Translation*

President's Chamber decision of 14 May 2018 on the order for and choice of proceedings for the award of spectrum in the 2 GHz and 3.6 GHz bands for mobile/fixed communication networks (MFCN)

– Reference: BK1-17/001 –

The Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen, through the President's Chamber, invited responses on a draft consultation document on the award of spectrum in the 2 GHz band (2 x 60 MHz at 1920-1980 MHz/2110-2170 MHz) and a large part of the 3.6 GHz band (1 x 300 MHz – 3400-3700 MHz) for mobile/fixed communication networks (MFCN).

Following this public consultation of interested parties, the President's Chamber presents its decision below on the order for and choice of proceedings for the award of spectrum in the 2 GHz and 3.6 GHz bands for MFCN.

The President's Chamber decision makes provision for auctioning nationwide usage rights for spectrum in the above bands on account of the scarcity of spectrum.

The execution of the auction procedure also presupposes that further legally prescribed decisions (Decision III on the award conditions and Decision IV on the auction rules) will be made by the President's Chamber in consultation with the Advisory Council of the Bundesnetzagentur.

The Chamber aims to ensure the usability of the spectrum in a timely fashion, before the expiry of assignments. Likewise with the initial provision of spectrum in the 700 MHz, 900 MHz and 1800 MHz bands in 2015, the Bundesnetzagentur ensured that the potential of this spectrum in Germany – particularly for the switch to LTE broadband systems – could be utilised as quickly as possible to the benefit of consumers. The provision of rural area spectrum in 2015 served, above all, to encourage LTE rollout in rural areas.

The award of spectrum in the 2 GHz and 3.6 GHz bands aims to build on this success. In particular, the nationwide provision of spectrum in the 3.6 GHz band at an early stage aims to ensure to the greatest possible extent that the potential of this band for 5G or peak data rates in the gigabit range and user data rates with average speeds of 100 megabits per second is fully utilised (known as enhanced mobile broadband or eMBB). The Bundesnetzagentur will enable a fast, flexible and needs-oriented 5G rollout to this end.

By making the spectrum available, the Bundesnetzagentur contributes to the implementation of the objectives laid down in the coalition agreement.

The coalition agreement between the CDU, CSU and SPD includes the following:

> *"We are giving the highest priority to paving the way to a gigabit society. Therefore we intend to achieve nationwide rollout of gigabit networks by 2025. […]*
>
> *We will drive the expansion of mobile coverage and turn Germany into a leading market for 5G. 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."*
>
> (Coalition agreement "A new awakening for Europe – A new dynamism for Germany – A new cohesion for our country" between the CDU, CSU and SPD of 7 February 2018, pages 38-39)

* In case of divergent interpretation of the German and English text, the German text shall prevail.

Consequently, and in line with the broadband policy objectives of the federal government stated above and with the 5G Strategy for Germany, the Bundesnetzagentur's primary objective is to create planning and investment certainty for broadband rollout in Germany by making available appropriate spectrum resources.

In respect of the foreseeable availability of spectrum for further broadband rollout in Germany, the Bundesnetzagentur is endeavouring to exhaust all potential to expedite proceedings.

This procedure contributes to achievement of the spectrum management and broadband policy objectives of using the 3.6 GHz band as a pioneer band for 5G (cf RSPG 18-005, "Strategic Spectrum Roadmap towards 5G for Europe") and for the rollout of digital infrastructures in Germany:

> “The RSPG is of the opinion that the availability of the primary 5G band 3.4-3.8 GHz in Europe, will be key for the success of 5G in Europe. Member States should consider appropriate measures to defragment this band in time for authorising sufficiently large blocks of spectrum by 2020”
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> (Radio Spectrum Policy Group, “Strategic Spectrum Roadmap towards 5G for Europe” of 30 January 2018; ref RSPG18-005 FINAL; https://circabc.europa.eu/sd/a/fe1a3338-b751-43e3-9ed8-a5632f051d1f/RSPG18-005final-2nd_opinion_on_5G.pdf)

To achieve these objectives, notification of the intention to provide spectrum for 5G networks in line with the 5G roadmap of the Radio Spectrum Policy Group (RSPG) must be provided to enable large-scale, commercial operations by the end of 2020.

The provision of spectrum for 5G in line with demand is a key milestone of the Federal Ministry of Transport and Digital Infrastructure's 5G strategy. This strategy places particular emphasis on the important role of spectrum in the 3.6 GHz and 700 MHz bands for the introduction of 5G:

> *"The 3.4-3.8 GHz frequency range will also play an important role when it comes to the introduction of 5G. In this frequency band, there is a good chance that mobile communications companies will be able to use channel bandwidths of up to 100 MHz so that this area can generally be used for data-intensive and smaller-cell applications, e.g. in urban areas. Moreover, due to their favourable transmission conditions, the frequencies in the 700 MHz band that have already been allocated in Germany provide network operators with the opportunity to develop comprehensive 5G coverage based on their existing network infrastructure early on."*
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> (Federal Ministry of Transport and Digital Infrastructure, 5G Strategy for Germany, pages 9 and 23; www.bmvi.de.)

With regard to the digital transformation, the Federal Ministry for Economic Affairs and Energy has also formulated requirements for the rollout of digital infrastructures in its Digital Strategy 2025:

> *"High-performance broadband networks are the foundation and driver of digitisation and are therefore indispensable for Germany’s digital future. Without sufficient information highways, Germany cannot successfully accomplish the process of digitisation that is progressing at an ever increasing speed. For this reason we must create a viable digital infrastructure that can support the triple requirements of high capacity, broad availability and low latency."*
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> (Federal Ministry for Economic Affairs and Energy, Digital Strategy 2025, page 13; www.bmwi.de)

It is a primary objective of the Bundesnetzagentur to make available appropriate spectrum resources in order to create planning and investment certainty for broadband

rollout in Germany and for user groups affected by this (including satellite communications, radio astronomy, regional network operators and small and medium-sized enterprises) and their interests.

Spectrum in the bands at 2 GHz and 3.6 GHz, which is well suited for the rollout of high-speed telecommunications networks, is being made available for mobile broadband services or 5G at the earliest possible opportunity. The Bundesnetzagentur sees particular potential for expediting proceedings in the reallocation of the 3.6 GHz band, taking account of existing uses, as swiftly as possible before the expiry dates. This is intended to enable future assignment holders to plan and start network rollout for 5G with the new spectrum packages before the current spectrum assignments expire in 2021/2022, ie if possible as early as 2019.

The Chamber expects the 2 GHz and 3.6 GHz bands to offer great social and economic potential for broadband rollout in Germany. The 2 GHz band has already been identified globally for IMT systems and harmonised in Europe, providing economies of scale in respect of the cost-efficient provision of technical systems and terminal equipment.

The 2 GHz band is expected to become an important frequency band for 4G/5G broadband services in the coming years, like the 1.8 GHz band before it. The Chamber is hence working on the assumption that consumer coverage with mobile broadband services can be given a further boost as envisaged in the above-mentioned objectives.

In assessing the great social and economic potential of the 3.6 GHz band for broadband rollout in Germany, the Chamber is also taking account of the significance of satellite communications, radio astronomy and the interests of regional network operators. The Chamber's deliberations consider these differing interests that need to be reconciled.

In order to roll out 5G across the country as quickly as possible, the majority of the spectrum in the 3.6 GHz band, totalling 300 MHz, is to be made available nationwide so it can be used completely, flexibly and freely for 5G applications. For spectrum to be used efficiently across the country, it is helpful if the usage is not restricted by fixed guard bands. It is ensured that the spectrum for nationwide assignments will be able to be used in full from 3400 MHz to 3700 MHz – and thus up to the upper edge at 3700 MHz. The future nationwide assignment holder will, therefore, not have to observe a guard band with respect to the adjacent applications above 3700 MHz. Rather, the local and regional assignment holders will have to comply with a potential guard band to the adjacent national usage.

With regard to the interests of regional network operators, small and medium-sized enterprises and start-ups that will not need spectrum until a later date, the Bundesnetzagentur is establishing an application procedure, parallel to the award procedure, for exclusive regional spectrum assignment in the 3700 MHz – 3800 MHz and 26 GHz bands. To provide all interested companies with a complete overview of frequency provision in the 2 GHz, 3.6 and 26 GHz bands, notification of the conditions for the application procedure is to be provided in good time before the beginning of the qualification procedure for the auction.

The President's Chamber decision on the order for and choice of proceedings for the award of spectrum in the 2 GHz and 3.6 GHz bands for MFCN provides impetus for the use of 2 GHz and 3.6 GHz spectrum in order to meet the ambitious goals set on the way to the gigabit society.

Translation*

Decision of the President's Chamber of the Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen of 14 May 2018 on the order for and choice of proceedings for the award of spectrum in the 2 GHz and 3.6 GHz bands for mobile/fixed communications networks (MFCN);
decision taken under sections 55(4), (5) and (10), section 61(1) and (2) and section 132(1) and (3) of the Telecommunications Act (TKG)

– Reference: BK1-17/001 –

The Bundesnetzagentur für Elektrizität, Gas, Telekommunikation, Post und Eisenbahnen, through Ruling Chamber 1 (President's Chamber), hereby issues the following decisions under section 55(10), section 61(1) and (2) and section 132(1) and (3) of the Telecommunications Act (TKG) on the award of spectrum for mobile/fixed communication networks (MFCN) in the frequency bands at 2 GHz and 3.6 GHz:

Decision I: Order for award proceedings

It is hereby ordered under section 55(10) TKG that assignment of spectrum for MFCN in the 1920 MHz – 1980 MHz (lower band), 2110 MHz – 2170 MHz (upper band) and 3400 MHz – 3700 MHz bands is to be preceded by award proceedings as set out in section 61 TKG.

Decision II: Choice of award proceedings

The proceedings referred to in section 61(1) TKG will be conducted in the form of an auction in accordance with section 61(2) TKG.

Rationale

1 The following considerations and grounds have prompted the Chamber to order and choose proceedings for the award of spectrum in the 2 GHz and 3400 MHz – 3700 MHz bands for MFCN.

1. Steps

2 These decisions were preceded by the following four steps:

1.1 "Frequenz-Kompass"

3 With its "Frequenz-Kompass" document of 15 July 2016, the Bundesnetzagentur provided an overview of the next steps in the area of spectrum management and identified corresponding fields of activity for the rollout of digital infrastructures (Communication no 1032/2016, Bundesnetzagentur Official Gazette no 14/2016 of 27 July 2016, page 1714ff). Based on the "Frequenz-Kompass", current and future regulatory framework conditions for the rollout of high-speed digital radio infrastructure for society and industry are to be evaluated and geared to future requirements.

4 21 responses to the consultation were received. With respect to the introduction of next-generation 5G technology, respondents were interested in spectrum for nationwide mobile radio networks on the one hand, and local or regional mobile radio networks on the other (eg in the offshore segment). Interest was especially high in the 3.4 GHz – 3.8 GHz and 2 GHz bands. Owing to the high level of interest in the spectrum, further

bands were proposed for 5G in addition to the spectrum listed in the "Frequenz-Kompass" document.

5 However, interest in the above-mentioned bands was also registered for other radio applications (eg by satellite operators and PMSE operators).

6 In respect of the "service providers" and "newcomers" fields of activity addressed in the "Frequenz-Kompass", a wide variety of responses was received. Some were in favour of measures to strengthen service and infrastructure competition, while others rejected service provider obligations and measures that stand to benefit newcomers.

1.2 Points of Orientation

7 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 4483ff.).

8 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 (known as UMTS spectrum), 3.4 GHz – 3.8 GHz, 26 GHz and 28 GHz. They also addressed whether regulations that benefit service providers/MVNOs and newcomers could be necessary. 39 responses to the consultation were received.

1.3 Key Elements and demand identification

9 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 2726ff.). This paper set out, as the basis for consultation, the initial framework conditions for a procedure for the provision of spectrum.

10 Essentially, the following comments were made during the course of the consultation:

- **Key Element 1– Combined provision**

  ⇨ All the 2 GHz spectrum in the band at 1920.0 MHz – 1980.0 MHz/2110.0 MHz – 2170.0 MHz will be provided in combination in good time before 31 December 2020.

Some respondents welcomed the Bundesnetzagentur's intended early, combined provision of the 2 GHz spectrum.

One respondent rejected the early, combined provision, saying that the inclusion of spectrum usage rights set to expire at the end of 2025 was legally inadmissible. Instead of including in this procedure the spectrum in the 2 GHz band that is set to expire at the end of 2025, this spectrum should be considered jointly with other spectrum usage rights that have been assigned until 2025. However, if the spectrum is awarded after all, the respondent believes that either the full amount should be paid when the spectrum becomes available or that payment should be made in instalments.

It was also noted that, in the event of scarcity, a spectrum reserve of 2 x 10 MHz each for existing mobile network operators should be provided to safeguard provision for existing customers. After deduction of the spectrum reserve for existing mobile network operators, the remaining spectrum should, in the event of scarcity, be made available by way of a call for tenders.

In respect of the spectrum distribution study, it was stated on the one hand that the massive imbalances in the 2 GHz band and the associated distortion of competition had

not yet been resolved. A prompt and fair decision covering at least the period up to 2020 was required. The combined award of all blocks in the 2 GHz band would give the market the opportunity to achieve a solution for the remaining period up to 2025.

On the other hand, it was pointed out that there is no reason for reallocation during the existing assignment periods. The view was put forward that the spectrum distribution study should be ended without interfering with existing assignments.

As regards the combined provision of 2 GHz spectrum with 3.6 GHz spectrum, it was noted that the bands at 2 GHz and 3.6 GHz are not interchangeable. Separate demand forecasts would therefore have to be prepared for each band. It is conceivable that scarcity could occur in one band and not in the other.

Some respondents welcomed the intention to ensure non-discriminatory access to 2 GHz spectrum for all user groups.

Additionally, the following points were made:

It is questionable whether the early reallocation of existing spectrum resources alone would offer all interested enterprises the opportunity to acquire a non-discriminatory spectrum package to suit their business model. Although such reassignment would generally enable newcomers to be able to take part in this process, the key elements do not state how a holistic market entry concept might look.

To operate a mobile network efficiently and competitively, the option of using all bands is generally required. New market players should therefore have a formal right to additive shared use of existing mobile networks.

- **Key Element 2 (Intended use)**

⇨ The 2 GHz spectrum is to be made available throughout the country for MFCN.

The majority of respondents welcomed the Bundesnetzagentur's intention to provide the 2 GHz spectrum for MFCN throughout the country. One respondent objected in part to the intended use, arguing that a neutral guard band of 300 kHz for MSS must be provided above 1979.7 MHz and 2169.7 MHz.

Some respondents pointed out that mobile technology and network infrastructure could potentially be used for wireless PMSE equipment.

By contrast, one respondent proposed that spectrum in the 2 GHz and 3.6 GHz band be assigned for WLAN.

- **Key Element 3 (5 MHz blocks)**

⇨ Provision of the 2 GHz spectrum will be in blocks of 5 MHz. Guard bands will not be stipulated.

The provision of the 2 GHz spectrum in blocks of 5 MHz was welcomed. Suitable block edge masks (BEM) must be defined to this end.

One respondent explicitly welcomed the provision of spectrum without guard bands, as this would enable the typical 5 MHz carrier bandwidths for 3G, 4G and 5G.

By contrast, another respondent favoured the use of guard bands, provided that the technical feasibility of such a reduction has not been proven by CEPT studies. There were renewed calls for maintenance of the 300 kHz guard band above 1979.7 MHz and 2169.7 MHz, referencing ECC Decision (06)01 and European Commission Implementing Decision 2012/688/EU.

- **Key Element 4 (Contiguous spectrum)**

⇨ The 2 GHz spectrum is to be assigned as contiguous spectrum in each case. Where necessary, usage rights assigned until 2025 will be relocated.

The assignment of contiguous spectrum was welcomed by respondents. It was noted that the highest level of efficiency is achieved through the use of contiguous spectrum, as this enables, among other things, the realisation of slightly differing carrier bandwidths.

- **Key Element 5 (Time limit)**

⇨ All the 2 GHz spectrum will be assigned with the same expiry date of 31 December 2040.

Respondents generally welcomed long durations for spectrum assignments. However, most respondents called for longer periods.

The proposals included periods of 22 years, but also at least 25 years, in order to provide planning certainty and achieve a return on investment. One respondent agreed with the European Union's proposal for a standardised period up to the end of 2045. Another was in favour of extending assignment durations beyond 2050. Switching from limited to unlimited assignments would provide greater planning certainty in the context of high capital investments.

One respondent called for a combination of a guaranteed initial usage period with a predefined option of extending for 5-10 years before expiry, depending on the investments and intensity of spectrum use.

- **Key Element 6 (Provision of the 3.6 GHz band)**

⇨ All the 3.6 GHz spectrum in the 3400 – 3800 MHz band will be provided in good time before 31 December 2021. A total of 400 MHz (unpaired) is therefore available.

⇨ The sub-band 3400 – 3700 MHz will be provided for nationwide frequency assignments and the sub-band 3700 – 3800 MHz for regional assignments.

