5 MHz) per cell (*)	-43 dBm/(5 MHz) per cell (*)
(*) In a multi-sector base station, the radiated power value applies to each one of the individual sectors		

The strict limits for unsynchronised or semi-synchronised operations between networks generally apply to indoor and outdoor operations. For operations with sufficient separation between networks (eg geographical or indoor), the limits for synchronised operations between networks may apply. Less stringent technical parameters can also be agreed between the different frequency users concerned.

4.1.3. Technical conditions for TDD terminals

The in-block emissions for mobile TDD terminals should not exceed 28 dBm TRP.

4.2 Out-of-band emissions

4.2.1 Frequency coordination for the protection of military radar systems below 3400 MHz

In Germany, the additional basic requirement for out-of-band emissions for non-active (non-AAS) and active antenna systems (AAS) applies to base stations in order to protect radar below 3400 MHz (see CEPT Report 67 or ECC Decision (11)06 and Commission Decision derived therefrom).

If passive antennas (non-AAS) are used in the base station, the limit on out-of-band emissions for TDD operation of -50 dBm/MHz EIRP per antenna contained in ECC Decision (11)06 will apply.

For active antenna systems (AAS), out-of-band emissions for TDD operation of base stations must be limited nationwide to -52 dBm/MHz TRP (Total Radiated Power) per cell. In addition, a coordination zone of 12 km from adjacent military radar systems is necessary.

These limits for the protection of military radar systems generally apply to outdoor and indoor operations. For indoor operations, the Bundesnetzagentur may permit a less stringent limit value in individual cases.

4.2.2 Frequency coordination for the protection of radio astronomy below 3400 MHz

The protection criteria for the (passive) radio astronomy service are defined in Recommendation ITU-R RA.769. To protect the Effelsberg radio astronomy station below the lower band limit at 3400 MHz, local restrictions may need to be imposed on wireless network access. In line with the Bundesnetzagentur's administrative practice, compatibility is established in the setting of the site-related technical parameters as part of the frequency assignment and taking into account the conditions on site.

In this context, it is, in principle, possible for the frequency users to reach agreement. The Bundesnetzagentur must be notified of any such agreements prior to commissioning.

4.2.3 Additional basic requirement for out-of-band emissions for non-AAS and AAS for base stations for coexistence with FSS/FS above 3800 MHz

Frequency band	Maximum permissible equivalent radiated power (EIRP) non-AAS	Maximum permissible TRP value AAS
3800-3805 MHz	Min(PMax-40, 21) dBm/ (5 MHz) per antenna (*)	Min(PMax'-40, 16) dBm/ (5 MHz) per cell (**) (***)
3805-3810 MHz	Min(PMax-43, 15) dBm/ (5 MHz) per antenna (*)	Min(PMax'-43, 12) dBm/ (5 MHz) per cell (**) (***)
3810-3840 MHz	Min(PMax-43, 13) dBm/ (5 MHz) per antenna (*)	Min(PMax'-43, 1) dBm/ (5 MHz) per cell (**) (***)
Over 3840 MHz	-2 dBm/(5 MHz) per antenna (*)	-14 dBm/(5 MHz) per cell (***)
<small>* measured as EIRP per carrier, interpreted as per antenna ** In a multi-sector base station, the radiated power value applies to each one of the individual sectors *** The TRP per carrier is measured per cell</small>		

4.3 Frequency coordination for the protection of radio applications within the 3.6 GHz band

4.3.1 Frequency coordination for the protection of the Geodetic Observatory Wettzell (GOW) in the 3400 MHz – 3700 MHz band

The compatibility of mobile radio stations located within the 120 km coordination zone around the GOW must be considered on a case-by-case basis. Mobile networks operators could take various measures at their individual sites to minimise restrictions on the observatory, such as:

- restricting the transmitter power;
- reducing the antenna height;
- adjusting the antenna elevation angle;
- adjusting the direction of the antenna (away from Wettzell); or
- restricting use to urban areas (shielding offered by buildings).

In this context, it is, in principle, possible for the frequency users to reach agreement. The Bundesnetzagentur must be notified of any such agreements prior to commissioning.

4.3.2 Frequency coordination for the protection of the monitoring earth station in Leeheim

The monitoring earth station in Leeheim is the Bundesnetzagentur's satellite monitoring station. The reception of satellite communications in, among others, the 3400 MHz – 3600 MHz band by the earth station has been coordinated and must be protected. To ensure that frequency usage is monitored effectively in accordance with section 64 TKG, frequency usages cannot cause interference to the Bundesnetzagentur's radio monitoring stations (cf Communication No 613/2012, Bundesnetzagentur Official Gazette No 17/2012, page 3161).

It is intended to apply a coordination radius of 20 km around the Leeheim monitoring earth station for terrestrial spectrum use. The technical parameters for mobile base stations within this radius will be set on a case-by-case basis when assigning spectrum, taking account of

the topography and usage parameters with regard to the special features of the Leeheim monitoring earth station. The mobile radio parameters currently available were used as a basis to determine the coordination zone. For coverage in the built-up area, it can be assumed that buildings provide additional shielding effects and thus that frequencies can be used for mobile radio applications, 5G in particular.

4.3.3 Frequency coordination for the protection of existing and coordinated reception radio installations of the fixed satellite service (FSS)

According to the Frequency Plan, no interference may be caused to existing coordinated receiving stations of the fixed-satellite service in the sub-band 3600 - 3800 MHz (see Frequency Plan, April 2016, entry no 317003).

Protection requirements will be determined for each specific case within a coordination zone. A generic coordination zone around the earth stations of about 50 km is calculated if the topography and morphology and the pointing direction of the antennas of the earth stations are not taken into account. Given the topography and morphology, restrictions for mobile communications should, as a rule, only apply within a radius of 20 km in the direction of maximum radiation and 5 km for the side lobes of the earth station antennas. A general angle range of 100° to 260° is defined for north over east for the main beam direction. A coordination radius of 5 km is defined in the other angular ranges. For the determination of the coordination zone, the mobile radio parameters currently available were used as a basis.