As regards the combined provision of 2 GHz spectrum with 3.6 GHz spectrum, it was noted that the bands at 2 GHz and 3.6 GHz are not interchangeable. Separate demand forecasts would therefore have to be prepared for each band. It is conceivable that scarcity could occur in one band and not in the other.

Further issues addressed include the protection of radar, satellite communications, radio astronomy and the Geodetic Observatory Wettzell.

Several respondents were in favour of the intended provision of the 3.6 GHz band, stating that it would enable the advantages of this frequency band for 5G to be harnessed to optimum effect. This approach would also meet the expectations of industry. Many 5G applications require a specific quality of service, ie reliability and/or latency. This quality can only be achieved through "licensed" spectrum, as there would be no unexpected interference.

It was noted that the earlier usability of the spectrum for 5G is very important – especially given the anticipated availability of terminal equipment before 2020.

However, it was pointed out that, if new market players are to take part in the award procedure, special rules will have to be established. Particularly with regard to the provision of nationwide spectrum, it must be ensured that potential newcomers have rights of access to the spectrum beyond the award period, in the sense of an extended interpretation of Key Element 13.

Some respondents were generally in favour of the fact that, in the 3.4 GHz – 3.8 GHz band, the intention is to offer both nationwide and regional assignments. In particular, reserving spectrum in the 3.7 GHz – 3.8 GHz band for regional assignments would

provide the opportunity for dedicated, autonomous networks. Providing an extended spectrum would encourage the development of solutions for the radio-based communication of automation systems (robots, etc) and for real-time communication requirements. The (wherever possible) free provision of spectrum could play an important role in maintaining competitiveness.

Some respondents were also in favour of the approach of reserving spectrum in the upper range for regional use. It is expected that this would have the least impact on satellite communications and would facilitate regional coordination. For the development of digital infrastructure in Germany, it is necessary that no new protection zones for earth stations are created or existing ones expanded in Germany in future. In the long term, the migration of existing satellite services to other bands would be desirable.

In the event of the band being opened up to terrestrial IMT systems, other respondents called for existing and future FSS ground stations to be protected by internal guard bands where necessary. The award procedure for the 3.7 GHz – 3.8 GHz band should be postponed as far as possible, with a view to gaining initial experience in the 3.4 GHz – 3.6 GHz band. This can then be used to protect earth stations and enable migration.

In respect of the protection of radar in the band below 3400 MHz, it was noted that it is important to ensure that the spectrum in the 3400 MHz – 3410 MHz band for MFCN remains usable nationwide.

Several respondents were, at least in some respects, against the approach set out in Key Element 6. They essentially called for a different approach to the quantitative distribution of spectrum for regional and nationwide assignments.

Some respondents called for the entire 400 MHz of spectrum to be provided for nationwide use. The planned division into 300 MHz for nationwide assignments and 100 MHz for regional assignments would discriminate against established mobile network operators, constitute unlawful market entry assistance and lead to artificial spectrum scarcity. Others put forward the view that it would be sufficient if only 40 MHz was made available for regional use.

Moreover, it was noted that the proposed approach of reserving 100 MHz for regional assignments could lead to regional assignment holders being allocated more spectrum than nationwide assignment holders. This was already having a distorting effect on competition, which would be compounded by the fact that the regional assignments were awarded upon application.

In addition, the definition of "regional assignments" is believed to be unclear. If a defined region is too large, regional scarcity cannot be ruled out. It was also argued that the division into regions does not meet the usage requirements for industrial applications. It was proposed that the term "local assignments" should be used.

It is also unclear whether regional limitations are to apply per operator or whether an operator can, for example, be assigned spectrum in the 30 biggest cities.

If the intention is to realise the reallocation of the 3.6 GHz band, taking account of existing uses, as swiftly as possible before the expiry dates, it was noted that clarification of the term "reallocation" will be needed.

In the case of scarcity, it was argued that a spectrum reserve of 1 x 50 MHz in the 3.6 GHz band should be provided to ensure coverage for existing customers.

By contrast, it was also proposed that the 3.4 GHz – 3.8 GHz band be made available for local and regional assignments. All user groups should be given non-discriminatory access to spectrum, including PMSE users in particular.

It was stated that an unbureaucratic, automated and transparent procedure is required for the award of regional spectrum. In any case, more spectrum must be provided for regional assignments, as many industrial applications depend on this.

The view was also put forward that radar, satellite communications, radio astronomy and the Geodetic Observatory Wettzell should be protected. In terms of the interests of satellite communications, it was argued that, given the importance of satellite communications for Germany's infrastructure, the protection of earth stations plays an important role in safeguarding the interests and investments of Germany and the satellite industry. Satellite communications are a primary user of this frequency band and should therefore be taken into account to the same extent as mobile communications. Instead of relocation, a more sensible approach would be to develop measures that facilitate the coexistence of mobile and satellite communications. Because this involves dedicated locations for earth stations, specifically regional solutions would be conceivable.

It was noted that many studies on the compatibility of IMT and radio astronomy (RAS) have shown that careful and extensive coordination of mobile radio is required to protect the measurements of the radio telescope in Effelsberg. The radio measurements of the Geodetic Observatory Wettzell must also be protected to the greatest possible extent from MFCN transmissions.

- **Key Element 7 (Alternate shared use as additional capacity)**

⇨ Alternate shared use can be made of the 3.6 GHz spectrum provided for nationwide and regional assignments.

⇨ Holders of regional assignments in the 3.6 GHz band can make shared use, as temporary additional capacity, of unused spectrum in the 3.6 GHz band provided nationwide.

⇨ Holders of nationwide assignments in the 3.6 GHz band can make shared use, as temporary additional capacity, of unused spectrum in the 3.6 GHz band provided regionally.

Alternate, temporary shared use was generally welcomed. However, several respondents noted that more information and clarification is needed with regard to the framework conditions.

One respondent rejected the key element due to a lack of clarity. It was proposed that spectrum for shared use must be released immediately upon commencement of use by the actual assignment holders. On the other hand, it was noted that temporary users require investment and planning certainty.

With regard to the shared use of regionally provided spectrum, it was suggested that spectrum assigned regionally should be divided up among locally active nationwide network operators. Shared use of nationwide assignments should end as soon as just one holder of nationwide assignments uses the spectrum at this location.

There were calls for clear pricing rules on the shared use of the spectrum assigned nationwide. The same conditions for the use of regional spectrum should also apply for nationwide and regional users.

In respect of applications for shared use of nationwide spectrum, it was noted that the expansion planning of the nationwide assignment holder in the relevant region must be taken into account.

On the other hand, it was explained that alternate shared use as additional capacity could be helpful for vehicle network access applications and could support the provision of in-vehicle services, provided spectrum use is not limited to MFCN.

- **Key Element 8 (5G coverage in line with demand)**

⇨ Holders of nationwide assignments are to enable coverage in areas of demand for 5G at the end of a suitable period after assignment and under non-discriminatory conditions.

Some respondents were generally in favour of the objectives and considerations in this key element. However, there were calls for the key element and/or the necessary framework conditions to be specified in greater detail.

Several areas were said to be unclear, including the definition of demand for 5G, which assignment holder would have to meet the obligation in the event of this demand, which frequencies were to be used, delivery quality, and which framework conditions should apply in the event of spectrum leasing. Network operators with or without their own radio network infrastructure were not to be included in the group of stakeholders expressing demand.

Since 5G would make it possible for multiple applications to share a network and thus infrastructure costs, it would be important to ensure that mobile network operators and users and/or stakeholders could enter into partnerships. In conjunction with Key Element 13, Key Element 8 created a "use it or lease it" system that should encourage investment in 5G. In order to achieve the economies of scale needed for the development of terminal equipment, the framework conditions for access to 5G spectrum should be harmonised across Europe.

There were calls from some quarters for nationwide providers to commit to providing a minimum level of local coverage in rural areas. Regional or local providers should be able to use and/or be linked to the infrastructure of nationwide providers on fair and non-discriminatory terms. Access to the networks, along with competition between networks, was urgently needed in order to offer rapid access to 5G in line with demand.

By contrast, other respondents pointed out that the provision in Key Element 8 must not result in a de facto coverage obligation. The selection of alternatives must rest with the network operator. Neither may the key element be interpreted as a universal service obligation with no compensation mechanism. Uneconomic regions should be tapped primarily using state funding.

Some respondents proposed waiving coverage obligations on newcomers due to their lack of existing infrastructure.

- **Key Element 9 (Intended use)**

⇨ The 3.6 GHz spectrum will be made available for MFCN.

The majority of respondents were in favour of the plans to award spectrum in the 3400 MHz – 3,800 MHz range on a technology- and service-neutral basis. Unresolved technical questions would have to be answered before any award could take place.

One respondent called for industrial and infrastructure applications to be given priority over applications in the public domain. Another respondent suggested using 3.6 GHz for WLAN.

- **Key Element 10 (10-MHz blocks)**

⇨ The 3.6 GHz spectrum will be provided in blocks of 10 MHz. Guard bands will not be stipulated.

The majority of respondents were in favour of splitting the 3.6 GHz band into 10 MHz blocks. The 3.6 GHz band was expected to enable bandwidths of 50 – 100 MHz to be realised.

By contrast, other respondents called for 5 MHz blocks, which would require the development of guard bands to be considered.

Yet another respondent suggested employing block edge masks. One respondent highlighted that it may be necessary to apply geographic restrictions on use for the future assignment holders, depending on the level of protection required for earth stations.

- **Key Element 11 (Contiguous spectrum)**

⇨ Frequencies in the 3.6 GHz band will be assigned as contiguous spectrum in each case. This may necessitate relocating assigned rights of use.

⇨ The Bundesnetzagentur intends to reallocate the 3.6 GHz band, taking account of existing uses, as quickly as possible.

The assignment of frequencies in the 3.6 GHz band as contiguous spectrum was welcomed. 5G would need sufficient bandwidth in this range in order to best utilise the benefits of this frequency band.

The respondents expressly supported a reallocation to enable the realisation of contiguous spectrum. One respondent was of the opinion that this could only relate to a relocation, which would leave existing spectrum usage rights unaffected. By contrast, another respondent felt that the consideration of existing uses could only relate to the actual active operation of radio network infrastructure and not to existing assignments in general.

- **Key Element 12 (Time limit)**

⇨ The 3.6 GHz spectrum will be assigned until 31 December 2040 at the latest.

Some respondents were in favour of assigning spectrum for the longest possible durations in order to increase planning and investment certainty. Some suggested setting the time limits in accordance with the European Commission's proposal of at least 25 years/the end of 2045 or the end of 2050.

Others were in favour of introducing unlimited spectrum usage rights on the basis that this would offer comprehensive planning certainty for investments in network infrastructure. There were calls from some quarters for the assignments to include pre-defined extension options.

Some respondents suggested that regional and local frequency assignments should be based on a dynamic process with the maximum level of automation. A highly automated "use it or lose it" principle should apply to assignments in order to prevent spectrum from remaining unused for longer periods.

- **Key element 13 (Shared use of capacity and services)**

⇨ Holders of nationwide assignments shall, on a non-discriminatory basis, enable shared use of capacity and services for the maximum diversity of business model.

Some respondents rejected the shared use of capacities and services by service providers/MVNOs. This was in part because there was no legal basis for interpreting service provider obligations. In addition, a personalised obligation would also apply to spectrum that did not comprise part of the current procedure. This would have an unlawful retroactive effect. There could also be interaction with other key elements,

which could have a disproportionate and discriminatory negative effect on the holders of nationwide assignments. Regional assignment holders would be released from any service provider obligation and thus receive inappropriate preferential treatment.

Furthermore, an obligation was not felt to be necessary in view of the fact that the wholesale market was functioning well. In particular, contracts were already being concluded that went above and beyond the applicable service provider obligation. In any case, to prevent misunderstandings it was important to note that a potential rule should not consist of an access obligation or obligation to contract.

The shared use of capacities and services by service providers/MVNOs was welcomed by others, who expressly advocated the involvement of MVNOs. Detailed regulation was necessary, since service providers were not assured non-discriminatory access to LTE technology despite the requirement currently in place. In addition, respondents made reference to consideration of the concerns of regional and local businesses, in particular with respect to acceptable minimum sales volumes and adequate interface requirements.

With respect to MVNOs, there was still no competition surrounding MVNO access to the mobile communications sector, even though they had the technical capabilities to design their own innovative services and thus encourage competition at the service level. In addition, an obligation to interconnect with the networks of nationwide network operators would enable MVNOs to contribute to network densification. An MVNO obligation would also allow existing service providers to climb the "ladder of investment".

What is more, some respondents were active both as service providers and fixed-network operators. In view of this, it was important to consider that the penetration of convergent service offerings and hybrid technologies had been on the rise for several years.

Some respondents advocated the shared use of capacities and services in view of the interests of newcomers. Other user groups, such as users of PMSE or transport companies, were also in favour.

- **Key Element 14 (700 MHz centre gap)**

⇨ It is not intended to provide the centre gap in the band at 700 MHz (738 – 753 MHz) until a later date.

One section of respondents welcomed the Bundesnetzagentur's decision to exclude the centre gap in the 700 MHz band from the current requirement notification. This was particularly the case in view of the planned use of the 733 MHz – 736 MHz and 753 MHz – 758 MHz ranges – also in the centre gap – for broadband applications by the military and by authorities and organisations concerned with public safety (BB-PPDR).

Instead, the spectrum should be included in re-award proceedings for the 800 MHz, 1800 MHz and 2.6 GHz bands. It made sense to wait first to see how the situation developed in other countries in Europe. In addition, there was no reason to make further spectrum available for SDL as long as demand in bands already available was not evidenced by market success.

Other respondents favoured making the centre gap in the 700 MHz band available quickly in the upcoming proceedings as there was specific demand for it.

In connection with the loss of spectrum under the second digital dividend, PMSE users had been given the prospect of access to the 700 MHz centre gap and the guard bands. As with the 800 MHz band, this gap was suited to use for command links and semi-professional applications. As such, it could ease the burden on the 470 MHz – 694 MHz range, which was important, for example, for metropolitan areas.

Automotive manufacturers also welcomed the provision of sub-1 GHz spectrum for vehicle-to-vehicle communication. The bands currently harmonised around 5.9 GHz for

ITS in Europe were not sufficiently universally usable for this type of communication. Lower frequencies, such as the 700 MHz centre gap, could increase the range for this kind of services.

The duplex gap was a useful addition with respect to additional downlink capacity. 3GPP had specified band 67 for this purpose. However, an ecosystem of chipsets, terminal equipment and infrastructure could only be expected where there were clear prospects of spectrum assignments.

- **Key Element 15 (Spectrum above 24 GHz)**

⇨ Spectrum above 24 GHz – in particular 26 GHz – is to be provided for 5G in line with demand and in consideration of existing uses.

Some respondents felt that spectrum above 24 GHz was needed in order to realise 5G data throughput and capacity targets. The prompt provision of 26 GHz band upon application was thus welcomed by some respondents, since – alongside 3.6 GHz as 5G pioneer band – it was suitable for providing additional 5G coverage in areas with high and the very high capacity demands. The 26.5 GHz – 27.5 GHz (military) range in particular was used very little and could be made available together with 3.6 GHz band. Applications currently on 26 GHz should be relocated to other (significantly higher) frequency bands.

The option of combining the 26 GHz band and the 3.6 GHz band was needed in order to retain spectrum suitable for 5G. The 26 GHz band would allow 5G services to be offered from 2018/2019. This spectrum was particularly suited to use in the access network and to link to base stations due to the dense frequency reusability. There were also calls for spectrum to be made available on a technology-neutral basis.

In the view of some respondents, the spectrum should be provided for local/regional use in order to be able to implement high terminal equipment density, intrinsic security, extended data security mechanisms and, potentially, high localisation accuracy in a factory environment. Assignments should be awarded transparently and as part of a dynamic procedure. One respondent suggested that it should also be possible to apply for large bandwidths of up to 1 GHz at least in large contiguous geographical areas.

Some respondents proposed that spectrum at 26 GHz also be used to cover outdoor areas (such as streets, recreation grounds, company sites). Reference was made in this context to the “Characteristics of terrestrial IMT systems for frequency sharing/interference analyses in the frequency range between 24.25 GHz and 86 GHz” report to be published by ITU-R Task Group 5/1.

The opposite quarter proposed retaining the development potential of fixed point-to-point links instead of point-to-multipoint links and extending corresponding spectrum assignments as and when needed. One respondent welcomed the planned protection of existing applications in the military range of 26.5 GHz – 27.5 GHz.

By contrast, one respondent felt that making spectrum available in the application procedure at this early stage would be counter-productive not only because specific application scenarios were still in the definition phase, but also because there were concerns that assignments to contiguous geographical areas for use for fixed-network substitution could not be guaranteed.

Yet another respondent called for nationwide assignment holders to undertake a general commitment to giving regional and local companies the use of their infrastructure on fair and non-discriminatory terms or to suitably incorporate/connect regional and local networks in/to their nationwide network infrastructure.

From the satellite communications quarter, reference was made to ongoing studies by CEPT on the protection of existing users and investigations by working group 1 of the Bundesnetzagentur. The proposal to protect satellite communication applications was

welcomed; however, there was uncertainty regarding how to safeguard the protection of existing and future sites of earth stations for earth observation and the space research service, as well as the passive earth observation communication service and radio astronomy. One respondent stated that, under the Radio Regulations, the 25.5 GHz – 27 GHz range was the only assigned band that allowed large data volumes for earth observation purposes to be transmitted from space to Earth in the brief window of contact between satellites and earth stations.

Some respondents advocated making the 28 GHz band available in addition. However, one respondent made reference in this context to the existing fixed-link assignments. Other respondents rejected making the 28 GHz band available, pointing out that this frequency band was of greater importance for mobile satellite communication applications and links to end users and thus the number of mobile and stationary terminals would increase. One respondent called on the Bundesnetzagentur to allow the use of ESIMs on aircraft in the 27.8285 GHz – 28.4445 GHz and 28.9485 GHz – 29.4525 GHz ranges in line with the power flux density thresholds set forth in ECC Decision (13)01, Annex 2(6). Several respondents were also in favour of making the 32 GHz band available, with some referring to the Bundesnetzagentur's consensus with all users in the Bundesnetzagentur's working group 1.

11 In addition, the following points were commented on in the context of the Key Elements:

- **"Protection of satellite network operators and the military"**

A portion of respondents expressed concern that there were no plans to incorporate a guard band between MFCN use at 2 GHz and the neighbouring MSS (Mobile Satellite Services). They felt that the current 300 kHz guard bandwidth should not be reduced until technical feasibility was proven in CEPT studies.

Several respondents expected that the plans for the 3.6 GHz band would potentially expose radio astronomy to substantial interference. There were concerns regarding the assignment of frequency blocks to terrestrial mobile communications networks without any guard bands to adjacent services.

Other respondents anticipated that the Bundesnetzagentur would take steps to safeguard the co-existence of all radio services in the frequency bands identified for 5G.

One respondent noted that spectrum requirements of the satellite services in the 3.4 GHz – 3.8 GHz frequency band would continue to be high. Satellite communications was a primary user and should thus be given equal consideration with mobile communications. It was important to safeguard protection for the operators of earth stations operating in the 3.6 GHz – 3.8 GHz band due to the level of investment and sustained global demand for C-band satellite communications services.

One respondent explained how, on the basis of a compatibility study for the Effelsberg site, he had come to the conclusion that an out-of-band emission of maximum -50 dBm/MHz would require a guard band between the base station and telescope of a few kilometres. An out-of-band emission of -30 dBm/MHz would result in a guard band of several dozen kilometres.

Another respondent made reference to the same study, saying that the studies conducted for Effelsberg had come up with comparatively short guard bands that could not be applied to the situation in Wettzell on a like-for-like basis. The repercussions for Wettzell would be significantly worse than for Effelsberg. One respondent called for the development and implementation of suitable protection measures for the Geodetic Observatory Wettzell.

Two respondents called for the award proceedings for the 3.7 GHz – 3.8 GHz band to be postponed and for spectrum to be released on a gradual basis.

One respondent called for formal confirmation that the 3.8 GHz – 4.2 GHz band would not be subjected to measures in the future.

The confinement of the consultation to the 28.9485 GHz – 29.4525 GHz bands, with the remaining elements in the 27.5 GHz – 30 GHz band continuing to be reserved for satellite services, was welcomed.

Some respondents maintained that the 28 GHz band should not be approved for IMT services as it was not one of the bands up for review as per WRC19 agenda item 1.13. Initial studies had shown that a protection distance of up to several dozen kilometres would already be necessary just for out-of-band emissions. Spectrum should not be awarded until the findings of the studies still pending at CEPT and ITU were available.

There were calls for CEPT to develop harmonised instruments and establish regulatory certainty in order to make it easier for administrative bodies to safeguard a coordinated 5G rollout and to help protect existing (and future) fixed satellite earth stations in the 26 GHz band.

- **Frequencies at 450 MHz:**

There were calls for the frequencies at 450 MHz to remain dedicated to MFCN because it is the same market as for M2M services. These frequencies should be made available as part of objective, transparent and non-discriminatory combined proceedings – preferably in the proceedings under discussion together with 2100 MHz and 3600 MHz spectrum, or alternatively in a later set of proceedings.

- **Expansion in the 1.5 GHz band:**

One respondent was in favour of making the extension bands at 1.5 GHz available promptly for MFCN.

1.4 Draft consultation document

12 Based on the views submitted on the Key Elements paper and the spectrum requirements notified, the Bundesnetzagentur has drawn up a draft President's Chamber decision on the order for and choice of award proceedings. Comments were able to be submitted up to 28 February 2018.

13 The responses received – as far as they are not confidential – have been posted on the Bundesnetzagentur's website at www.bundesnetzagentur.de/mobilesbreitband.

14 As far as responses dealing with issues related to the award conditions and auction rules are concerned – in particular possible coverage obligations, rules for service providers or terms of payment – the Chamber points out that these are not covered by this decision. The relevant responses will be taken into consideration in the drafting of the other decisions in the proceeding.

2. Detailed reasoning

2.1 On Decision I: Order for award proceedings

15 In accordance with section 55(10), section 61, section 55(4) and (5) and section 2(2) and (3) TKG, the order for award proceedings is made in such a way that the nationwide assignment of spectrum for MFCN in the 2 GHz and 3.6 GHz bands must be preceded by award proceedings.

16 Under section 55(10) first sentence TKG it may be ordered, without prejudice to section 55(5) TKG, that the assignment of frequencies be preceded by award proceedings based on conditions according to section 61 TKG as determined by the Bundesnetzagentur. Award proceedings can be ordered where frequencies are not available for assignment in sufficient numbers or where more than one application has

been made for particular frequencies. The order as per section 55(10) TKG is made at the discretion of the Bundesnetzagentur.

2.1.1 Timing of the order

The following comments were made:

17 The timing of the order received a largely positive response. Many respondents took a positive view of the early planning certainty.

18 The plans to enable future assignment holders in the 3.6 GHz band to start network rollout from 2019, even though the current assignments run until 2021/2022, were also welcomed. This was said to be necessary for an early start of commercial 5G services.

19 However, other respondents maintained that it was too early to carry out both demand identification proceedings and the present consultation on the President's Chamber decision, given the numerous issues from the Key Elements that had not yet been clarified. Unanswered questions on the proceedings should be cleared up promptly and then further demand identification proceedings should be carried out.

20 The spectrum usage rights in the 2 GHz band assigned until 2025 are not currently available and should therefore not be included in the current proceedings. Earlier provision of this spectrum would lead to significant unequal treatment. Moreover, it is not necessary since any technical issues concerning the relocation, defragmentation or reallocation could be resolved without re-awarding spectrum.

21 While creating planning certainty is generally to be welcomed, it is no guarantee for a swift rollout of 5G. Planning certainty is possible even if framework conditions are unfavourable, whereas to expedite the network rollout, it is more important to create conditions that are conducive to investment. An investment-friendly regulatory framework would be primarily concerned with the provision of spectrum without depriving the market of urgently needed investment for the network rollout and while providing incentives for the rollout of new mobile infrastructure. If measures to facilitate this are being considered for the fixed network, they should certainly be considered for mobile communications as well.

22 It was pointed out that it was not necessary to issue the decisions on the provision of spectrum prematurely in order to give companies the opportunity to plan or begin network rollout for 5G with the new spectrum packages as early as 2019. For 5G, the challenge does not lie in the planning or in constructing the access network on the basis of the spectrum to be made available, but rather in ensuring sufficient fibre connections for the advantages of 5G to come into effect at all.

23 The early provision of spectrum could have a negative effect, for example costs arising from tying up capital at an early stage.

24 The expected start to the commercial roll-out of 5G from 2020 does not justify rushing into proceedings too soon. Instead, there should be a careful assessment of how proceedings can be designed to create investment-friendly framework conditions. The major issue is not the timing of the spectrum provision but its availability/technical usability.

25 The European Commission's 5G Action Plan states that the timely availability of harmonised spectrum is necessary – that does not mean it must be early. The decisive point is, therefore, the time from which the spectrum can be used. In the case of 2 GHz spectrum, this would be the expiry of the existing usage rights at the end of 2020/2025 and in the case of 3.6 GHz, the expected start of 5G rollout from 2020.

26 The opinion was also expressed that only the 2 GHz band should be auctioned and the provision of the 3.6 GHz band should be postponed to a later date. It was already becoming clear that, on the one hand, more than the stated 100 MHz for local and regional users would be necessary and, on the other, that an auction would not be a

suitable method of awarding the spectrum since many smaller companies would not be able to compete against mobile network operators. This would slow or even limit the development of 5G.

The Chamber has ruled as follows:

27 The Chamber considers it appropriate to order early award proceedings for the spectrum in the 1920 MHz – 1980 MHz, 2110 MHz – 2170 MHz and 3400 MHz – 3700 MHz bands.

28 The award proceedings include all the spectrum that will become available in the foreseeable future in the 2 GHz and 3.6 GHz bands for MFCN for nationwide assignments, to enable the parties requesting assignment to acquire adequately competitive spectrum packages. This includes the spectrum anticipated to be available for later assignment for MFCN but for which the usage rights have not yet expired at the time the award proceedings are ordered. That applies not only to spectrum that will become available upon expiry of the usage rights but also spectrum that is highly likely to become available for re-award for other reasons such as a planned relocation of frequency usage rights. If the Chamber were not to open award proceedings for such spectrum until its availability within the meaning of section 55(5) para 2 TKG, this would be contrary to the principle of efficient spectrum use because it would inevitably mean that the spectrum might remain unused during the considerable period of time required for award proceedings under section 61 TKG.

29 In its Key Elements paper dated June 2017, the Bundesnetzagentur had announced that the award proceedings for the nationwide provision of spectrum in the 2 GHz and 3.6 GHz bands should, if possible, be concluded in 2018 and thus in good time prior to the expiry of assignments in 2020/2021 in order to safeguard the necessary planning and investment certainty for the companies and other parties involved (see Key Elements 1 and 6).

30 To ensure spectrum is made available at an early stage, the award proceedings are to be ordered at the present time so as to give both existing network operators and newcomers equal opportunity to access the nationwide spectrum and to ensure that the proceedings for awarding this spectrum are concluded at a reasonable point in time.

31 Regarding the calls to answer open procedural questions prior to any decision, the President's Chamber wishes to draw attention to the following: the procedure (see above) makes clear that the Key Elements and the demand identification proceedings are not the first step in the consultation. On the contrary, the Key Elements were developed on the basis of the Points of Orientation, published previously, and the "Frequenz-Kompass" as well as the consultations of stakeholders. As regards the timing of an order for award proceedings, there are no further unanswered procedural questions.

32 The Chamber wishes to point out that aspects relating to the later award conditions, such as technical usage conditions, rules for service providers and coverage obligations, will be decided at a later date as part of the President's Chamber Decisions III and IV on the award conditions and auction rules. A separate consultation will be held at a later date for this purpose.

2.1.1.1. Combined provision in the 2 GHz band

33 Spectrum totalling around 2 x 40 MHz (paired) is available in the 2 GHz band for assignment from 1 January 2021. The remaining spectrum in the 2 GHz band totalling some 2 x 20 MHz (paired) will be available for assignment from 1 January 2026. The Bundesnetzagentur is making all 2 GHz spectrum totalling 2 x 60 MHz (paired) available jointly in these proceedings.

34 Additionally, further spectrum totalling 300 MHz (unpaired) in the 3400 MHz – 3700 MHz band will be available for nationwide assignment. Of this, subject to regional restrictions,

174 MHz are already available for re-assignment. Further spectrum totalling 126 MHz is still currently assigned de facto nationwide and will thus become available for re-assignment from 1 January 2022. To uphold the principle of efficient spectrum use pursuant to section 2(2) para 7 TKG and meet the further regulatory objectives in section 2 TKG, the Bundesnetzagentur plans to make spectrum available for new assignments potentially as early as 2019.

35 The 3400 MHz – 3700 MHz spectrum will be made available in combination with the spectrum in the 2 GHz band nationwide for MFCN. The order to award this spectrum in combination is to be given at the present time.

36 The decision to award this spectrum in combination is based on the following considerations:

37 Some of the 2 GHz spectrum usage rights expire on 31 December 2020. A decision is required now on the future use of this spectrum from 2021 to ensure – before expiry – that it can continue to be used efficiently and without interference. In the Chamber's view, the associated questions are especially complex and the necessary decision is particularly important with significant consequences for the market. To ensure this decision is reached on a suitably solid and stable basis, the Chamber is making the decision at an early stage. According to current estimates, this means that the proceedings should be concluded on time prior to the end of current assignment durations in order to provide the necessary planning and investment certainty for the companies and other parties involved.

38 In making the 2 GHz spectrum available, the Chamber aims to establish planning certainty at an early stage for all spectrum use in the 2 GHz band. For this reason, the spectrum totalling 2 x 40 MHz (paired), for which the usage rights expire on 31 December 2020, and the 2 x 20 MHz (paired), for which the usage rights expire on 31 December 2025, will be made available jointly in one set of award proceedings so that each can continue to be used. This offers forward-looking support for effective investments in LTE and next-generation 5G systems in the 2 GHz band, thus providing early planning and investment certainty amongst all network operators for upgrading the current UMTS technology on the spectrum to LTE or innovative 5G systems. It works toward the regulatory objectives of protecting user and consumer interests pursuant to section 2(2) para 1 TKG, promoting sustainable competitive markets pursuant to section 2(2) para 2 TKG, expediting the rollout of public high-speed next-generation telecommunications networks pursuant to section 2(2) para 5 TKG and securing efficient spectrum use pursuant to section 2(2) para 7 TKG.

39 Regarding respondents' arguments that part of the 2 GHz spectrum will not be available until 2026 but that investments would already be tied up at the present time, the Chamber will take account of this situation in its considerations for the decision on award conditions and auction rules (Decision III and IV) and assess it accordingly. It is necessary to create a framework that helps to meet the aim of expediting the rollout of high-speed next-generation telecommunications networks pursuant to section 2(2) para 5 TKG and promotes investment in new, high-speed broadband networks. Regarding respondents' arguments that the early provision of spectrum in award proceedings would deprive the market of urgently needed investments for the network rollout, the President's Chamber wishes to point out that previous auctions have not confirmed this theory. There is no indication that companies that invested higher sums in acquiring spectrum have subsequently invested less in the network rollout than other companies that acquired fewer spectrum usage rights with correspondingly lower payment obligations.

40 Making all 2 GHz frequencies available at an early stage in one set of award proceedings is in compliance with the regulatory objectives of the TKG. The early provision serves in particular the regulatory objective of the expedited rollout of high-speed next-generation public telecommunications networks set out in section 2(2) para 5

TKG, upholds the principle of efficient frequency use in accordance with section 2(2) para 7 TKG, protects user and consumer interests in the field of telecommunications pursuant to section 2(2) para 1 TKG and ensures fair competition and promotes sustainable competitive markets pursuant to section 2(2) para 2 TKG. The goal is to reallocate spectrum in a way that gives all assignment holders in this band the option to hold contiguous spectrum and achieve competitive spectrum packages.

41 Combined provision can contribute to ensuring fair competition and promoting sustainable competitive markets pursuant to section 2(2) para 2 TKG. Firstly, the long-term planning certainty in respect of the available spectrum resources can provide impetus for competition. In addition, the combined provision enables all parties requesting assignment to have equal access to spectrum resources. By contrast, dividing the 2 GHz frequency usage rights up and holding two award proceedings in quick succession would mean that the assignment holders would not all have the same long-term planning and investment certainty.

42 The early combined provision of the 2 GHz spectrum allows all 2 GHz spectrum to be awarded in 5 MHz blocks. Even if only the 2 x 40 MHz for which the usage rights expire at the end of 2021 were to be made available, the usage rights expiring in 2025 would have to be modified in such a way as to allow efficiency gains to be made using LTE/5G technology. By making the spectrum available in combination, the entire band will be kept up to date with advancements in technology, giving companies planning and investment certainty over a long period. The combination of several 5 MHz blocks into one package of contiguous frequency blocks will lead to efficiency gains in the use of spectrum.

43 Regarding respondents' comments that issues concerning the relocation, defragmentation or reallocation could be resolved without re-awarding spectrum, the Chamber wishes to draw attention to the following: although it would be conceivable to award the 2 GHz spectrum successively according to its expiry, the different assignment durations in the band would be an obstacle to the acquisition of contiguous spectrum. This would lead to spectrum usage rights having to be relocated following each award proceedings in order to achieve contiguous frequency blocks. Moreover, network operators would only have planning certainty for a short period of time, as revisions, and possibly further relocations, would have to be carried out within a few years. It is therefore appropriate to make the spectrum available jointly, in one proceeding, even though the spectrum usage rights in the 2 GHz band expire at different times. The aim is to enable all assignment holders in this band to have contiguous spectrum for broadband applications.