When determining the site-related frequency usage parameters of mobile radio as a component of frequency assignment, particular consideration was given to Report ITU-R M.2109 (2007) and Report ITU-R p.2368-0 (06/2015), ECC Report 203 (on 4G/LTE) and CEPT Report 67 as well as to local conditions. In this context, the topography (terrain obstacles) and morphology (shielding, for instance in dense urban areas) can have a positive effect on compatibility. The mitigation techniques and measures required for MFCN to achieve compatibility with satellite communications may therefore vary in each case (eg reduction in transmitter power, reduction in antenna height, disabling of antenna sectors pointing towards earth stations, separation of more than 50 degrees between the direction of radiation of the mobile base station and the earth station, indoor use).

In the 3600 MHz – 3700 MHz band, the following existing and coordinated locations will be considered:

Earth station	Frequency band (10 MHz blocks concerned)
Ruppichteroth	3600 – 3640 MHz
Fuchsstadt	3600 – 3700 MHz
Backnang-Waldrems	3620 – 3700 MHz
Berlin-Wannsee	3650 – 3700 MHz
Landstuhl	3600 – 3700 MHz
Ottobrunn	3600 – 3690 MHz
Raisting	3630 – 3700 MHz
Weßling	3630 – 3700 MHz
Wiesbaden-Erbenheim	3650 – 3700 MHz
Leeheim (Bundesnetzagentur)	3600 – 3700 MHz

Table: Existing coordination for the reception of satellite radio in the 3600 MHz – 3700 MHz band

In addition to these earth stations, a single-digit number of earth stations used for security-related communications are also to be given consideration. In light of this, the assignment holders will only be informed of the locations bilaterally when the site-related frequency parameters are set. An overall angle range of 100° to 260° can be assumed with reference to north over east. A coordination radius of 5 km is defined in the other angular ranges. The mobile radio parameters currently available were used as a basis to determine the coordination zone.

Furthermore, the Frequency Plan provides scope for development in use at the above-mentioned earth station sites in individual cases (see Frequency Plan, April 2016, entry no 317002):

"The sub-band 3600 - 3800 MHz will only continue to be available to the fixed-satellite service with restrictions following the introduction of MFCN applications. Existing coordinated receiving stations of the fixed-satellite service shall be protected; new uses will be possible in individual cases, in particular at existing sites."

Operators of existing coordinated earth stations can apply for coordination for reception for new uses in the 3600 MHz – 3700 MHz band. The application must include a frequency usage concept giving an account of why the 3800 MHz – 4200 MHz band is not sufficient in the specific case. If the account is conclusive and the mobile assignment holder is not using the spectrum and agrees to use by the earth station, use will be coordinated. If the mobile network operator is already using the spectrum, coordination between the earth station operator and the mobile network operator will be required. The operators will only have to apply for coordination in compliance with the extended obligation to present the facts where new uses are planned. New uses via additional antennas at existing earth stations that are successfully coordinated using this procedure will be protected.

The mobile operator's specific rollout plans are also to be taken into consideration in the coordination. The mobile operator may be required to present the plans to the Bundesnetzagentur. In the event that frequencies are leased or provided for temporary use, the involvement of each specific frequency user will be required as well.

However, reception at new earth station sites in the 3600 MHz – 3700 MHz band will not be protected.

4.3.4 Protection of the radio monitoring stations of the Bundesnetzagentur's radio monitoring and inspection service

To secure the aims of frequency regulation in accordance with section 64 TKG, frequency usages cannot cause interference to the Bundesnetzagentur's radio monitoring stations. Electromagnetic fields generated by transmitting equipment operated in close proximity to the Bundesnetzagentur's receiving stations can result in desensitisation and overloading, thus impairing the ability of the Bundesnetzagentur's measuring equipment to receive signals (cf Bundesnetzagentur Official Gazette No 17/2012, Communication No 613/2012).

The Bundesnetzagentur has evolved its administrative practice for setting MFCN parameters in line with the above regulation and feels that it will continue to offer a fair framework for balancing the individual interests of mobile network operators as regards their network rollout efforts with the Bundesnetzagentur's legal mandate.

With a view to protecting stationary radio monitoring stations operated and planned by the Bundesnetzagentur's radio monitoring and inspection service in Germany, the field strength of transmissions in the frequency band above 694 MHz may not exceed a value of 90 dBµV/m at these sites (cf Bundesnetzagentur Official Gazette No 3/2016, Communication No 35/2016).

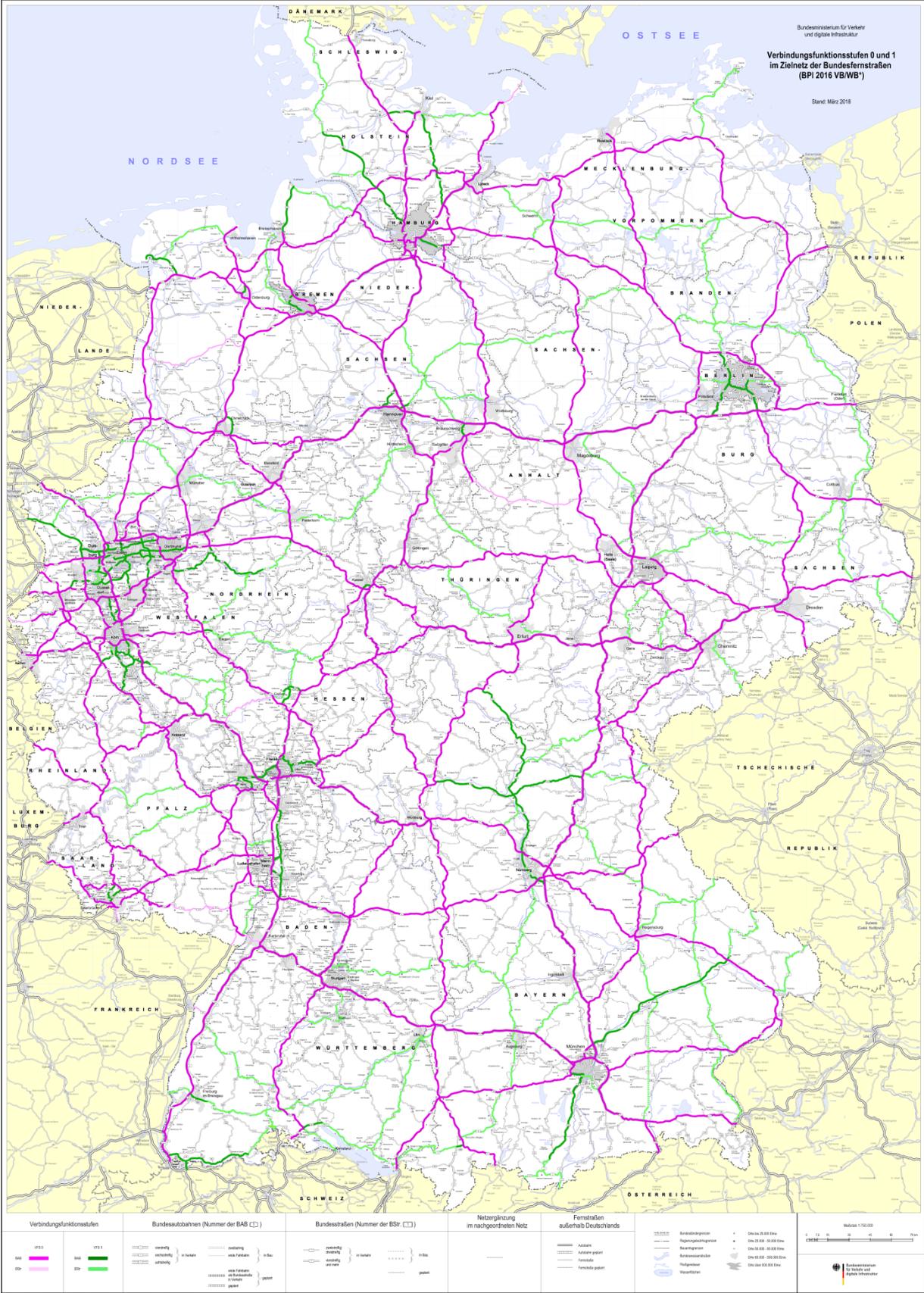
4.4 Frequency coordination for radio stations in border areas