44 The fact that assignment holders are required to forecast their frequency requirements from 2026 at this stage is no reason not to make the spectrum available jointly at an early stage. Combined provision can give companies the greatest possible planning and investment certainty, in particular with respect to the rollout of new technologies like 5G. In addition, applicants are required to demonstrate and safeguard efficient frequency use over the entire assignment period. It is irrelevant whether the point in time at which use begins differs due to varying durations.

45 Combined provision is also non-discriminatory, since it does not unfairly disadvantage parties potentially requesting assignment. The fact that a demand forecast for spectrum from 2026 may be required affects all applicants participating in the auction for the spectrum blocks under consideration. Existing assignment holders will not be disadvantaged as the terms of assignment expiring at the end of 2025 are not affected.

46 The combined provision of 2 GHz spectrum would not, as put forward in the comments, lead to significant unfair treatment. It is in line with the principle of equality laid down in article 3 of the German Basic Law (GG). The principle of equality prohibits the unequal treatment of what is basically equal and the equal treatment of what is basically unequal. The case in hand relates to frequencies dedicated to the same use. They are located in

the same band and are equal with respect to the technical and physical frequency propagation characteristics. In light of this, they are given equal treatment in that they are being made available in one set of award proceedings. The frequencies differ in terms of their expiry dates. This fact is taken into consideration in the award proceedings by treating the differentiating characteristic of unequal expiry dates differently. The differences relating to the varying durations will need to be taken into account in the auction rules (Decision IV) by defining spectrum usage rights with different durations as different lots.

47 There is therefore not, as one respondent asserted, an unequal treatment of current assignment holders of the 2 GHz spectrum assigned until 2025. The early provision of spectrum for the period from 2026 will not devalue existing usage rights. To the extent that auction participants would incur costs from capital being tied up in the spectrum usable from 2026, it would not necessarily be the previous assignment holders that would be affected but, without discrimination, any auction participants that successfully bid for the spectrum and thus incur payment obligations.

48 The early combined provision of all 2 GHz spectrum serves the above-mentioned objectives of the Federal Ministry of Transport and Digital Infrastructure's 5G Strategy and the European Commission's 5G Action Plan (5G for Europe: An Action Plan dated 14 September 2016, ref. COM(2016) 588 final) by providing planning certainty for spectrum with large channel bandwidths.

2.1.1.2. Combined provision of the 2 GHz and 3.6 GHz bands

49 Together with all of the 2 GHz spectrum, the 3400 MHz– 3700 MHz spectrum will also be awarded nationwide at the present time for MFCN.

50 Although there are existing regional usage rights in this band that run until 31 December 2022 at the latest, the Bundesnetzagentur plans to make this spectrum available to new assignment holders earlier, from 2019, in order to uphold the principle of efficient spectrum use (section 2(2) para 7 TKG) and meet the other regulatory objectives of protecting user and consumer interests (section 2(2) para 1 TKG), ensuring fair competition and promoting sustainable competitive markets (section 2(2) para 2 TKG), and expediting the rollout of high-speed next-generation public telecommunications networks (section 2(2) para 5 TKG). This applies to spectrum not being efficiently used by the current assignment holders.

51 In addition, there are still usage rights currently assigned de facto nationwide that run until 31 December 2021. The Bundesnetzagentur plans to make this spectrum available to new assignment holders earlier, from 2019, in order to uphold the principle of efficient spectrum use (section 2(2) para 7 TKG) and meet the other regulatory objectives of protecting user and consumer interests (section 2(2) para 1 TKG), ensuring fair competition and promoting sustainable competitive markets (section 2(2) para 2 TKG), and expediting the rollout of high-speed next-generation public telecommunications networks (section 2(2) para 5 TKG). This applies to spectrum assigned de facto nationwide that is not being used efficiently by the current assignment holders and for which the holders do not have successive assignments up to 2040.

52 This approach aims to ensure that all spectrum in the 3.6 GHz band can be made available for use for 5G applications without delay. The inclusion of the 3.6 GHz spectrum serves in particular the regulatory objective of the expedited rollout of high-speed telecommunications networks set out in section 2(2) para 5 TKG. The 3.6 GHz band plays a major role in the rollout of 5G, as it is possible to use large contiguous frequency blocks.

53 The early provision of this band on new, more flexible terms is intended to enable the rollout of 5G. This will promote the efficient use of the spectrum and be in the interests of users and consumers in accordance with section 2(2) para 1 TKG. The band offers large bandwidths and its propagation characteristics make it particularly suitable for capacity

coverage. Particular importance is attached to the possibility of using the 3.6 GHz band for 5G at an early stage. The Chamber expects the appropriate technology to be available even before 2020.

54 The early combined provision of all spectrum is in line with the Federal Ministry of Transport and Digital Infrastructure's 5G Strategy and the European Commission's 5G Action Plan. The 5G Action Plan (loc. cit., pages 5 et seq.) states:

> *"The deployment of 5G networks requires the timely availability of a sufficient amount of harmonised spectrum. […]*
>
> *Member States and the Commission, working together in the Radio Spectrum Policy Group (RSPG), have recognised the importance of the early identification of common EU-wide pioneer spectrum bands to enable 5G take-up as early as in 2018. This is indispensable to give proper guidance to industry and keep the EU on a par with spectrum availability in other regions of the world.*
>
> *This first set of such pioneer bands should include a mix of spectrum with different characteristics to address the versatile 5G requirements. […]."*

55 The early combined provision of all 2 GHz spectrum together with the 3.6 GHz spectrum will take account of these aims. Companies will have the opportunity to acquire spectrum with the characteristics that best suit their business models, in particular in view of the progress of 5G.

56 Respondents commented on this point that the decision to make available the spectrum should not be made prematurely because with regard to 5G, the challenge does not lie in planning or constructing networks but rather in ensuring sufficient fibre connections. On this topic, the Chamber wishes to draw additional attention to the following: it could be necessary for 5G base stations to be connected to fibre cables in future, depending on the data volumes. However, it has not been ruled out that powerful radio relay links would be sufficient for this purpose. Irrespective of this, the President's Chamber has no influence on how mobile network operators structure their backbone networks and works on the basis that such networks will be rolled out in accordance with requirements. The Chamber is in a position, however, to create a framework for the nationwide rollout of 5G by making the necessary spectrum resources available at an early stage. Otherwise, bearing in mind the length of award proceedings, there would be a risk that the delayed provision of spectrum resources could delay the 5G rollout as a whole. In addition, it should be noted that the early provision of spectrum guarantees planning and investment certainty for the development and standardisation of the technology.

57 Overall, the inclusion of all 2 GHz and the 3.6 GHz spectrum supports the regulatory approach of preventing regulatory-induced spectrum scarcity. Order 33/2005 dated 4 May 2005 (OG RegTP 8/2005, page 782 et seq.) said the following about this approach:

> *"(….) the regulatory authority is trying to prevent as far as it possibly can regulatory-induced spectrum scarcity as a result of partial awards.*
>
> *The regulatory authority established the following key points as a basis for the concept of a frequency award for UMTS mobile communications to be developed. The subject of the key points is the joint provision – in line with requirements and at the earliest possible time – of spectrum for UMTS/IMT-2000 mobile communications from the frequency bands of the UMTS core band and the UMTS extension band".*

58 The GSM concept also followed these considerations. The GSM concept stated the following (order 88/2005, OG BNetzA 23/2005, page 1852 et seq.):

> *"In addition to questions to do with the technical aspects of frequency regulation, the competitive aspects must also be taken into account as particular importance can be attached to them when awarding spectrum. Among other things, the*

amount of spectrum made available or able to be made available can influence the question of spectrum scarcity (section 55(9), section 61 TKG), and hence the type of award procedure, and, last but not least, the costs of acquiring the resource called "spectrum". On the other hand, radio applications (like GSM and UMTS/IMT-2000 mobile communications for instance) can only be successful in competitive terms if they have enough spectrum and optimum technical framework conditions available. Consequently, those sub-concepts currently being discussed, like those for GSM and UMTS, as well as the future overall concept "Radio based access facilities" are to be developed with the aim of avoiding frequency scarcity as much as possible and of facilitating fast, transparent and unbureaucratic procedures on the award of spectrum.

It is planned to carry forward the GSM concept after implementation of the described raft of actions with a view to linking up later with other concepts, like the UMTS concept, in order to ultimately achieve extensive merging of radio markets and their regulatory framework conditions".

59 The combined award of all 2 GHz spectrum and the 3.6 GHz spectrum is thus in line with the existing award principles practised by the President's Chamber, which are to include the maximum amount of spectrum available in one set of award proceedings.

60 In particular, the combined provision can avoid the artificial spectrum scarcity that could arise if partial spectrum were to be awarded in isolation. The Chamber therefore needs to carefully consider different approaches before awarding spectrum so as to ensure that as much of the available and suitable spectrum as possible is awarded in one set of proceedings.

61 In addition to questions to do with the technical aspects of frequency regulation, when developing its concepts the Bundesnetzagentur thus also takes competitive aspects into account that could be of particular importance when awarding spectrum. Among other things, the amount of spectrum made available for use can influence the question of spectrum scarcity and thus the type of award and, not least, the cost of assigning spectrum. On the other hand, business models using radio applications can only be successful in competitive terms if they have enough spectrum and optimum technical framework conditions. Consequently, overall concepts must be developed with the goal of preventing regulatory-induced spectrum scarcity where possible and ensuring fast, transparent and unbureaucratic procedures.

62 In including additional spectrum, the Chamber has also taken into consideration the fact that a combined award of all 2 GHz spectrum with the 3.6 GHz spectrum may lessen competition in bidding somewhat and make access to spectrum easier as it allows bidders to opt for other frequencies during the proceedings. This makes it easier for newcomers, in particular, to access scarce frequency resources.

63 The early combined provision of all 2 GHz spectrum and the 3.6 GHz spectrum thus reflects the principle of simple, appropriate and prompt administrative procedures, as this approach avoids the need for multiple, lengthy award proceedings, each of which involve numerous individual stages from the opening of proceedings to the award of individual frequency bands.

64 Therefore, the Chamber will not follow the suggestion from the consultation that only the 2 GHz should be auctioned off in the first instance, among other reasons because regional and local users would require more spectrum than 100 MHz. Splitting the proceedings would lead to a separate proceeding for the 3.6 GHz band taking place soon, so spectrum award proceedings would take place in relatively quick succession. This is not appropriate from either the regulatory or administrative perspective, nor is it likely to be in the interests of the parties requesting assignment.

2.1.2 Spectrum availability

65 Spectrum is available when it is not encumbered by other usage rights and where the further assignment criteria are met pursuant to section 55(5) TKG.

66 The Bundesnetzagentur is making a total of 2 x 60 MHz (paired) in the 2 GHz band available for nationwide assignment. Of this, 2 x 40 MHz (paired) is available for re-assignment from 1 January 2021. The remaining spectrum totalling around 2 x 20 MHz (paired) is still assigned until 31 December 2025 and will thus only be available for re-assignment at a later date.

67 The 2 GHz spectrum is to be assigned as contiguous spectrum following the auction. If necessary, the usage rights/uses that are valid until 2025 will be relocated. This could be necessary in order to achieve defragmentation in the frequency band and promote efficient frequency use (section 2(2) para 7 TKG).

68 The Bundesnetzagentur expressly notes that any relocation of frequency uses will not affect the assignments that are currently valid until 2025. Such steps will thus not result in the early provision of that spectrum.

69 In the 3.6 GHz band, the Bundesnetzagentur is making a total of 300 MHz (paired) available for nationwide assignment. Of this, subject to regional restrictions, 174 MHz is already available for re-assignment. Further spectrum totalling 126 MHz is still currently assigned de facto nationwide and will thus, in principle, become available for re-assignment from 1 January 2022.

70 The Bundesnetzagentur intends to enable 300 MHz of spectrum in the 3.6 GHz band to be used for 5G systems and make the spectrum available for new assignments at an earlier stage from 2019, in order to uphold the principle of efficient spectrum use (section 2(2) para 7 TKG) and meet the other regulatory objectives of protecting user and consumer interests (section 2(2) para 1 TKG), ensuring fair competition and promoting sustainable competitive markets (section 2(2) para 2 TKG), and expediting the rollout of high-speed next-generation public telecommunications networks (section 2(2) para 5 TKG). The goal is to ensure as early as possible that contiguous spectrum can be fully used and/or re-assigned prior to expiry. The Bundesnetzagentur has already initiated administrative procedures to this end. The companies concerned have been given an opportunity to state their views on appropriate and proportionate measures.

71 On the one hand, the measures will affect regional assignments. Existing regional uses in the 3400 MHz – 3700 MHz band are to be relocated to the 3700 MHz – 3800 MHz band where necessary and appropriate in individual cases.

72 On the other, existing uses of quasi-nationwide assignments are to be relocated to the new band locations before the end of the current assignment periods and adapted to the future spectrum packages resulting from the auction. This should enable current 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 assignment holders do not hold successive assignments for the period up to 2040, the spectrum concerned will be made available early for re-assignment.

73 The approach of the Bundesnetzagentur as described above is in line with the objectives of the federal government and the European Union.

74 Details of availability:

2.1.2.1. Availability in the 2 GHz band

The following comments were made:

75 A nationwide, combined provision of all 2 GHz spectrum at an early stage was generally welcomed. It was stated that this would provide long-term planning certainty and that it was appropriate to bring the expiry dates into alignment. The possibility of relocating

usage rights in this band in order to achieve defragmentation in the frequency band and promote efficient frequency use was also viewed positively.

76 Some respondents rejected the early provision of all 2 GHz spectrum, with the argument that the inclusion of usage rights set to expire at the end of 2025 would be legally inadmissible. A prerequisite for the assignment of spectrum is its availability, it was said. The 2 GHz spectrum that is still assigned until 31 December 2025 is not available at the time of the planned provision in these proceedings.

77 Instead of including in these proceedings the spectrum in the 2 GHz band that is set to expire at the end of 2025, this spectrum should be considered jointly with other spectrum usage rights that have been assigned until 2025.

78 Regarding the question of whether guard bands are necessary, some respondents believed that it would be possible to do without them, which would permit blocks of 5 MHz.

79 However, others called for guard bands to be kept. The current 300 kHz separation from MSS should be maintained, they argued. If the Bundesnetzagentur intends to permit 5G systems without the present guard bands, it would be necessary to carry out an analysis of the potential interference aspects and possibly to introduce technical limitations for 5G systems to prevent the potential causes of interference.

The Chamber has ruled as follows:

80 The 2 GHz spectrum is currently assigned as follows:

Paired 2 GHz spectrum		Expires on
1920.3 – 1930.2 MHz / 2110.3 – 2120.2 MHz	(2 x 9.9 MHz)	31 December 2020
1930.2 – 1940.1 MHz / 2120.2 – 2130.1 MHz	(2 x 9.9 MHz)	31 December 2025
1940.1 – 1950.0 MHz / 2130.1 – 2140.0 MHz	(2 x 9.9 MHz)	31 December 2020
1950.0 – 1959.9 MHz / 2140.0 – 2149.9 MHz	(2 x 9.9 MHz)	31 December 2025
1959.9 – 1979.7 MHz / 2149.9 – 2169.7 MHz	(2 x 19.8 MHz)	31 December 2020

Table 1: Current assignments and expiry dates in the 2 GHz band

81 All the 2 GHz spectrum in the band 1920.0 MHz – 1980.0 MHz / 2110.0 MHz – 2170.0 MHz will be provided in combination; a total of 2 x 60 MHz (paired) will be provided.

82 Part of the 2 GHz spectrum comprising 2 x 20 MHz (paired) will be available for new assignments as from 1 January 2026, section 55(5) para 2 TKG. This spectrum will be awarded for the period after 2025 and thus will be available from this point in time. The spectrum has usage rights running until 31 December 2025.

83 Regarding the rejection of the early provision of all 2 GHz spectrum, the Chamber points out that the combined provision of 2 GHz spectrum aims to create planning certainty for all spectrum usage in the 2 GHz band at an early stage. For this reason, the spectrum totalling 2 x 40 MHz (paired), for which the usage rights expire on 31 December 2020, and the 2 x 20 MHz (paired), for which the usage rights expire on 31 December 2025, will be made available jointly in one set of award proceedings (see above for the reasoning on the timing of the order).

84 Adjacent applications – such as satellite services (MSS) in the band above the 2 GHz spectrum under discussion here – can be protected without guard bands. This will enable all the spectrum in the band at 1920.0 MHz – 1980.0 MHz/2110.0 MHz – 2170.0 MHz to be made available in future. By providing all the spectrum in the band it will be possible to assign complete blocks of 5 MHz, thus promoting efficient frequency

use in accordance with section 2(2) para 7 TKG and the expedited rollout of high-speed next-generation public telecommunications networks set out in section 2(2) para 5 TKG.

85 Stipulating a guard band would rule out usage of this 300 kHz. By contrast, an assignment up to 1980.0 MHz/2170.0 MHz enables the full spectrum to be used. Future assignment holders are to take suitable measures to protect adjacent applications insofar as this is necessary.