The availability of spectrum for MFCN is limited in border areas and some other geographical regions of the Federal Republic of Germany due to the need for spectrum coordination with neighbouring countries.

Restrictions vary in terms of frequency and scope from area to area, depending on whether two, three or possibly four countries need to be included in the coordination process.

Restrictions also depend on the transmission methods in use either side of the borders.

Annex 4 – Overview of federal roads with connectivity function levels 0/1



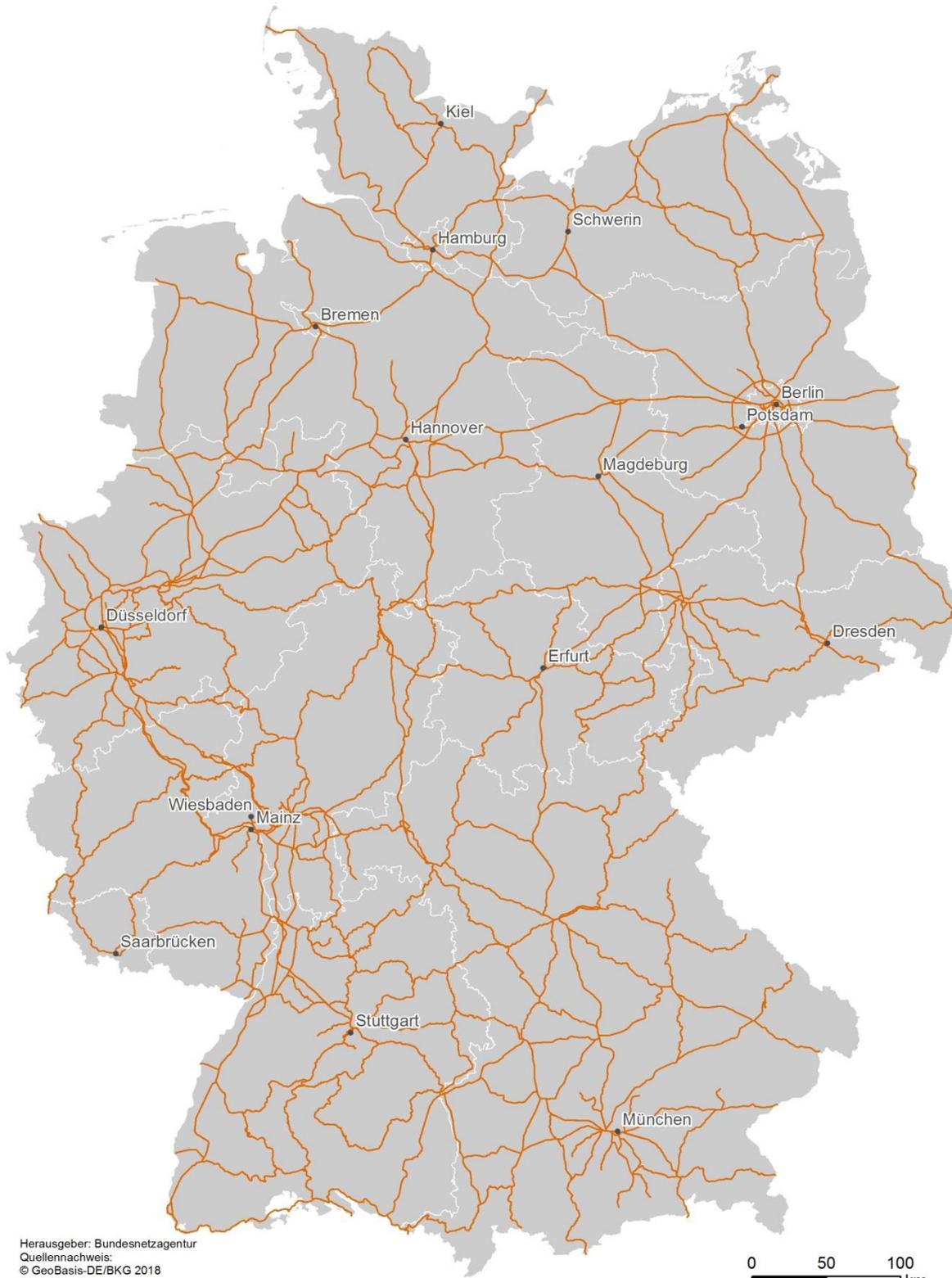
Source: Federal Ministry of Transport and Digital Infrastructure