86 ECC Decision (06)01 addresses the harmonised usage of the 1920.0 MHz – 1980.0 MHz/2110.0 MHz – 2170 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 studies on this issue are expected to be completed in mid-2019. It is to be expected that European Commission Implementing Decision 2012/688/EU will also be amended on the basis of a forthcoming mandate to CEPT. Any measures necessary to protect MSS are to be ensured by the assignment holder, depending on the technology used (eg AAS).

87 In addition, the Chamber is working on the basis that the same technology will in future be used in the MSS 2 GHz band as in the 1920 MHz – 1980 MHz/2110 MHz – 2170 MHz band, eg an OFDM-based transmission system. In this regard, too, the stipulation of a guard band is not necessary.

88 It is also not necessary to stipulate a guard band at the lower edge of the band at 1920 MHz with regard to the adjacent usages, for the reasons stated above. Moreover, the spectrum below 1920 MHz is not currently being used and is intended to be designated for another purpose.

2.1.2.2. Availability in the 3.6 GHz band

89 In the 3.6 GHz band, spectrum will in principle be available for MFCN in the whole of the 3400 MHz – 3800 MHz band. This spectrum is in principle suitable for regional and local uses owing to its physical propagation characteristics, as shown by the currently anticipated uses. However, both regional and nationwide business models were specified in the survey of scenarios of use with the points of orientation. The Chamber takes the view that, for 5G to be introduced quickly and the related planning certainty needed for companies active across the country, it makes sense to make a large part of the spectrum in this band available for nationwide assignments.

90 In order to roll out 5G across the country as quickly as possible, the majority of the spectrum in the 3.6 GHz band, totalling 300 MHz, is to be made available nationwide so it can be used completely, flexibly and freely for 5G applications. This approach serves the regulatory aim of expediting the rollout of high-speed next-generation telecommunications networks, section 2(2) para 5 TKG. Not restricting usage with fixed guard bands promotes the efficient nationwide use of spectrum in accordance with section 2(2) para 7 TKG. It is ensured that the spectrum for nationwide assignments will be able to be used in full from 3400 MHz to 3700 MHz – and thus up to the upper edge at 3700 MHz. The future nationwide assignment holder will, therefore, not have to observe a guard band with regard to the adjacent applications above 3700 MHz. Rather, the local and regional assignment holders will have to comply with a potential guard band to the adjacent national usage.

- **Protection of military radar and radio astronomy**

The following comments were made:

91 It was pointed out that radio astronomy services could be protected from unwanted emissions from mobile services by a coordination zone. Base station sites within any such coordination zone to be defined around the radio astronomy station would need to be assessed on a case-by-case basis. Within the coordination zone, various measures would be available for each base station site to minimise the unwanted emissions at the receiving location of the radio astronomy station so that it could be expected that the

radio astronomy station could operate without restrictions. Such measures would include restricting the transmitter power, reducing the antenna height, adjusting the antenna elevation angle or direction of the antenna or the beamforming antenna pattern (not in the direction of the radio astronomy station). Such a coordination zone would range from a few kilometres (at -50 dBm/MHz) to several dozen kilometres (at -30 dBm/MHz).

92 It was pointed out that the specific protection needs of radio astronomy, including protection radii and field strength limits, must be determined in detail before potential award proceedings so that the potential impact and restrictions on the network rollout can be known in advance.

93 Regarding protection of the radio astronomy station at Effelsberg, it is not clear what requirements and criteria would have to be met. It is also not clear whether the protection requirements would apply equally to the entire 3.6 GHz frequency band or whether there would be differing requirements depending on the specific frequency. Further information is therefore required to assess the spectrum.

94 The specific protection needs of military radar, including protection radii and field strength limits, must be determined in detail before potential award proceedings so that the potential impact and restrictions on the network rollout can be known in advance. These include specific details on the location of existing usage that must be protected.

95 If it is not possible to specify the location of military sites for security reasons, a general location relative to (densely) populated areas (the primary coverage target of the 3.6 GHz band) would be sufficient.

96 The Bundesnetzagentur's proposal for a proper assessment of the frequency blocks at the lower band edge at 3400 MHz is not suitable. To assess the value of the frequency blocks with restricted usage, it would be necessary to provide the information in good time before the auction.

97 The same would also be necessary with regard to the availability of frequency blocks at the lower band edge at 3400 MHz with a view to any military usage abroad near to the German border.

98 According to the Draft CEPT Report 67, an additional filter would be needed to guarantee operations for military radar devices below 3400 MHz. Current technology would require a guard band of about 20 MHz. That would mean that only 280 MHz would be available for use by mobile network operators in the 3420 MHz – 3700 MHz band.

99 Observing the harmonised European regulatory technical conditions would mean there would be no equipment for the 3400 MHz – 3420 MHz band.

The Chamber has ruled as follows:

100 No guard band will be stipulated with regard to the adjacent applications below 3400 MHz. A guard band from 3400 MHz to 3410 MHz or, as some respondents called for, from 3400 MHz to 3420 MHz, is not necessary since local solutions can be found individually to achieve compatibility with adjacent military radar systems. A guard band is not necessary to protect radio astronomy either.

101 Protection for radio astronomy concerns the Effelsberg station. Below the lower band edge at 3400 MHz, it could be necessary to impose slight local restrictions on MFCN to protect the radio astronomy station at Effelsberg. The permissible unwanted emissions correspond to the permissible out-of-band emissions to protect military radar systems. There should be no restrictions, as far as possible, on the operations of the radio astronomy station. 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. It is, therefore, not necessary to stipulate a fixed guard band within the frequency band for MFCN to protect reception at the radio astronomy station in Effelsberg.

102 The federal armed forces operate fixed radar systems in the band below 3400 MHz at fewer than ten sites in rural areas. It is intended to inform future holders of assignments for the frequency blocks concerned about the geographical location so as to enable efficient and interference-free use of the frequencies.

103 Regarding the implications of usage restrictions on availability, the following should be noted:

104 If passive antennas (non-AAS) are used in the 5G base station, the limit of -50 dBm/MHz EIRP on out-of-band emissions for TDD given in ECC Decision (11)06 is to apply.

105 For AAS, the emissions of the 5G base station are to be limited to -52 dBm/MHz TRP (Total Radiated Power) per cell. In addition, a coordination zone of 12 km to protect adjacent military radar is necessary.

106 Studies on this issue by CEPT are expected to be completed in July 2018. Should it prove necessary to modify the protection criteria given above, the Bundesnetzagentur will provide information. Other than that, the frequency usage conditions form part of the forthcoming President's Chamber decision on the award conditions (Decision III).

107 Regarding respondents' calls for information confirming that there are no larger towns, with more than 50,000 inhabitants for example, within the 12 km coordination zones, the Bundesnetzagentur is able to confirm this. Moreover, it is possible to use spectrum within the radius after coordination.

108 Regarding responses mentioning military locations abroad, the Chamber wishes to make it clear that the coordination zone of only 12 km means that no significant limitations arising from cross-border coordination are to be expected.

109 Although some respondents express the opinion that there will be no equipment for the 3400 – 3420 MHz band owing to observation of the harmonised European regulatory technical conditions, this band will be made available for MFCN. While it is not yet possible to provide definitive information on the availability of hardware, the Chamber assumes that technology will be available for this frequency band, too.

- **Division of the 3.6 GHz band**

The following comments were made:

110 The nationwide provision of spectrum from the 3400 MHz – 3700 MHz band was welcomed in some quarters. It was said to be very important for the automotive industry, in particular, to be able to use services across the country. Measures to promote the large-scale dissemination of services across all road transport infrastructure is desirable insofar as it is technically feasible and takes account of economic viability.

111 There was also general agreement with the provision of spectrum from 3700 MHz – 3800 MHz for regional assignments in an application procedure. The provision of 100 MHz for use in regional and/or local business models was said to be urgently needed. Local and regional assignments would allow companies to share in the advantages of 5G. The band's propagation characteristics make it particularly suited to use in industrial automation with 5G technology. The provision of less than 100 MHz would restrict the implementation of regional and local business models. Only adequate spectrum resources will enable Germany to take a leading role in 5G applications. It must be possible to operate a local radio network in production facilities independently of any nationwide provision of broadband services by mobile network operators. The operation and monitoring of a production site's radio network must be carried out internally for reasons of liability, the protection of trade secrets and patents.

112 It does not make technological sense to link the services offered by mobile network operators to the requirements of "Industrie 4.0". Any bottlenecks in network capacity could then directly affect automotive manufacturing. Automotive manufacturing, in particular, must be able to prioritise its capacity itself.

113 An increased demand for spectrum in the medium to long-term is expected, so an arrangement for the local (shared) use of the 3400 MHz – 3700 MHz band that promotes innovation is to be welcomed.

114 The subject of coverage is also mentioned in the consultation responses. The provision of local spectrum above 3.7 GHz is judged to be of central importance as this band seems suited to contributing to nationwide coverage in sparsely populated areas. Since 5G coverage is to initially remain restricted to major roads and the secondary road network and all railway lines, a regional and local assignment of 100 MHz in the 3.7 GHz – 3.8 GHz band is absolutely necessary, as it would provide the opportunity for autonomous networks, which are also needed in the agricultural and forestry industry.

115 Reserving spectrum in the 3.7 GHz – 3.8 GHz band does not discriminate against established mobile network operators, constitute unlawful market entry assistance or lead to artificial spectrum scarcity.

116 It was pointed out that the conditions for the use of regional/local spectrum must be made known before the application procedure to be admitted to the auction.

117 Some responses called for the whole 3.6 GHz spectrum, or at least more spectrum, to be made available nationwide.

118 The reservation of 100 MHz for regional assignments would prevent three nationwide providers from being able to make full use of the potential of 5G.

119 Germany only has the ability to become the leading 5G market in Europe if 400 MHz is made available nationally. The planned division would lead to a sort of "5G lite" in Germany, at best. The main motivation for network operators is the possibility of attracting new markets and industries, the "verticals", with different usage scenarios. Network slicing is a key prerequisite for this.

120 If 300 MHz is made available, only 280 MHz is effectively usable. According to the draft CEPT Report 67, it will be necessary to protect adjacent applications. Current technology would therefore require a guard band of 20 MHz with regard to military radar systems.

121 Moreover, the nationwide operation of TDD networks in Germany is new. In the case of unsynchronised operation, guard bands of 20 MHz will be needed between adjacent TDD usages by different network operators, or the networks will have to be synchronised. The 20 MHz guard bands required mean that the total spectrum of 300 MHz would lead to a net usable spectrum of only 240 MHz. However, channel bandwidths of 100 MHz are required to achieve full performance of 5G. The synchronisation is technically difficult and this issue is made even more difficult by the regional reservation.

122 There are currently no known 5G applications that require the 3.7 GHz – 3.8 GHz spectrum at a local or regional level. Local applications can also be provided in other bands with significant greater bandwidths, eg 26 GHz. It is clearly evident that requirements for local – not regional – solutions for "Industrie 4.0" applications, automation and digitisation of business processes are geared towards autonomous systems and 40 MHz is sufficient for this. In any case, reserving 100 MHz for local/regional assignments is not justified, nor is any other country planning this kind of division.

123 Reserving 100 MHz for regional/local spectrum purposes will lead to scarcity that is artificial or caused by regulation.

124 In addition, the different award proceedings and conditions for regional or nationwide spectrum would lead to significant distortion of competition.

125 By contrast, the PMSE user group calls for the most of the entire spectrum to be made available regionally/locally. The 3.6 GHz spectrum should be reserved for regional assignments and awarded without an auction.

The Chamber has ruled as follows:

126 Of the whole band at 3400 MHz – 3800 MHz, the Chamber will provide the spectrum from 3400 MHz to 3700 MHz (and therefore the majority of the 3.6 GHz band) for nationwide assignments. It will thus be possible to provide adequate spectrum for nationwide operators to realise their business models. This will ensure that the spectrum for nationwide assignments will be able to be used in full from 3400 MHz to 3700 MHz – and thus up to the upper edge at 3700 MHz. The future nationwide assignment holder will, therefore, not have to observe a guard band between the adjacent applications above 3700 MHz. Rather, the local and regional assignment holders will have to comply with a potential guard band with regard to the adjacent national usage.

127 It will nevertheless also be possible to provide adequate spectrum in the band at 3700 MHz – 3800 MHz for small and medium-sized enterprises to realise local and regional business models.

128 In contrast to nationwide assignments, an application procedure for regional assignments will best allow account to be taken of spectrum requirements emerging in the future, as well. A number of business models are expected to emerge as the digital revolution and 5G developments advance. The assignment procedure for regional and local assignments must therefore ensure that the spectrum is used efficiently and emerging spectrum requirements can be met.

129 Division into 300 MHz for nationwide assignments and up to 100 MHz for regional and local assignments is consistent with the regulatory aims set out in the TKG. The intended division serves to expedite the rollout of high-speed next-generation public telecommunications networks, section 2(2) para 5 TKG, and secure the efficient use of frequencies, section 2(2) para 7 TKG.

130 The provision of 300 MHz for nationwide assignments will provide regulatory support for the introduction of high-speed 5G systems and the rollout of high-speed telecommunications networks. It will also ensure that the same frequencies are available throughout the country to the assignment holders, enabling them to roll out 5G networks in line with demand. Provision of the same frequencies nationwide will also promote the efficient use of spectrum by avoiding, for instance, the need for coordination with other users. Network planning will also be facilitated.

131 Provision of the 3,400 MHz – 3700 MHz band for nationwide assignments will deliver planning certainty for nationwide 5G rollout. Large bandwidths for 5G are available in the 3.6 GHz band in particular. 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.

132 Regarding the comments that the planned division would prevent three nationwide providers from being able to make full use of the potential of 5G, the Chamber wishes to draw attention to the following:

133 The Chamber takes account of the fact that companies require large contiguous bandwidths for the introduction of 5G in its considerations. The Chamber considers it necessary that spectrum totalling 300 MHz is usable for nationwide assignments. The draft CEPT Report 67 also states that contiguous frequency assignments of up to 100 MHz per operator are to be introduced for 5G applications. However, in the award of spectrum totalling 300 MHz for nationwide assignments, bidders will be able to decide to acquire more or less than 100 MHz to put their own business models into practice. The Chamber does not specify the number of nationwide network operators or the amount of spectrum per network operator in advance.

134 Respondents' arguments that more spectrum must be made available nationwide because in the case of unsynchronised operation, guard bands of 20 MHz will be needed between adjacent TDD usages by different network operators are not completely convincing.

135 Network operators can synchronise their networks. In the case of synchronised operation of adjacent networks, the relevant technical conditions, in accordance with international harmonisation arrangements, are to be observed without the necessity of guard bands. Here, the Chamber would like to point out that other markets already using TDD systems for mobile communications largely have synchronised operations, enabling the use of the entire spectrum. Contrary to the opinions put forward by respondents, therefore, a guard band of 20 MHz is not necessary in every instance.

136 However, the Chamber agrees with the submissions to the extent that establishing compatibility with multiple regional and local networks above 3700 MHz could lead to disproportionate restrictions on usability of the spectrum provided nationwide and thus also to a rollout of 5G that is flexible and as fast as possible. In this respect, any potential guard band to the adjacent national usage will have to be complied with by local and regional assignment holders. In individual cases of unsynchronised operation, this could mean that less than 100 MHz of spectrum is provided for local and regional assignments, but it would ensure that the spectrum for nationwide assignments will be able to be used in full from 3400 MHz to 3700 MHz – and thus up to the upper edge at 3700 MHz. This will be taken into account in the application procedure for local and regional assignments in the 3700 MHz – 3800 MHz band.

137 With regard to the comment above that a guard band of 20 MHz is necessary, the Chamber also takes the following circumstance into consideration: potential bidders can in principle acquire contiguous spectrum with large bandwidths for 5G applications. Moreover, the Chamber assumes that the division of spectrum in the course of the auction will not necessarily be carried out symmetrically but will depend on the respective business model and willingness to invest. Parties requesting assignment could, for example, consider acquiring more spectrum to have greater freedom for unsynchronised operation.

138 Network operators also have other options to avoid mutual interference. With appropriate technology, mutual interference with the use of passive antenna systems can be avoided by a power limit of -34 dBm/5 MHz EIRP per cell between two adjacent unsynchronised networks. A power limit of -43 dBm/5 MHz TRP is necessary with the use of AAS. Here, the Chamber would like to point out that the international studies for the necessary power limit are expected to be finished in July 2018; there could therefore be changes in the power limit and the resulting necessary restrictions in the use of frequencies. Other than that, the frequency usage conditions form part of the forthcoming President's Chamber decision on the award conditions (Decision III).

139 Affected network operators could also come to a mutual agreement on other measures. Alternative procedures for network operators of unsynchronised adjacent networks are currently being examined.

140 Regarding comments that according to the draft CEPT Report 67 a guard band of 20 MHz to military radar systems must be provided and that this would make only 280 MHz usable, the Chamber wishes to draw attention to the following: the draft CEPT Report 67 states that additional filters will be necessary to protect the operations of military radar equipment below 3400 MHz. Current technology would require a guard band of about 20 MHz. There are fewer than ten military radar systems operating below 3400 MHz in Germany, which would require protection. They are located outside urban areas and larger towns. The small number of sites and the location of the radar systems does not justify setting a fixed guard band for the entire band. The 3400 MHz – 3420 MHz band is therefore, in principle, usable for nationwide assignments.

141 The Chamber has also taken account of the fact that the 3400 MHz - 3600 MHz band is the least restrictive for nationwide business models as regards compatibility with other radio services, most notably satellite communications. This ensures, to the greatest possible extent, that the potential of the 3.6 GHz band for 5G can be fully exploited through enabling 5G to be rolled out rapidly, flexibly and in line with demand. Holders of the nationwide assignments will therefore be in a position to meet the demand for 5G applications rapidly, flexibly and in line with market demand.

142 Provision of the upper sub-band 3700 MHz – 3800 MHz for regional assignments will allow companies to obtain large contiguous spectrum blocks regionally, so that they can fully exploit the advantages of this frequency band for 5G. The provision of up to 100 MHz for regional assignments will enable the rollout of regional and local 5G networks with high channel bandwidths. This will enable regional or local business models on the basis of large channel bandwidths or several business models on the basis of smaller channel bandwidths.

143 Regarding the responses that were put forward that 360 MHz should be made available nationwide because 40 MHz is enough for regional usage, the Chamber wishes to point out that this is not sufficient:

144 The fact that regional assignments of up to 80 MHz already exist was taken into consideration. In this context, the fact must be taken into consideration that existing regional assignments in the 3.6 GHz band will be shifted into the 3700 – 3800 MHz band.

145 The draft CEPT Report 67 also states that contiguous frequency assignments of up to 100 MHz per operator are to be introduced for 5G applications. Provision of the spectrum for regional and local assignments is intended to allow acquisition of up to 100 MHz to implement business models.

146 The provision of spectrum totalling up to 100 MHz also takes account of the fact that, for operational and security reasons, some business models require "their own" frequencies for autonomous, local telecommunications networks. Responses to the draft Decision from industry, small and medium-sized enterprises and interest groups confirmed the need for regional assignments for industrial applications.

147 Moreover, the Chamber agrees that the 3700 MHz – 3800 MHz band can contribute to coverage in sparsely populated areas. This applies both to public networks for consumer coverage and for autonomous local networks, eg for the agricultural and forestry sector. The provision of spectrum for local and regional applications will also promote the development of solutions for radio-based communications in automation systems and real-time communications. It works toward the regulatory objectives of protecting user and consumer interests (section 2(2) para 1 TKG) and expediting the rollout of public high-speed next-generation telecommunications networks (section 2(2) para 5 TKG).

148 In addition, it will be possible to obtain regional assignments at a later date flexibly and in line with demand. Responses confirmed that increased demand for these frequencies is expected, particularly in the medium to long-term, so regional business models that have yet to emerge, for instance those of start-ups, will then be able to be implemented at this later time. The Bundesnetzagentur will draw up an application procedure for the regional assignments. The aim is to provide a swift, flexible and transparent assignment procedure.

149 In this context, the Chamber wishes to draw attention to the fact that responses confirmed that, due to the physical propagation characteristics of spectrum in the 3.6 GHz band, it can be assumed that this band will be used locally or regionally and that the network rollout will thus also take place regionally.

150 In view of this, it would not be justified to provide the whole of the 3.6 GHz band for nationwide assignments. The 300 MHz of spectrum will be provided for nationwide

assignments in an open, objective, transparent and non-discriminatory procedure. The provision of up to 100 MHz for regional assignments does not represent an inadmissible measure to aid market entry that would create an artificial scarcity of spectrum. There will be provision of spectrum for both nationwide use and regional use so that all interested parties can obtain access to the spectrum. The intended division of the spectrum therefore serves to secure fair competition and promote sustainable competitive markets in accordance with section 2(2) para 2 TKG.

151 While the nationwide network operators stated their demand for spectrum in the 3.6 GHz band, industry, associations and small and medium-sized enterprises also declared a demand for spectrum for regional and local uses and this was confirmed in the responses to the draft Decision. Therefore, the Chamber takes the view that it is appropriate not to make the entire spectrum available for nationwide assignments. The division of the band results from the weighing-up of national and regional demand and interests. There is, in particular, no "artificial" scarcity created of the spectrum for nationwide assignments, as was commented.

152 Regarding the comment that this sort of division into nationwide and regional assignments has not been introduced in any other country, the Chamber wishes to make it clear that provision of 3.6 GHz spectrum has been dealt with differently in European countries. Some countries, such as Czechia, have awarded the 3.6 GHz spectrum nationally, while others will award it for regional/local assignments or have already done so (eg Austria, Ireland, Slovakia). It is therefore not possible to draw conclusions for the procedure in Germany. Moreover, it should be noted that there are different conditions in different countries, and therefore different requirements. The President's Chamber has a prerogative of assessment in this respect. In the case at hand, the President's Chamber has collected the statements of demand made by all interested parties and assessed them with a view to the regulatory objectives. The Chamber also took into account the importance of medium-sized enterprises for the German economy, in particular industry. Many of these companies are based in rural areas and thus have an interest in spectrum for autonomous networks.

153 The Chamber therefore takes the view that it is sufficient to make up to 100 MHz available for regional/local assignments. The Chamber does not agree to the request from the PMSE user group to make most of the entire spectrum available for local and regional assignments. As previously explained, the provision of 300 MHz for nationwide assignments will serve to promote the rollout of high-speed next-generation public telecommunications networks (section 2(2) para 5 TKG) by giving assignment holders planning certainty for the flexible network rollout.

154 The aim of dividing the spectrum into frequencies for nationwide and regional assignments is to reconcile the different interests by enabling a variety of business models to be realised.

155 Regarding comments that local applications could be situated in, for example, the 26 GHz band, the Chamber wishes to point out that it is planned to make this band available for local assignments in an application procedure. Regarding the spectrum requirements given by national and regional parties requesting assignment, all parties requesting assignment are to be able to obtain spectrum to implement their business models in a non-discriminatory manner. The very different physical characteristics of the 3.6 GHz and 26 GHz bands do not justify restricting local and regional parties requesting assignment to the 26 GHz band alone.

156 Regarding comments that the different award proceedings and conditions for regional or nationwide spectrum would lead to significant distortion of competition, the Chamber wishes to make it clear that in the division of the spectrum, the interests of small and medium-sized enterprises, section 61(4) first sentence TKG, and the variety of conditions relating to competition and consumers that exist in the various geographic areas within the Federal Republic of Germany, section 2(3) para 5 TKG, were taken into

account. Preference for regional applicants is not apparent here. Up to 100 MHz of spectrum will be provided for regional assignments. Applicants must give an account of their spectrum requirements in a frequency usage concept. This will prevent spectrum hoarding.

157 Here, the Chamber would like to point out that spectrum in the 3700 MHz – 3800 MHz band will be assigned upon application. The Bundesnetzagentur is currently drawing up arrangements for application procedures for regional and local assignments in the 3700 MHz – 3800 MHz band. Non-discriminatory fees will be imposed for regional and local frequency assignments, too. It is planned to initiate a consultation procedure on the arrangements as early as possible to be able to give sufficient planning and investment certainty.

158 Irrespective of the question of the division of the 3.6 GHz into nationwide and regional assignments, the Chamber wishes to make clear that it has the task of ensuring that spectrum usage is efficient. In particular, it must ensure that assigned spectrum does not go unused regionally even though there is demand for it.

- **Current assignments in the 3400 MHz – 3700 MHz band**

The following comments were made:

159 Holders of BWA usage rights were expressively supportive of the Bundesnetzagentur's plan to enable future assignment holders in the 3.6 GHz band to roll out their network as early as 2019. The initial considerations for an appropriate switchover have already been made, it was commented.

160 There was a largely positive response to the defragmentation of regional assignments in the 3.6 GHz band. Reference was made in particular to the CEPT 5G Roadmap and the draft ECC report "Guidance on defragmentation of the frequency band 3400-3800 MHz", which contain starting points for the defragmentation procedure. The acceleration of spectrum trading was also mentioned as a further means of defragmentation.

161 It was pointed out that existing uses are heavily restricted at the local level and there are only eleven of them in total. The efficient usage of the 3.6 GHz spectrum that is currently regionally assigned was also called into question. The few existing regional uses could therefore be individually coordinated with nationwide assignments.

162 By contrast, several respondents called for opportunities for shared use of spectrum assigned nationwide.

163 It was also pointed out with regard to possible migration of WLL applications, that not only 5G but alternative connectivity solutions such as fibre would have to be taken into account as well.

164 The few existing regional uses in the 3.6 GHz band could therefore be individually coordinated with nationwide assignments. For this, it is helpful to know whether TDD or FDD technology is used in the WLL applications. Guard bands are necessary in the case of TDD operation of the existing BWA/WLL assignments.

The Chamber has ruled as follows:

In the 3400 MHz – 3600 MHz band, there are the following de facto nationwide and regional assignments:

- **De facto nationwide assignments**

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

Translation*

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)			
Bernkastel-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			
Alzey-Worms	Rhineland-Palatinate	3473 – 3494 MHz / 3573 – 3594 MHz	4th BWA 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	

* In case of divergent interpretation of the German and English text, the German text shall prevail.

Region	Federal state	Frequency band	
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 ("Greater Saarbrücken")	Saarland	3450 - 3480 MHz / 3550 - 3580 MHz	

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

166 The spectrum was auctioned for broadband wireless access (BWA) in 2006 and assigned de facto on a nationwide basis. At present, two assignment holders each hold 42 MHz of spectrum from what is known as the first BWA package for use in all of the original 28 BWA regions and thus nationwide. One assignment holder holds 2 x 21 MHz (paired) of spectrum from the third BWA package for use in 27 of the original 28 BWA regions and 2 x 21 MHz (paired) of spectrum from the fourth BWA package in one further region. This assignment holder also holds regional WLL assignments conferred for flexible use for a limited period. These WLL assignments all expire on 31 December 2021 together with the other de facto nationwide assignments.

167 The Chamber intends to enable an early reallocation of spectrum after the auction, as respondents had called for. This will be able to create the conditions for an early use of spectrum for the rollout of 5G in order to promote both regulatory objectives of efficient frequency use in accordance with section 2(2) para 7 TKG and the expedited rollout of high-speed next-generation public telecommunications networks set out in section 2(2) para 5 TKG.

168 Regarding comments on the possibility of shared use of nationwide assignments of spectrum, the Chamber wishes to point out that these provisions are not the subject of this Decision. The same applies to calls to regulate spectrum leasing.

- **Local and regional assignments**

169 As well as the BWA usage rights assigned on a de facto nationwide basis, spectrum was assigned for regional and local use in an application procedure. Assignments for MFCN were made based on a block size 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 3 for details). As a rule, the assignment holders are 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.

Translation*

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	Alzenau	3480-3500 3580-3600	17 July 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
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

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Federal state	Assignment area	Frequency band (MHz)	Time limit
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
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

Federal state	Assignment area	Frequency band (MHz)	Time limit
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 3: Local and regional assignments in the 3400 MHz – 3700 MHz band

170 The assignments were provided in an application procedure 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 regional assignments are being used efficiently in all the areas. Unused spectrum will have to be returned to the Bundesnetzagentur, otherwise revocation of the frequency assignment will be considered.

171 The Bundesnetzagentur has already initiated consultation procedures to this end. As a result of the consultations it should be noted that some of the assignment holders no longer use their spectrum or will stop doing so in the near future. The Chamber will update the above table accordingly.

172 Regarding the existing local and regional uses, some respondents pointed out that, owing to their number and size, these could be coordinated individually with nationwide assignments. The Chamber can confirm that existing local and regional uses will have to be coordinated with nationwide assignments, at least for a transition period.

173 However, since the local and regional assignments expire on 31 December 2022 at the latest, they are coming to an end and will not have to be coordinated on a permanent basis. The Chamber does not share the view of respondents that the possibility in principle of coordinating local and regional uses calls the regional and local provision of spectrum into question. In this context, the Chamber wishes to draw attention to its explanations on the division of the 3.6 GHz band (see above).

174 Coordination will be carried out individually based on the site-related frequency parameters determined for the base stations using the nationwide assignment. The international studies on defragmentation of the 3.6 GHz band can also be taken into account here, even though they are currently only at the draft stage.

175 Spectrum at 3700 MHz – 3800 MHz will be provided for regional assignments in an application procedure. This will ensure that the spectrum requirements for both current applications and new local and regional business models can be accommodated. It is also conceivable that current holders of expiring regional assignments at 3400 MHz – 3700 MHz could migrate into the 3700 MHz – 3800 MHz band early in order to have long-term planning certainty. Extensive comments were also made on this issue in the draft Decision. An early publication of the application procedure was particularly welcomed. The Chamber wishes to make clear that the responses received will be taken into account in the drafting of the application procedure.

- **WLL assignments**

176 In the 3.6 GHz band, there are, moreover, 32 unlimited regional assignments in blocks of 7 MHz for wireless local loop (WLL) as point-to-multipoint radio relay (see Administrative Order No 55/1998, RegTP Official Journal No 11/1998 of 10 June 1998).

177 These WLL assignments concern the following areas and frequency blocks:

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)		

Translation*

District	Federal state	Frequency band
Hof (urban)	Bavaria	3480 – 3494 MHz / 3580 – 3594 MHz
Kitzingen		
Neustadt a.d.Aisch-Bad Windsheim		
Passau (rural)		
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)	Lower Saxony	3480 – 3494 MHz / 3580 – 3594 MHz
Hannover		
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		
Mettmann		
Minden-Lübbecke		
Mönchengladbach (urban)		
Mülheim a d Ruhr (urban)		
Münster (urban)		
Neuss		
Oberhausen (urban)		
Remscheid (urban)		
Solingen (urban)		
Wuppertal (urban)		
Kaiserslautern (rural)	Rhineland-Palatinate	3459 – 3473 MHz / 3559 – 3573 MHz
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		

* In case of divergent interpretation of the German and English text, the German text shall prevail.

District	Federal state	Frequency band
Segeberg	Schleswig-Holstein	3480 – 3494 MHz / 3580 – 3594 MHz
Stormarn		
Erfurt	Thuringia	3480 – 3494 MHz / 3580 – 3594 MHz

Table 4: Regional WLL assignments in the 3400 MHz – 3600 MHz band

178 The WLL assignments currently apply for an unlimited period. The Bundesnetzagentur is currently looking at whether the regional assignments will be used efficiently in all the areas and at the conditions for relocating the assignments to the 3700 MHz - 3800 MHz band.

179 In response to the comment that in view of a possible migration of WLL applications not only 5G but also alternative connectivity solutions such as optical fibre should be taken into consideration, the Chamber's position is that such alternative solutions are not considered in the provision of spectrum. Possible optical fibre lines are not relevant to the question of providing spectrum. In these proceedings the Chamber does not check on the viability of business models using landline products. The sole criterion it applies is the efficient use of spectrum.

180 With regard to the comment that the few existing regional uses in the 3.6 GHz band could be individually coordinated with nationwide assignments, this does not alter the fact that the Chamber regards it as expedient to split up the 3.6 GHz band and allow local and regional use in future exclusively in the 3700 – 3800 MHz band. This will involve moving existing regional services in the 3400 – 3700 MHz band to the 3700 – 3800 MHz band. The WLL assignments too are regional assignments for which spectrum in the 3700 – 3800 MHz band will be made available.

181 It was suggested that spectrum trading in the 3700 – 3800 GHz band was a suitable means of defragmentation. The Chamber's position is as follows. While it is true that spectrum trading can help the defragmentation process, the Chamber has no way of influencing market players' decisions to buy or sell. To achieve defragmentation through spectrum trading alone seems as good as impossible.

- **Satellite communications in the 3.6 GHz band**

The following comments were made:

182 Protection of the satellite downlink in the 3400 – 3700 MHz band should be ensured, since operations in this band were connected with the uplink bands, for which there were regulatory operating rights under the Bundesnetzagentur's licensing obligations. A call was also made for clearly defined measures to protect existing FSS teleports.

183 Reference was made to the *Second Opinion on 5G networks* by the Radio Spectrum Policy Group (RSPG), which includes a request for a proper balance between the benefits of allowing 5G use of the 3.6 GHz band and keeping access to satellite operators in this frequency band.

184 If it was necessary to request another coordination for already established and coordinated earth stations, including a statement of reasons why the use of the 3.7 – 4.2 GHz band did not suffice for operating purposes, this would result in a re-coordination of all existing licences, which would be dependent on the consent of new 5G operators. It was also unclear whether new stations would have secure protection in future or whether additional antennas at existing earth stations would be protected on a case-by-case basis. This was not felt to be necessary. As soon as a licence reached the end of its renewal cycle (ie after 10 years), a check could be made on whether FSS earth stations were using spectrum efficiently.