Annex 5 – Overview of the waterways core network

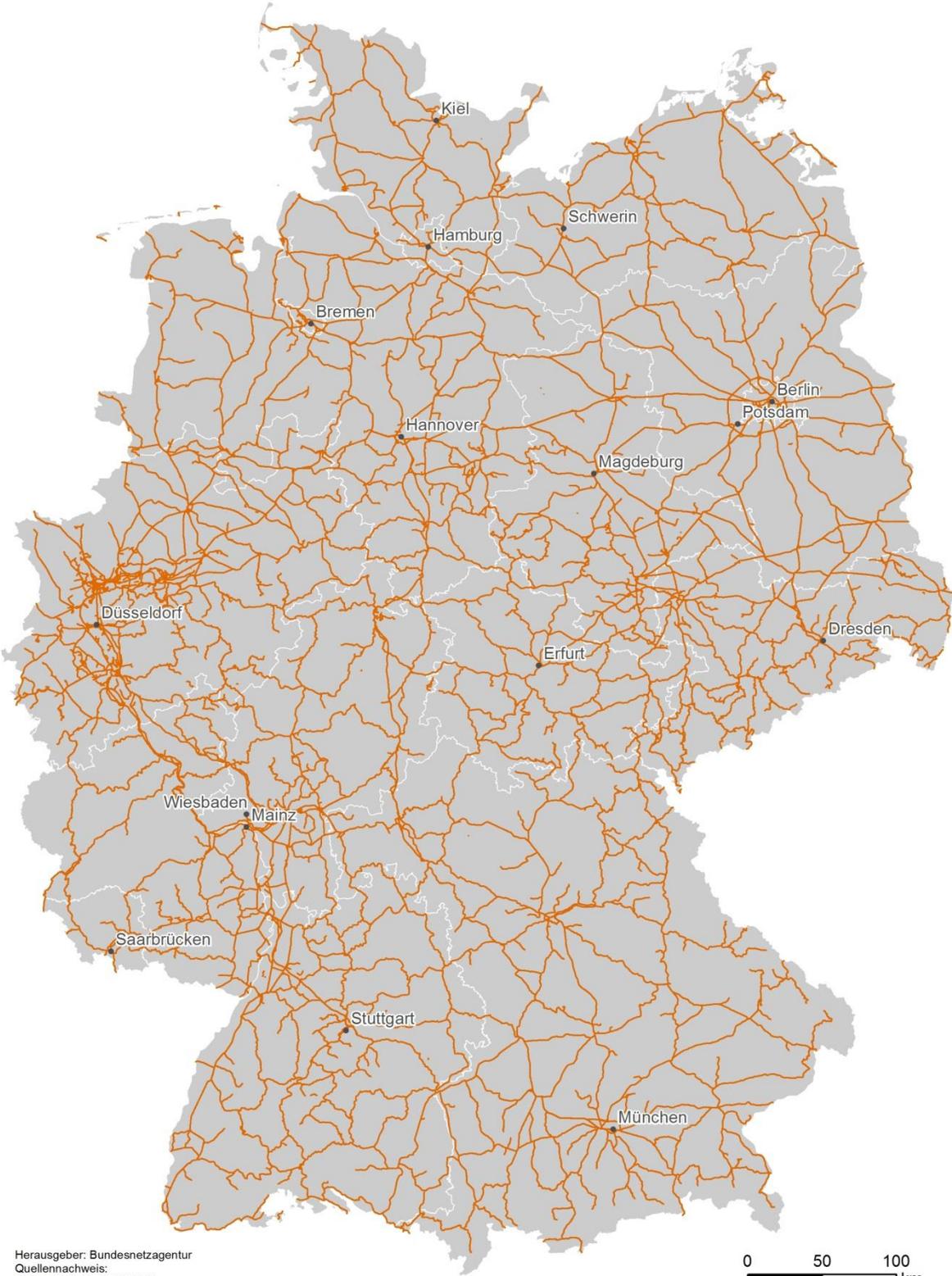


Source: Federal Ministry of Transport and Digital Infrastructure

Annex 6 – Overview of rail routes with more than 2000 passengers daily



Annex 7 – Overview of all rail routes



Herausgeber: Bundesnetzagentur
Quellennachweis:
© GeoBasis-DE/BKG 2018

0 50 100
km

Annex 9 – Overview of auction lots

Frequency blocks in the 2 GHz band					
Designation	Amount	Type of award	Frequency band	Minimum bid	Lot Rating
01A 2 GHz	2 x 5 MHz (paired)	abstract	1920 MHz – 1980 MHz/ 2110 MHz – 2170 MHz	€5,000,000	1
02A 2 GHz	2 x 5 MHz (paired)			€5,000,000	1
03A 2 GHz	2 x 5 MHz (paired)			€5,000,000	1
04A 2 GHz	2 x 5 MHz (paired)			€5,000,000	1
05A 2 GHz	2 x 5 MHz (paired)			€5,000,000	1
06A 2 GHz	2 x 5 MHz (paired)			€5,000,000	1
07A 2 GHz	2 x 5 MHz (paired)			€5,000,000	1
08A 2 GHz	2 x 5 MHz (paired)			€5,000,000	1
09A 2 GHz (2026)	2 x 5 MHz (paired)			€3,750,000	1
10A 2 GHz (2026)	2 x 5 MHz (paired)			€3,750,000	1
11A 2 GHz (2026)	2 x 5 MHz (paired)			€3,750,000	1
12A 2 GHz (2026)	2 x 5 MHz (paired)			€3,750,000	1

Frequency blocks in the 3400 MHz to 3700 MHz band							
Designation	Amount	Type of award	Frequency band	Minimum bid	Lot Rating		
01K 3.6 GHz	1 x 20 MHz	specific	3400 – 3420 MHz	€2,000,000	2		
02A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
03A 3.6 GHz	1 x 10 MHz	abstract	3420 – 3690 MHz	€1,700,000	1		
04A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
05A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
06A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
07A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
08A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
09A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
10A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
11A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
12A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
13A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
14A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
15A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
16A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
17A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
18A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
19A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
20A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
21A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
22A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
23A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
24A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
25A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
26A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
27A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
28A 3.6 GHz	1 x 10 MHz			€1,700,000	1		
29K 3.6 GHz	1 x 10 MHz			specific	3690 – 3700 MHz	€1,700,000	1

Annex 10 – Decision taken by the Advisory Council

Decision taken by the Advisory Council of the Bundesnetzagentur on 25 June 2018

The Advisory Council notes that the forthcoming decisions on the future expansion of the 5G network are of great economic and infrastructural importance for the Federal Republic of Germany and will have a major impact on the equality of living conditions in the long term. The significance in terms of economic policy results from the fact that the existence of a 5G network will be essential for the realisation of a whole range of technologically innovative applications, both for the population and for the economy as a whole. It is foreseeable that it will only be possible to implement these applications in regions in which the corresponding infrastructure is available (the chicken and the egg dilemma). As a result, the political focus in the decision-making process for maintaining equal living conditions must be placed in particular on those areas in which no 5G network rollout is to be expected purely from private sector impetus.