185 With reference to the protective radii demanded, it was stated that a radius of 20 km in the direction of maximum radiation and 5 km for the side lobes was not sufficient. The

simulation results found in the relevant studies suggested a coordination zone of at least 60 km for co-channel interference and 10 km for adjacent channel interference. The analysis had been done on the basis of macro-cell configuration. Restrictions on the transmission capacity of 5G base stations (smaller cell sizes) or on the antenna tilt angle or restricting 5G use to indoor applications would result in smaller coordination zones.

186 It was mentioned that several hundred million euros had been invested in satellite and ground infrastructure for the Fuchsstadt teleport. With reference to the Bundesnetz-agentur's expectation that mobile network operators and FSS earth station operators would coordinate in order to prevent interference, the view was expressed that the Bundesnetzagentur ought to be involved in the search for a mutually acceptable solution which would ensure the continued operation of the Fuchsstadt teleport without interference from new users of the frequency band.

187 A request was made for the angle ranges of the main beam and the side lobes to be stated for every single earth station in relation to the points of the compass, so that it would be possible to assess the actual effects of the protection requirements for satellite communications and thus the value of the spectrum usage rights. As regards the earth stations not used for security-related communications there was, it was stated, no apparent reason not to make the necessary information available immediately. It was proposed that earth stations used for security-related communications should be subject to the same procedure as the military radar installations below 3400 MHz.

188 With regard to the Leeheim earth station it was pointed out that insistence on a coordination radius of 20 km would make it very difficult, if not indeed completely impossible, to supply Darmstadt with spectrum from the 3.6 GHz band for mobile phone services. Darmstadt had just been proclaimed, in 2017, a "digital city". It should be understood that 5G technology was an essential component of the "digital city" concept.

The Chamber has ruled as follows:

189 The interests of the satellite services must be taken into account in providing 3.6 GHz spectrum. To ensure the compatibility of satellite and mobile communications, the following procedure is planned:

190 Protection requirements will be determined for each specific case within a coordination zone. In the subsequent setting of site-related frequency usage parameters for mobile communications as part of the spectrum assignment process, consideration is to be given in particular to Report ITU-R M.2109 (2007), Report ITU-R S.2368-0 (06/2015), ECC Report 203 (on 4G/LTE), the forthcoming ECC report on 5G, and the local conditions. In this context, the topography (terrain obstacles) and morphology (shielding, for instance through dense urban development) can have a positive effect on compatibility. In individual cases, MFCN mitigation techniques and measures may therefore be required to ensure compatibility with satellite communications, as suggested by respondents (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).

191 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. The coordination zone for the direction of maximum radiation is 100° to 260° clockwise through South. The currently available LTE mobile parameters were used as the basis for determining the coordination zone.

192 With regard to the comment calling for a protection radius of 60 km, the Chamber points out that site-related frequency usage parameters for mobile communications are set for

each individual site as part of the spectrum assignment process. In setting these parameters, the needs of satellite communications, insofar as they warrant protection, are considered separately from the abstract coordination radii.

- **Earth stations in the 3400 MHz – 3600 MHz band**

193 In the Frequency Plan, the 3400 - 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 - 3600 MHz band is in principle possible, but it cannot be claimed that reception is free from interference. The demand by respondents for guaranteed protection of downlink communications in the 3400 – 3700 MHz band is one that cannot be complied with in the 3400 – 3600 MHz band. In this connection the Chamber would refer to the award of spectrum in the 3400 – 3600 MHz band in 2006 (file no BK1-05/008). In this case the spectrum was awarded without consideration for the protection of existing earth stations. Even if the uplink in a different band continues to be available for satellite services, this does not in principle imply that there is a right to protection in the downlink area.

194 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 - 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 a willingness to work out acceptable solutions with the earth station operators. As for a demand by respondents that the Bundesnetzagentur should be involved in the process of finding a mutually acceptable solution, the Chamber stresses that it will give appropriate consideration to the interests of the earth station operators in each individual case. This will make it possible to achieve the requested proper balance between releasing the 3.6 GHz band for 5G and ensuring continued access by the above-mentioned earth station operators to that band.

195 The earth station in Leeheim is the Bundesnetzagentur's satellite monitoring station. The reception of satellite communications in the 3400 - 3600 MHz band by the earth station has been coordinated and must be protected. Effective monitoring of the frequency regulations under section 64 TKG is conditional on the Bundesnetzagentur's monitoring stations being free of interference by spectrum usage (see Communication no 613/2012, Bundesnetzagentur Official Gazette17/2012, page 3161). It is intended to provide for a coordination radius of 20 km for terrestrial spectrum usage. The technical parameters for mobile base stations within this radius will be set on a case-by-case basis as part of the spectrum assignment process, taking account of the topography and usage parameters. The coordination zone was defined on the basis of the LTE mobile communication parameters currently available.

196 With reference to the assertion that the use of spectrum in Darmstadt was thus not possible, the Chamber wishes to make it clear that the above-mentioned radius is a coordination radius – which means that the use of spectrum is basically possible. With regard to coverage in an urban area, it can be expected that building development creates additional shielding effects and the frequencies can therefore be used for 5G applications.

- **Earth stations in the 3600 MHz – 3700 MHz band**

197 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 MHz - 3800 MHz

(see Frequency Plan, April 2016, entry no 317003). In the 3600 MHz - 3700 MHz band, consideration must therefore be given to the following stations:

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 5: Current frequency coordination for satellite reception in the 3600 MHz – 3700 MHz band

198 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 usage parameters are set. With regard to the request for specific details of the angular ranges for the coordination radius of 20 km, what can be assumed is a general angular range of 100° to 260° clockwise through South. A coordination radius of 5 km has been decided on for the other angular ranges. The coordination zone was defined on the basis of the LTE mobile communication parameters currently available.

199 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".*

200 Attention is drawn to the following with respect to the scope for development in individual cases at existing coordinated sites:

201 Operators of existing coordinated earth stations can apply for coordination for reception 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, agreement between the earth station operator and the mobile operator will be required to enable coordination in the individual case. In this connection the Chamber made it clear that there is no need to make another application for existing coordinated spectrum use. Only in the case of new planning is it necessary for the above-mentioned operators to file an application for coordination subject to the obligation to present a detailed account. With regard to the claim by respondents that it was not clear whether additional antennas at existing earth

stations would be protected on a case-by-case basis, the Chamber explains that new planning which was successfully coordinated according to the above procedure was being protected at already existing sites.

202 As regards the consent of the mobile operators, consideration is to be given to their 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.

203 Reception in the 3600 MHz - 3700 MHz band at new earth station sites will therefore not be protected.

204 The 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. Effective monitoring of the frequency regulations under section 64 TKG is conditional on frequency use not causing interference at the Bundesnetzagentur's monitoring stations (see Communication No. 613/2012, Bundesnetzagentur Official Gazette17/2012, page 3161). 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 as part of the spectrum assignment process, taking account of the topography and usage parameters. The coordination zone was defined on the basis of the LTE mobile communication parameters currently available.

205 With reference to the assertion that the use of spectrum in Darmstadt was not possible, the Chamber wishes to make it clear that the above-mentioned radius is a coordination radius, which means that the use of spectrum is basically possible. With regard to coverage in an urban area, it can be expected that building development creates additional shielding effects and the frequencies can therefore be used for 5G applications.

- **Consideration of the Geodetic Observatory Wettzell**

The following comments were made:

206 The information supplied to date on the technical conditions surrounding the Geodetic Observatory Wettzell (GOW) was said to be still, in general, very vague. In order to assess the local availability of spectrum for MFCN services and thus the value of the spectrum usage rights, however, it was necessary to provide further technical details at short notice on the aspects in question (maximum protective radius, required protective measures).

The Chamber has ruled as follows:

207 In connection with the availability of the 3.6 GHz band, consideration is to be given to protection for the Geodetic Observatory Wettzell (GOW) operated by the Federal Agency for Cartography and Geodesy (Bundesamt für Kartographie und Geodäsie – BKG). Measurements carried out at the observatory do not constitute frequency usage within the meaning of the TKG but performance of the GOW's statutory tasks. In the process the observatory receives signals from space over a large number of frequency bands. Its measurements provide, among other things, the basis for the most exact possible positioning of points on the earth. The high accuracy of these measurements could be of growing importance for 5G applications such as autonomous driving.

208 The BKG has pointed out that provision of 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.

209 Yet the 3.6 GHz band has also been identified as a pioneer band for 5G rollout. In the dialogue with the BKG it was ascertained what effects future restrictions would have on the scope and accuracy of GOW's measurements and how far these would be tolerable

without endangering its operations. Unrestricted use of the frequencies in question for 5G is out of reach, as it is not possible for the observatory to use other bands instead, in particular the band above 3800 MHz.

210 As a result it will be necessary to have a coordination zone of 120 km round the Wettzell site for 5G applications, including Greater Munich. Spectrum use by 5G inside this zone is in principle possible, but it must be properly coordinated.

211 The assumption is that there will be few technical and planning restrictions necessary for future 5G mobile operators regarding urban areas bordering the coordination zone, due to the low level of necessary additional attenuation, the building penetration loss and the currently foreseeable application cases for supplying hotspots with very high data rates. The 3.6 GHz band is in principle also available in the vicinity of the observatory.

212 With regard to the setting of technical parameters as part of spectrum assignment process, base station sites inside the 120 km coordination zone round the observatory will be assessed on a case-by-case basis. 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).

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

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

2.1.3 Scarcity

The following comments were made:

215 On the one hand approval was given to the finding that there is scarcity and that in consequence award proceedings would be ordered.

216 On the other hand scarcity was denied for a wide variety of reasons. In the first place the draft consultation was said to make it clear neither what the finding was based on nor in what frequency bands scarcity was found to exist. It could not be concluded from the Bundesnetzagentur's arguments that the qualified notifications of requirements produced excess demand and therefore scarcity. The Bundesnetzagentur had wrongly confused specific notifications of requirements with forecasts of future needs. It was also a problem that, because notifications of demand were kept strictly confidential, market players could not check on the process of determining a situation of scarcity.

217 In addition the determination rested on insecure foundations, as the demand identification proceedings had been conducted at too early a date.

218 The reservation of spectrum for regional uses resulted in a regulation-induced scarcity. The Bundesnetzagentur should therefore check, on the one hand, whether there would have been scarcity if 400 MHz had been provided in the 3.6 GHz band. On the other, there was no way the aim of avoiding scarcity induced by regulation could justify including in the proceedings 2 GHz usage rights that were due to expire in 2025. It was also possible to make all the 2 GHz rights available at the same time by adjusting the terms of the various rights to a common final date, as from 2026.

219 Nor was the argument found convincing that it would be possible to avoid conducting a number of expensive award proceedings if all 2 GHZ frequencies (and the 3.6 GHz

frequencies) were offered in combined proceedings. This would mean that, in addition to the said 2 GHz usage rights, assignments in other bands (800 MHz, 1800 MHz, 2.6 GHz) would also expire at the end of 2025, so that further proceedings on the future provision of these frequencies would in any case be inevitable before 2025.

220 There was criticism that the Bundesnetzagentur, by determining frequency bands for nationwide and regional applications even before the start of the demand identification proceedings, had decided on the volume of available spectrum and thus had a significant influence on the likelihood of a scarcity situation.

221 Finally, the lack of substitutability meant that a cumulative finding of scarcity was inadequate. For example, because of their disparate propagation properties and the at least medium-term differences in the usage scenarios (3G/LTE in 2 GHz vs 5G in 3.6 GHz), the 2 GHz and 3.6 GHz bands could not be substituted for each other. Consequently, demand forecasts for the two bands would have to be drawn up separately. It was therefore conceivable that there would be scarcity in one band but not in the other, and consequently award proceedings would take place for one of the bands but application proceedings for the other.

222 Award proceedings needed to be conducted if insufficient spectrum was available for assignment. According to case law from the Federal Administrative Court, the first step the Bundesnetzagentur needs to take in order to ascertain an excess of demand is to draw up a forecast basis. On that basis the regulatory authority would have to take a forecast decision as to whether the number of assignment applications to be entered would be in excess of the available spectrum at the time of assignment.

223 With regard to the 2 GHz bands still assigned for the period until 31 December 2025, it is not possible, according to respondents, for a forecast basis for a decision to be duly and correctly established. Interested companies were hardly able to particularise their requirements for the period as from 2026 – that is, about eight years beforehand – so precisely that an adequate forecast basis for a forecast decision could be established.

The Chamber has ruled as follows:

224 Based on the qualified notified demand of 30 September 2017 and taking account of the submissions made by interested parties and other parties affected on 20 December 2016 (Points of Orientation; cf procedure above), the Chamber is convinced that demand for frequencies in the 2 GHz and 3400 MHz- 3700 MHz bands referred to above exceeds the available spectrum and that these frequencies are therefore scarce resources within the meaning of section 55(10) first sentence, first alternative TKG.

225 Under section 55(10) first sentence TKG it may be ordered, without prejudice to section 55(5) TKG, that the assignment of frequencies be preceded by award proceedings based on conditions according to section 61 TKG as determined by the Chamber, when spectrum is scarce. The scarcity posited in the two alternatives set out in section 55(10) first sentence TKG can result from either the established fact of a surplus of applications (section 55(10) first sentence, second alternative) or the forecast of an insufficient number of frequencies being available (section 55(10) first sentence, first alternative).

226 In consideration of the wording of the law and of the connection between the two possible cases referred to in section 55(10) first sentence TKG, the forecast mentioned in the first alternative refers to a greater number of applications being made than frequencies are available at the time of assignment. This forecast is based on the Chamber's determination that the demand for spectrum exceeds supply.

227 To identify the demand, a tried and tested, informative, multi-stage procedure is available in the shape of demand identification proceedings. The procedure takes proper account of the criteria of objectivity, transparency and non-discrimination and grants

applicants equal opportunity for access to spectrum. With the demand identification proceedings the Chamber is making a public call for requirements for particular frequencies to be notified within a set period, paving the way for its decision on issuing an order for award proceedings.

228 Formal demand identification proceedings are not explicitly prescribed in section 55(10) TKG. Moreover, the Chamber draws on information that offers a comparable guarantee for the accurate recording of current frequency requirements and thus is no less suitable as a basis for a forecast of sufficient or possibly insufficient spectrum (cf also Federal Administrative Court Ruling 6 C 3.10, margin no 25). Scarcity is therefore not exclusively established and determined by the demand notified.

229 The Chamber held that it is appropriate and efficient to initiate, by its Key Elements of 27 June 2017, demand identification proceedings to determine spectrum demand in the 2 GHz and 3.6 GHz bands in order to ensure that frequencies are assigned in open, objective, transparent and non-discriminatory proceedings (for details see Key Elements paper of 27 June 2017, loc cit).

230 With regard to the comment that the demand identification proceedings were carried out at too early a date and therefore were an insecure foundation for a finding of scarcity, the Chamber wishes to point out :

231 The demand identification proceedings were carried out a relatively short time before expiry of the 2 GHz spectrum usage rights in 2020 (2 x 40 MHz) and the 3.6 GHz spectrum usage rights in 2021/2022. In the past, too, the demand identification and the award proceedings were conducted just two or three years before the end of the assignment period, in order to ensure conditions of investment and planning certainty. There are thus no signs here that too early a date was chosen. The same applies to the spectrum usage rights for the 2 GHz band which will only expire in 2025. These frequencies of 2 x 20 MHz size were included in the demand identification proceedings so as to give the companies the greatest possible planning and investment certainty, with particular reference to the introduction of new technologies – eg 5G. There is no indication here that the foundation is insecure.

232 The fact that assignees have to prepare a forecast now for their demand as from 2026 is also no argument against a combined provision of spectrum at an early date. It is not too much to expect an applicant to present and ensure an efficient use of spectrum for the full assignment period. Whether use is commenced at the same or different times because of varying terms is here of no relevance.

233 Taken altogether, the qualified notifications of demand exceed the volume of available spectrum in both the 2 GHz and the 3400 MHz – 3700 MHz bands. In the demand identification proceedings a number of companies notified the Bundesnetzagentur of qualified requirements, which result in excess demand in both bands. With regard to the comment that it was not clear either what the finding of scarcity was based on or in what frequency bands it was found to exist, the Chamber now states that scarcity was established in each band. The reasons why the qualified requirements and the excess demand cannot be published have to do with market structure and the protection of operational and trading secrets.

234 The basis for the finding of scarcity is the frequencies which are available for spectrum assignments on a nationwide basis (see spectrum availability). They are also what the Key Elements paper and the demand identification are based on, and thus the finding of scarcity. The Chamber makes 300 MHz available for nationwide assignment, although the propagation properties of the frequencies make them more suitable for local or regional network rollout (cf details of this in: subdivision of the 3.6 GHz band). The demand for nationwide assignments exceeds the amount of spectrum available for such assignment. The comment that there should be a check on whether scarcity would also

have occurred if 400 MHz had been provided in the 3.6 GHz band is therefore unconvincing. There is no sign here of an alleged regulation-induced scarcity.