1. Status analysis

In order to be able to select the right tools for future 5G network rollout, the current situation needs to be analysed first. To this end, it is first necessary to assess the development of usage patterns in the existing mobile radio networks and – as far as possible – to predict future applications. In addition, the instruments used so far in the mobile network rollout and their actual results need to be analysed.

1.1. Current usage behaviour

The Advisory Council notes that usage behaviour in German mobile networks has changed significantly in recent years. This applies to the number of devices active in the mobile network, on the one hand, and to the services handled via mobile networks, on the other.

As indicated in the Annual Report 2017 recently published by the Bundesnetzagentur, the number of SIM cards has increased again to 135 million. Of particular relevance here is the fact that this is attributable in particular to an increase in the number of cards used for data communication between devices (end of 2016: 11.1 million; now 17.6 million).¹ It should also be noted that the number of 4G SIM cards in active use rose to 44.9 million by the end of 2017 (end of 2016: 36.5 million), representing an increase of 23% within one year.²

This is also reflected in the services handled via mobile networks. While the number of call minutes has remained almost constant, the number of text messages sent continues to decline. However, the volume of data handled via mobile networks is experiencing a very significant and renewed surge. It increased from 156m GB in 2012 to 913m GB in 2016 to 1338m GB in 2017. This means that the volume of data transferred has increased eightfold in the past five years. Last year alone, mobile data volumes increased by 52%.³

¹ Bundesnetzagentur, Annual Report 2017, p 58.

² Bundesnetzagentur, Annual Report 2017, p 59.

³ Bundesnetzagentur, Annual Report 2017, p 59.

1.2. Current mobile network rollout in relation to households

The Advisory Council notes that rollout of the LTE network (4G) in relation to the population is progressing. The number of LTE base stations has increased to 48,146 (2016: 44,100). Deutsche Telekom has thus achieved 94% network coverage in relation to households, Vodafone network coverage of 91% for households and Telefónica network coverage of 82% for households. According to Bundesnetzagentur statistics, for all providers, this represents a slight increase compared with the previous year.⁴

1.3. Future challenges for mobile network rollout

The Advisory Council notes that the future rollout of mobile networks is facing new requirements that go beyond previous approaches. This results from changes in usage patterns, the current rollout strategy and foreseeable future applications.

As far as public perception is concerned, it is the case that – in relation to the current mobile network rollout of the 2G, 3G and 4G networks – more and more complaints are being made about telephone calls being disconnected and about data rates being insufficient. In recent years, the use of mobile communications has become much more important in people's everyday lives and the economy. As the above figures of the Bundesnetzagentur show, the use of data services has increased sharply. In addition, it has to be taken into account that more than 99% of mobile services are used for mobile purposes. Out of a total of 109.7 million active SIM cards in 2017, less than 1% (897,000) were being used at a fixed location.⁵ Consequently, other factors will play a much greater role in the future in addition to coverage of the resident population (households). Furthermore, 5G will lend a fundamentally new quality to digital networking that will no longer focus solely on the human mobile phone user. Through comprehensive, almost latency-free networking, 5G opens up the possibility of the Internet of Things and thus facilitates new applications in the areas of production (Industry 4.0), mobility and logistics, the extraction and processing of Big Data with the aid of artificial intelligence and thus new products, services and business models.

Foreseeable future applications, such as the various stages of automated driving and eventually self-driving cars, will require reliable vehicle connectivity on the road network. This applies to direct communication from the vehicle to the surrounding infrastructure (Car2Infrastructure), which will be based on WLAN or mobile radio-based technologies. Yet satisfactory mobile coverage will also become necessary for the indirect communication between vehicles and underlying IT services (Car2Backend). The European Commission's broad-based European strategy on Cooperative Intelligent Transport Systems (C-ITS) aims to introduce safety and efficiency functions that require appropriate mobile communications coverage along transport routes.

In addition to these applications involving private use of the road network, reliable mobile phone coverage will also be important in the future, especially for logistics applications.

⁴ Bundesnetzagentur, Annual Report 2017, p 61.

⁵ Bundesnetzagentur, Annual Report 2017, p 59.

A comparable development can be observed with mobile coverage along the German rail network. Private usage behaviour described above and the increase in the volume of data handled via mobile networks indicate that the focus along the rail network will be on the availability of high data capacity. This is due solely to the practical fact that on an ICE, IC or regional express train, there are a large number of mobile phone users within a limited space who are all using certain bandwidth at the same time.

The Council notes, however, that the current supply of 2G, 3G and 4G services along the transport routes is already in need of improvement. This is demonstrated by the data provided by the federal government:

1.3.1. Mobile availability on motorways:

Länge der Bundesautobahnen [in km]		
besiedelt	unbesiedelt	gesamt
2.158	16.083	18.241

Spannbreite der Anbieterverfügbarkeit [in % der Streckenlänge]	
Voice	LTE
99,5 – 100,0	72,1 – 96,0

(Source: (Broadband Atlas commissioned by the Federal Ministry of Transport and Digital Infrastructure, as of mid-2017)

The availability of voice services along motorways is satisfactory. However, there are noticeable differences between the respective providers regarding the availability of LTE (4G) and thus also the availability of data services. Whereas the provider with the best network had just under 730 km (4%) of motorways not covered by LTE in mid-2017, the worst provider was still unable to provide coverage on around 5090 km of the German motorway network. For clarification purposes, it should be noted in this context that the specifications from the 2015 auction will further improve LTE availability on motorways.

1.3.2 Mobile availability on federal roads:

Länge der Bundesstraßen [in km]		
besiedelt	unbesiedelt	gesamt
13.141	29.888	43.029

Spannbreite der Anbieterverfügbarkeit [in % der Streckenlänge]	
Voice	LTE
96,0 – 99,7	45,7 – 88,4

(Source: (Broadband Atlas commissioned by the Federal Ministry of Transport and Digital Infrastructure, as of mid-2017)

It may be observed that the first tangible differences between the providers become apparent in terms of pure availability of voice services on federal roads. While the provider with the best network still covers almost all of the federal roads with the exception of around 130 km of the route network, the worst provider is unable to provide voice telephony on 1721 km. The deficits in LTE supply (4G) are much more clear-cut. The provider with the best network was unable to provide 4G on 4990 km of the federal roads by mid-2017. The worst provider was unable to provide LTE coverage (4G) on 23,300 km (45.7%) of the federal roads.

1.3.3 Mobile availability on state roads:

Länge der Landesstraßen [in km]		
besiedelt	unbesiedelt	gesamt
25.578	61.935	87.513

Spannbreite der Anbieterverfügbarkeit [in % der Streckenlänge]	
Voice	LTE
91,3 – 98,6	39,4 – 82,3

(Source: (Broadband Atlas commissioned by the Federal Ministry of Transport and Digital Infrastructure, as of mid-2017)

There is no voice telephony available on 1225 km of the best provider's state road network. The provider with the worst network is unable to provide voice telephony services on 7613 km of the state road network. The best provider is unable to provide LTE and thus data services of the current generation on 15,489 km of the national road network, whereas the worst provider is unable to offer this coverage on 53,032 km of the national road network.

1.3.4 Mobile availability on local roads:

Länge der Kreisstraßen [in km]		
besiedelt	unbesiedelt	gesamt
20.468	71.658	92.126

Spannbreite der Anbieterverfügbarkeit [in % der Streckenlänge]	
Voice	LTE
90,7 – 98,4	37,4 – 80,9

(Source: (Broadband Atlas commissioned by the Federal Ministry of Transport and Digital Infrastructure, as of mid-2017)

The availability of mobile telephony on local roads is comparable to that available on state roads described above. The best provider is unable to provide voice telephony services on 1474 km of the local road network. The worst provider is unable to provide voice telephony services on 8560 km of this network. The best provider is unable to provide LTE services (4G) on 17,596 km of the local road network. By mid-2017, the worst provider was still unable to offer LTE services (4G) on 57,670 km of this network.

1.3.5 Mobile availability on ICE routes:

Länge der ICE-Strecken [in km]		
besiedelt	unbesiedelt	gesamt
2.929	4.727	7.656

Spannbreite der Anbieterverfügbarkeit [in % der Streckenlänge]	
Voice	LTE
98,2 – 99,9	69,3 – 94,7

(Source: (Broadband Atlas commissioned by the Federal Ministry of Transport and Digital Infrastructure, as of mid-2017)

The availability of voice telephony services along the ICE network is satisfactory. With regard to LTE availability (4G), however, it should be noted that the best provider was still unable to provide LTE on 405 km of the ICE route network by mid-2017 whereas the worst provider was offering no LTE coverage on 2350 km. There are no details available on mobile availability in the IC and regional express network.

1.4. Interim conclusion:

The Advisory Council has drawn the following interim conclusion from the above-mentioned status analysis:

- The approach adopted so far in relation to coverage of households has basically led to satisfactory results in terms of coverage for the resident population in urban areas. However, coverage for the resident population in rural areas remains unsatisfactory.
- User behaviour generally shows a significant increase in the volume of data handled via mobile networks (52% increase from 2016 to 2017 alone).
- Mobile communications are almost completely mobile and rarely from a fixed location. The current application scenarios and the foreseeable future usage scenarios for the mobile network, such as automated, networked and eventually autonomous driving, demonstrate clearly that reliable mobile radio coverage is already needed on transport routes and will certainly become even more necessary in the future.
- Even though it is too early to establish what effect use of the 700 MHz band will have, the coverage situation as of mid-2017 shows that the current approach of supplying households has not led to automatic coverage on transport routes. If even the provider with the best network is unable to provide voice telephony services on 1225 km of state roads and 1474 km of municipal roads, this deficit is certainly affecting subordinate roads in particular and thus essentially rural areas. This is not satisfactory. This same applies to the availability of LTE services (4G) considering there is no LTE supply (4G) in the best network on 15,489 km of the state road network or 17,596 km of the local road network.

All things considered, the Advisory Council draws the following conclusion with regard to the strategic orientation of the mandatory expansion of future 5G mobile communication networks in view of the great significance of 5G rollout for the economy and infrastructure policy of the Federal Republic of Germany and the major impact 5G will have on creating equal living conditions:

- Generally speaking, it still makes sense for the resident population for coverage to be oriented on households;
- Due to the long-term nature of the determination (up to 2040), precautions need to be taken in particular to meet the soaring demand for volume of data handled via mobile networks;
- In addition to supplying households (the resident population), the obligations to provide coverage for transport routes must be significantly intensified, as this is or will become necessary for existing and future applications.

Furthermore, the rollout of 2G, 3G and 4G has shown that a purely competition-driven coverage of transport routes, in particular in rural areas, is not reliable; the Council makes it clear that coverage of transport routes that merely provides for the rollout of a 4G network is not sufficient;

- In addition to coverage of households and transport routes, the needs of industry and trade must also be taken into account. This concerns, for example, the Internet of Things (IoT), logistics, factory automation (Industry 4.0) and the mobile use of data in the area of Augmented Reality/Virtual Reality;
- A three-fold approach needs to be adopted consisting of specific coverage obligations, continuous monitoring during and after rollout and a tiered penalty system in the event of non-compliance with coverage obligations;

2. Current procedure for the award of spectrum in the 2 GHz and 3.6 GHz bands for MFCN

The federal government will pursue the following objectives in the field of mobile communications in the current legislative period:

"Spectrum policy and the regulatory authority's defined goals and objectives for spectrum must ensure that reliable mobile coverage without any not-spots is achieved, especially in rural areas. To make the rollout more economically viable in poorly served areas, we intend to allow mobile operators to enter into agreements for national roaming by making relevant changes to the telecommunications and competition law.

We will link licensing to rollout requirements in order to eliminate existing not-spots and to dynamically roll out 5G. The following stipulation must apply: new spectrum only in exchange for blanket coverage. Innovative, future-proof mobility services will only be possible for the population in rural areas if state-of-the-art wireless technology (5G) coverage is secured on major roads and in scheduled stages on the remaining road network and all railway lines."(Coalition agreement of 7 February 2018)

2.1. Coverage obligation

2.1.1 Coverage of households and businesses

Based on the existing obligation arising from the spectrum award proceedings in 2015, the following is envisaged. The Advisory Council considers the following requirements for mobile networks to be necessary in order to further increase the quality and density of coverage:

	Date for fulfilling the obligation	Household coverage (nationwide and per federal state)	Transmission rate per sector
<i>a)</i>	<i>31 December 2019</i>	<i>98%/97%</i>	<i>50 Mbit/s</i>
<i>b)</i>	31 December 2022	98%/98%	100 Mbit/s
<i>c)</i>	31 December 2025	98%/98%	300 Mbit/s

The row marked a) shows the requirement from the award proceedings in 2015. The obligation from these award proceedings has to be fulfilled before any more far-reaching requirements can be imposed. The new licences will not be available until 1 January 2021 at the earliest (40 MHz 2 GHz spectrum). The existing 3.6 GHz assignments will also run until the end of 2022.

The first step (line b) involves doubling the available capacity per sector from 50 to 100 Mbit/s subject to the same nationwide coverage requirements as in 2015; these obligations must be met by 31 December 2022.

The second step (line c) is to achieve coverage of at least 98% of households offering a transmission rate of at least 300 Mbit/s per sector. This takes account of the introduction of the 3.6 GHz band as a potential carrier for 5G. A deadline for meeting the targets set for the end of 2025 gives the operators a three-year period for the rollout following assignment.

Besides residential development, the area coverage requirements must also apply equally to industrial estates in the future.

In addition, the Advisory Council suggests that, prior to drafting the President's Chamber's decision for consultation, intensive consideration be given to further increasing these requirements with an even stronger reference to rural as well as areas, extending 5G use beyond residential development and making it usable for rural areas and, for instance, for agriculture. In this context, the Advisory Council also requests that it be examined, and that the Advisory Council be notified accordingly by 15 August, whether additional capacity specifications can be issued in spectrum awards that are foreseeable in the medium term or whether the currently defined level conclusively defines the mandatory framework up to 2040.

2.1.2 Coverage for transport routes

2.1.2.1. Roads

The Advisory Council considers the following mandatory 5G network coverage of the road network to be necessary:

	Date for fulfilling the obligation	Transport route	
a)	31 December 2022	5G network coverage:	German motorways
b)	31 December 2022	5G network coverage:	Federal roads
c)	31 December 2024	5G network coverage:	Secondary road network (state roads)
d)	31 December 2025	5G network coverage:	Secondary road network (local roads)
e)	31 December 2027	5G network coverage:	Secondary road network (municipal roads)

In addition, the Advisory Council suggests that, prior to drafting the President's Chamber's decision for consultation, intensive consideration be given to which specific quality parameters (in particular latency and capacity) will be mandatory for future-proof 5G network coverage on the individual road levels in relation to the respective application scenarios. In addition to the mobile network operators, users (in particular vehicle manufacturers) should be consulted. At the present time, the Advisory Council assumes that, depending on the respective application, at least a latency of 10 - 20 ms and download rates of at least 100 Mbit/s represent a benchmark.

2.1.2.2. Rails

The Advisory Council considers the following mandatory 5G network coverage of the rail network to be necessary:

	Date for fulfilling the obligation	Transport route	
a)	31 December 2022	5G network coverage:	ICE train lines and TEN routes
b)	31 December 2024	5G network coverage:	Long-distance railway routes (EC/IC), regional railway lines and regional passenger services

In addition, the Advisory Council suggests that, prior to drafting the President's Chamber's decision for consultation, intensive consideration be given to which specific quality parameters (in particular capacity) will be mandatory for future-proof 5G network coverage along the rail network. In addition to the mobile

network operators, users (railway undertakings) should also be consulted. At the present time, the Advisory Council assumes that bandwidths of more than 10 Mbit/s per user for several hundred simultaneous users represent a benchmark.

In this context, the Advisory Council also requests the President's Chamber to examine and inform the Advisory Council by 15 August, prior to the President's Chamber's consultation draft, whether additional capacity specifications can be issued in frequency allocations that are foreseeable in the medium term or whether the currently defined level conclusively defines the mandatory framework up to 2040.

2.1.2.3. Waterways

The Advisory Council considers the following mandatory 5G network coverage of the waterway network to be necessary:

		Date for fulfilling the obligation	Transport route	
a)		31 December 2024	5G network coverage:	Federal waterways (core network)

2.2. Greater transparency and monitoring

The Advisory Council notes that, in addition to the specifications that need to be clearly defined as part of the coverage requirement, there is also a need for ongoing, dedicated monitoring during and after the rollout.

Measurement methods used to determine network coverage, which are recognised by the stakeholders and are as simple as possible, need to be developed in advance. As a general principle, it should be noted that mobile coverage is understood to mean a correspondence between network availability as such and usability of the services. The user perspective should generally be adopted, in which the respective service is used at typical times of the day and in typical application scenarios (for instance, in a motor vehicle or in a crowded train at the usual speed at the respective location).

In the draft decision for partial decisions III and IV, the Advisory Council requests that a continuous and dedicated monitoring concept be submitted. This should include an annual report on the network rollout progress made by the individual network operators in the form of a regional overview to the Advisory Council, which should be submitted to the Advisory Council by 31 March of the following year at the latest. It is suggested that this overview be published on a regular basis. The Advisory Council considers it necessary to set up a complaints management system for possible enquiries from consumers and contact points for municipal decision-makers on the 5G network rollout and to inform the Advisory Council regularly of any enquiries.

2.3. Penalties

The Advisory Council considers it necessary to introduce a penalty system to enforce the rollout obligations linked to frequency use in the event that agreed rollout targets are not achieved. In addition to fixed interim rollout targets, this system must include a graduated catalogue of penalties, comprising several escalation stages, ranging from penalty payments to the withdrawal of nationwide spectrum usage rights. The aim of this type of tiered system should be to make rollout the more attractive option. A tiered penalty system is imperative for the upcoming 5G network rollout.

The Advisory Council asks the Bundesnetzagentur to submit a tiered penalty system of this type with the draft of partial decisions III and IV and to indicate in advance whether the penalty payment framework provided for in the Telecommunications Act is sufficient for this purpose.

2.4. National roaming or alternative technical methods for shared use

The Advisory Council considers it necessary to thoroughly examine all instruments that could significantly reduce network development costs in rural regions. This will have to be seriously considered against the backdrop of the technological necessity of ultra-dense expansion of 5G networks and the associated costs. In principle, all measures and technologies (such as MOCN) that could potentially have a cost-reducing effect on the expansion of the 5G network should be examined and, if necessary, utilised. At the present time, the Advisory Council considers this to be an economically viable and, under certain circumstances, necessary approach for rural regions.

Against this backdrop, the Advisory Council asks the Bundesnetzagentur to examine in detail:

- Which technical methods (such as national or regional roaming or MOCN) that extend beyond the previous passive sharing can be used to reduce costs.
- Whether, and if so, to what extent, such cost-reducing methods could be applied in individual *regions* and along *certain levels of the transport network* where the parallel expansion of three or more 5G mobile networks could not be considered economically viable. Users of all network operators not expanding in this specific area should, however, be guaranteed 5G coverage on non-discriminatory terms, whereby the expanding provider can charge the non-expanding provider an appropriate fee.
- Whether, and if so, to what extent, such cost-reducing methods could be imposed *on a permanent basis* or possibly also *for a limited period* in selected rural regions.

The Advisory Council asks the Bundesnetzagentur to summarise the findings of the above-mentioned examination in a written report, to coordinate this report with the Bundeskartellamt and to make it available to the Advisory Council by 15 August 2018.

2.5. Regional or local use of 5G spectrum

The Advisory Council asks that limiting the use of spectrum above 3700 MHz to local applications be examined at a later stage in the proceedings. This should enable commercial, service, logistics and industrial sites, tourist destinations as well as sports and leisure facilities to be supplied with 5G locally, particularly with regard to the use of Industry 4.0, future autonomous mobility systems and emergency assistants. In the case of such local 5G services, the interoperability of the services must be ensured in order to avoid the emergence of "frequency islands". Here, for example, the use of technical methods such as the Multi Operator Core Network (MOCN) should be examined.

3. Further measures to improve the existing and future rollout of the mobile communications network

The Advisory Council asks the federal government to examine, and, if necessary, introduce promptly further measures to improve the existing and future expansion of the mobile communications network:

- To use empty conduits along transport routes.
- To support municipalities in providing base station sites and further network infrastructure for 5G network rollout. It must be examined how the planning and approval procedures for base station sites, in particular, can be simplified and made faster.
- In rail transport, it needs to be examined whether the existing mobile coverage, which is limited due to interference, can be improved by retrofitting the radio modules in the existing railway rolling stock with interference-resistant GSM-R units and whether this can be supported by federal funding.
- For the remaining not-spots in 4G mobile coverage remaining after the fulfilment of the obligation by 31 December 2019, a gap needs to be closed in built-up areas by 31 December 2022. Due to the propagation characteristics of the spectrum to be assigned, it is not necessary to impose a further expansion of population coverage, as no new spectrum will be assigned for pure area coverage. Since it will in many cases not be possible to set up a mobile communications site economically in the areas remaining after the coverage obligation has been met by 31 December 2019, monetary incentive systems by the federal government and other regulatory measures such as permission for national roaming to support the closure of the gap need to be explored in these cases. In order to handle the 5G applications of the future and to meet the dynamically evolving requirements for bandwidth, latency and availability which it is not yet possible to predict, beyond 2025, financial incentive systems could be considered as part of the assignment procedure, such as delayed or reduced payment of licence fees. The federal government is requested to examine and, if necessary, propose appropriate incentive systems by 15 August 2018 and to inform the Advisory Council accordingly. This must be compatible with appropriate measures by the federal states.

List of abbreviations

5G	Fifth generation of mobile communications
AAS	Active Antenna System (Definition in CEPT Report 67: "AAS will actively control all individual signals being fed to individual antenna elements in the antenna array in order to shape and direct the antenna emission diagram to a wanted shape, eg a narrow beam towards a user.")
ABl.	Official Gazette (Amtsblatt)
BEM	Block Edge Mask
BGB	German Civil Code (Bürgerliches Gesetzbuch)
BKG	Federal Agency for Cartography and Geodesy (Bundesamt für Kartographie und Geodäsie)
BWA	Broadband Wireless Access
CEPT	European Conference of Postal and Telecommunications Administrations
dBm/MHz	Decibel milliwatt per megahertz (unit of power level)
ECC / ECC PT1	Electronic Communications Committee (ECC Project Team 1 is responsible for mobile (IMT) issues, including compatibility studies, development of band plans, development and review of ECC deliverables and for the preparation of CEPT positions on WRC-19 agenda items 1.13, 9.1.1, 9.1.2 und 9.1.8)
EESS	Earth Exploration Satellite Service
EEZ	Exclusive economic zone
EIRP	Equivalent isotropically radiated power
eMBB	Enhanced Mobile Broadband (high-bandwidth data transfers for mobile services)
EU	European Union
FDD	Frequency Division Duplex
FS	Fixed Services
FSS	Fixed Satellite Services
GHz	Gigahertz (unit of frequency)
GOW	Geodetic Observatory Wettzell
HCM	Harmonised Calculation Method
IMT	International Mobile Telecommunications (global standard for international mobile telecommunications)
IoT	Internet of Things
IT	Information Technology

Courtesy translation

ITU/ITU-R	International Telecommunication Union (ITU) (ITU's Radiocommunication Sector – abbreviated to ITU-R – discusses technical trends in all areas of radio and wireless technology, prepares reports and issues recommendations to administrative bodies.)
kHz	Kilohertz (unit of frequency)
LTE	Long Term Evolution (fourth-generation (4G) mobile wireless technology)
M2M	Machine-to-machine (automated data exchange between end devices)
Mbit/s	megabits per second (unit of data rate)
MHz	Megahertz (unit of frequency)
MNO	Mobile network operator
ms	millisecond
MSS	Mobile satellite services
MVNO	Mobile virtual network operator
OFDM	Orthogonal frequency-division multiplexing
PMSE	Programme making and special events (a term used to denote wireless applications that are used in the production and staging of a wide range of live and broadcast entertainment events)
RSPG	Radio Spectrum Policy Group (a high-level advisory group that assists the European Commission in the development of radio spectrum policy)
SME	Small and medium-size enterprises
SRS	Space Research Service
StPO	Code of Criminal Procedure (Strafprozessordnung)
TDD	Time Division Duplex
TK	Telecommunications
TKG	Telecommunications Act (Telekommunikationsgesetz)
TRP	Total Radiated Power
UMTS	Universal Mobile Telecommunications System (third-generation mobile cellular technology)
WLL	Wireless local loop (a technology that uses a wireless link to connect subscribers to a local exchange via a point-to-multipoint directional radio link system)
WRC	World Radiocommunication Conference