235 With regard to the comment that the volume of available spectrum had been determined even before the start of the demand identification process and that significant influence had thus been exerted on the scarcity situation, the Chamber cannot agree. The Key Elements and the request for demand notification were based on the Points of Orientation. The purpose of the consultation was to identify and make available suitable frequencies at an early stage, particularly for the introduction of the next mobile generation, 5G. In view of the large number of conceivable spectrum uses, all interested companies were given the opportunity to explain their usage scenarios for the particular bands. In response to this consultation, demand was stated for both nationwide and regional assignments in the 3.6 GHz band. The Chamber therefore feels it is necessary to provide at any rate up to 100 MHz for regional assignments in an application procedure. There will thus be spectrum of 300 MHz available for nationwide and regional assignments in the 3.6 MHz band. No influence whatever was here exerted on the scarcity situation. These facts were presented openly and transparently in the context of the Key Elements and the process of identifying demand for nationwide assignmens. The Chamber takes a different view, namely that there would be a "regulation-induced" or "artificial" scarcity if 400 MHz had first been made available and then, based on an already known regional demand, only 300 MHz had been provided nationwide, after the identification of demand – and if scarcity had then been determined purely and simply on this basis.

236 In assessing frequency demand for MFCN, the Chamber took those requirements into account where the interested companies had demonstrated their demand for frequencies was plausible and serious in accordance with qualified demand identification proceedings. Therefore the Chamber's determination regarding the potential scarcity of spectrum was only based on notifications for which the interested companies clearly and conclusively demonstrated that they can ensure the efficient and interference-free use of the spectrum within the meaning of section 55(5) first sentence para 4 TKG at the time of assignment. This clear and conclusive account must cover both the subjective requirements of reliability, financial capability and specialist knowledge and the presentation of a convincing concept for intended use of the frequencies for assignment. Mere declarations of interest or the announcement of requirements are not sufficient for inclusion when demand is identified.

237 The Chamber consequently applied stringent criteria before notified requirements were included in demand identification proceedings, the aim being to ensure that notifications of demand are serious. In principle, requirements to be met by notifications in the demand identification proceedings were much the same as in a qualification procedure for an auction within the meaning of section 55(4) and (5) and section 61(4) third sentence TKG, without the need, however, to present applicable documentary evidence. The following was stated in the considerations of the Key Elements of 27 June 2017 (see Key Elements, loc cit, page 24):

> *"Particularly convincing, in line with the purpose of identifying demand, are notified requirements that also cover the objective and subjective criteria for future frequency assignment (section 55 subsections (3), (4) and (5) TKG) in setting out interest in a particular use. (...) This clear and conclusive account must cover both the subjective requirements of reliability, financial capability and specialist knowledge and the presentation of a convincing concept for intended use of the frequencies for assignment (...)."*

238 At this stage of the proceedings it would place an unreasonable burden on parties requesting assignment to expect them to provide evidence (such as financing commitments) in addition to plausible frequency requirements – not least on account of the cost of providing such evidence.

239 In this connection, the Chamber points out that the purpose of the notified requirements is to identify potential excess demand and the legally envisaged procedures which consequently arise for frequency assignments. Demand is identified in accordance with section 55 TKG and in non-discriminatory manner on the basis of transparent and objective procedures. It is essential that the Chamber can act on the basis of frequency requirements that are rooted in objective fact and reflect the actual requirements of the interested companies. The exercise of strategic influence on this objective procedure, or on the actual demand situation in the market, is therefore incompatible with the purpose of the demand identification proceedings.

240 The frequencies will be assigned by the Bundesnetzagentur only after written application and only after participation in award proceedings. The Bundesnetzagentur will issue a call to apply for admission to the award proceedings shortly before conducting proceedings, section 61(4) third sentence TKG. Applicants declaring their substantiated interest in specific use of the frequencies in the bands at 2 GHz and 3400 MHz - 3700 MHz at the stage of the demand identification proceedings already are also required under section 55(4) and (5) TKG to provide more detailed accounts and evidence of compliance with the legal requirements for assignment, section 61(4) fifth sentence TKG.

241 The Chamber considers all qualified notified requirements to be sufficiently informative for the purpose of forecasting that the number of applications should be expected to exceed the available frequencies in the 2 GHz and 3.6 GHz bands (cf section 55(10) first sentence, first alternative TKG).

242 The interested companies have presented clear and conclusive concepts in accordance with the demand identification proceedings (see Key Elements paper of 27 June 2017, loc cit).

243 After examining the notified requirements, the Chamber has reached the conclusion that total notified requirements exceed the frequencies available in the 2 GHz and 3400 - 3700 MHz bands.

244 The Chamber has taken the qualified requirements that have been notified and the resulting excess demand to be a sufficiently sound factual basis for its forecast decision. Accordingly, the Chamber assumes that there will not be enough suitable spectrum available for assignment. Following thorough verification of the facts of the case, the Chamber has based its forecast decision in accordance with section 55(10) first sentence, first alternative TKG on all the circumstances that are relevant for clarifying the availability of sufficient spectrum at the time of award.

245 Besides the demand identification proceedings, the President's Chamber has based its forecast of a potential excess demand for spectrum on other facts as well. These facts as set out below relate to the competitive environment, the expected increase in frequency usages, and the technical developments.

246 In a competitive environment, as in the case of MFCN as the basis for public mobile services, the assumption is that there is a high demand for spectrum resources. It must be assumed that mobile operators, when considering their spectrum requirements, do not only take account of technical aspects with respect to providing services for their customers. An operator's spectrum requirements are derived not only in absolute terms from the capacity requirements in the operator's own network, but also in relative terms by comparison with other market players' spectrum holdings. A better spectrum holding can result in a competitive advantage vis-à-vis other providers.

247 The capability of a mobile network is determined in particular by the spectrum holding as well as by the scope of the network build and the technology used. In light in particular of the development of the demand for mobile data services, each additional frequency block offers added value to the network operator, since the operator can use the

additional spectrum either to offer additional services or to improve the quality of a data service, for instance by increasing the data rate.

248 On account also of the rapid increase in capacity requirements, it can be assumed that there will be demand for additional spectrum. While the total spectrum available increased by around 20% in the period from 2010 to 2017, the volume of data traffic transported via mobile networks in the same period rose by more than 2000% from 65m gigabytes to 1,470m gigabytes (cf Bundesnetzagentur's Telecommunications Activity Report 2016/2017, page 40).

249 The demand for mobile data services with increasingly larger bandwidths will continue to rise in the future both worldwide and in Europe and Germany. Studies forecast a growth rate of around 45% for Europe in the subsequent years up to 2022 (cf Ericsson Mobility Report and Cisco Visual Networking Index). Simply increasing network density or using more efficient technology is not likely to be sufficient to provide the additional capacity required for this demand for data services. Thus a high demand for spectrum in the 2 GHz and 3.6 GHz bands is also likely on account of the higher capacity requirements.

250 The fact must also be taken into account that the 3.6 GHz band has been identified in Europe as a pioneer band for 5G applications. It is a key driver for the development of a standard needed for the provision of technology. In light of this, use of the band for broadband 5G applications in the near future is likely. The 3.6 GHz band has the advantage, compared to lower frequencies used for MFCN, of large, contiguous frequency blocks and is therefore especially suited to broadband radio applications. For this reason, a high demand for spectrum in this band is expected.

251 The 2 GHz band is currently used for UMTS and increasingly also for LTE systems. In the medium term, this spectrum will also be needed for future 5G applications. Thus both intensive UMTS usage and LTE usage via existing infrastructure and, consequently, a corresponding future interest in the frequencies in the 2 GHz band can be expected.

252 Thus not only the specific results of the demand identification proceedings, but also abstract technical and economic developments indicate that the demand for frequencies in the 2 GHz and 3400 MHz - 3700 MHz bands exceeds the available spectrum and that these frequencies are therefore scarce resources within the meaning of section 55(10) first sentence, first alternative TKG.

253 The assertion that specific notifications of demand were wrongly confused with demand forecasts cannot be accepted. On the basis of both the separate analysis of the results of the demand identification proceedings, together with other facts, and the overall picture, the Chamber has reached the conclusion that the number of applications must be expected to exceed the available spectrum in the 2 GHz band and the 3.6 GHz band.

254 The question can be left open as to whether the frequencies in the 2 GHz and 3400 MHz – 3700 MHz bands can be substituted for each other, since the Chamber has come to the conclusion that excess demand (or a number of applications that exceeds the amount of spectrum available) should be expected in both bands. The question of substitution capability is thus in the present case immaterial to the identification of scarcity.

255 With regard to the comment that no check can be made on the Chamber's decision regarding scarcity, the Chamber would like to point out that appeals can be lodged against the decision of the President's Chamber.

2.1.4 Order of award proceedings

The following comments were made:

256 Some of the comments expressed approval of the identification of scarcity and consequently the issue of an order of award proceedings. The order and selection of

proceedings for the award of spectrum in the 3400 MHz – 3700 MHz band was, they said, the logical next step.

257 Other respondents opposed the order of award proceedings.

258 A national Mobile Pact was proposed, like that currently agreed in France between the regulatory authority and the mobile operators. Every operator would receive a competitive spectrum package in the 2 GHz and 3.6 GHz bands. The spectrum could be provided by means of extension (that is, prolongation) of usage rights, invitation to tender, reservations of spectrum or a combination of these instruments. In return the operators could be required to fill in the white spots.

259 It would be consistent with the Bundesnetzagentur's administrative practice and also in the interest of the regulatory aims to refrain from award proceedings for the assignment of spectrum, even if it was scarce, and to use a discretionary decision instead. Reference was made to the GSM decision of 2005.

260 Provision of spectrum by way of prolonging rights or a spectrum reserve was felt to be distinctly better suited for the achievement of regulatory aims than award proceedings. It would prevent funds that were urgently needed for network rollout from being taken out of the market. The major beneficiary would be the consumer. It would also ensure that all operators had a spectrum package that would enable them to supply their customers with competitive products and services. Avoiding costly award proceedings would allow operators to optimise their investment in network rollout.

The Chamber has ruled as follows:

261 The order for award proceedings is issued in accordance with section 55(10), section 61, section 2(2) and (3) and section 55(4) and (5) TKG, to the effect that the assignment of spectrum for MFCN in the 2 GHz and 3400 MHz - 3700 MHz bands must be preceded by award proceedings.

262 Section 55(10) TKG states that the Bundesnetzagentur "may" order, without prejudice to subsection (5), that assignment be preceded by award proceedings according to section 61 TKG. The law makes provision for award proceedings to be ordered in the event of scarcity of spectrum.

263 The spectrum available for assignment in the 2 GHz and 3400 MHz – 3700 MHz bands is insufficient. On account of the scarcity identified in these bands, the law makes provision in section 55(10) TKG for award proceedings to be ordered.

264 In connection with this statutory provision the comment was submitted that for the Bundesnetzagentur to decide against award proceedings would be consistent with its own administrative practice and regulatory aims, even if there was a scarcity of spectrum. This however – in terms of administrative practice as well – applies only to exceptional cases. There are no grounds present, of sufficient nature and weight, that would justify departure from the standard procedure laid down in law.

265 Award proceedings are suited to ensuring fulfilment of the Bundesnetzagentur’s statutory task. In contrast, one of the comments called for a so-called "Mobile Pact"; one way of implementing it would be by prolonging spectrum usage rights. This however would not be equally well suited to securing the regulatory aims as set out in section 2(2) TKG. At any rate the President's Chamber does not see any grounds of sufficient nature and weight that would justify deciding against award proceedings for the spectrum in the 2 GHz and 3400 MHz – 3700 MHz bands.

266 Conducting award proceedings essentially meets the regulatory aims according to section 2(2) paras 1 and 2 TKG of safeguarding consumer interests with regard to the benefits for consumers in terms of choice, quality and price. Objective, transparent and non-discriminatory award proceedings are suited to encouraging competition, thus promoting the expansion of broadband infrastructure and the introduction of innovative 5G applications in line with mobile operators’ business models and demand. The

proceedings are the means by which consumer interests can be given the greatest possible consideration.

267 The order of award proceedings serves to ensure efficient use of spectrum as required in section 2(2) para 7 TKG.

268 The award proceedings are designed to create incentives for the prompt and efficient use of spectrum and hence provide consumers with affordable, innovative services (section 2(2) para 1 TKG). Prolonging the spectrum usage rights would not be as effective in ensuring swift broadband expansion (section 2(2) para 5 TKG). In this connection the comment was made that there were incentives to use spectrum efficiently and as fast as possible even without award proceedings. In its decision the Chamber did not disregard the fact that assignees could, irrespective of an award, have incentives to expand their mobile networks on the basis of their business models. One particular and significant incentive to do so could be infrastructure competition, which could be driven forward by means of additional base stations and the use of extra spectrum resources. However, spectrum is a limited resource and its efficient use and non-discriminatory provision must be secured. Prolonging the spectrum assignments could significantly reduce the incentive to expand the network, because there would be no competition for the requisite resource. Objective, transparent and non-discriminatory award proceedings provide an impetus that can stimulate competition and thus also the network rollout.

269 One of the questions that make a prolongation of rights a doubtful proposition is whether the volume of spectrum held by a particular assignee would in future still be exactly that needed for the assignee’s business model. Where this is not the case, there would be no incentive to use the "excess" spectrum for further network rollout. It could indeed encourage the hoarding of spectrum, with the unused frequencies being kept out of reach of potential users. Prolonging the rights would mean an administrative decision would determine whether and to what extent a party requesting assignment would receive spectrum. The point and purpose of award proceedings is to determine which such party will use spectrum efficiently. It should be made possible for all applicants, including possible newcomers to the market, to acquire spectrum in line with their business model.

270 With regard to the claim that award proceedings in auction form deprive the market of financial resources for network rollouts, the Chamber's position is as follows:

271 Past auctions offer no support for this argument. There is nothing to indicate that companies which have invested large sums in the acquisition of spectrum then invest less in network rollout than companies which have acquired fewer spectrum usage rights with correspondingly lower payment obligations.

272 It should also be noted that payment obligations resulting from past award proceedings probably play a subordinate role, measured against total turnover, and are thus not likely to be pivotal in deciding on investment in network rollout. Two auctions have been held in the last eight years, with total proceeds of 9.4bn euros. Total turnover in the mobile business came to more than 200bn euros in the same period, which means the operators' auction costs were less than 5 percent of total turnover (see the Bundes-netzagentur's Telecommunications Activity Reports for 2014/2015 and 2016/2017). In the Chamber's opinion the decisive factors for investment in network rollout are the company's business model, general demand trends and the level of competition on the market.

273 It should moreover be pointed out that a prolongation of usage rights for the lucrative frequencies in question here would also require payment of substantial amounts.

274 It was asserted that refarming could also be carried out without award proceedings. Here the Chamber would point out that the combined award of spectrum in the 2 GHz band is appropriate (cf timing of the order). Refarming the 2 GHz and 3.6 GHz bands is desirable

from a regulatory viewpoint so as to create, at the earliest possible opportunity, potential for innovation that would not be ensured should individual assignments be prolonged.

275 Award proceedings also contribute to achieving the regulatory aim of securing fair competition and promoting sustainable competitive markets (section 2(2) para 2 TKG). Award proceedings are objective, open, transparent and non-discriminatory proceedings which will provide both the current mobile operators and new entrants with equal access to spectrum resources to accommodate their business models. Fair competition for both existing market participants and new entrants can most notably be secured by means of award proceedings based on suitable rules. Prolonging the frequency assignments would not give new entrants access to the spectrum. Given the change in the market structure especially, access to spectrum resources needs to be guaranteed in open, transparent and non-discriminatory proceedings to promote competition in infrastructure and services.

276 Even though – as noted by some respondents – no new entrant has entered the market in recent years, the proceedings must still be designed to take potential new entrants into consideration. This is a logical consequence of having objective, transparent and non-discriminatory proceedings. The fact that there have been no successful new entries to the market in the recent past does not mean that new entrants have no interest in the proceedings. It should also be borne in mind that their interest may well be dependent on the rules applied in the proceedings. As against that, the announcement of an intention to prolong spectrum usage rights could deter potential new entrants at an early stage.

277 To promote sustainable competitive markets, as set forth in section 2(2) para 2 TKG the framework and procedural conditions – when providing spectrum to competitors as well – must be designed so as to enable well-functioning competition to be maintained and strengthened in as many areas as possible. Award proceedings are suited to preventing potential competitive disadvantages in respect of spectrum packages. Unlike the option of prolonging spectrum usage rights, award proceedings will enable existing network operators to adapt their spectrum packages in response to the changing market conditions and in line with their business models.

278 By way of contrast, some of the respondents proposed that each existing mobile operator should receive a spectrum package – or at least a spectrum reserve – in order to offer competitive products. This is an argument which the Chamber cannot accept, one reason being the points made above regarding the incentives for network rollout. As stated before, one purpose of the award proceedings is to scrutinise the allocation of expiring spectrum usage rights in objective, transparent and non-discriminatory proceedings. A prolongation of rights, on the other hand, or a comparable individual assignment of scarce resources would raise the question of how the spectrum package proposed should be shaped so as to enable competitive products to be offered. There could be wide differences, depending on operator and business model. This would involve an element of discrimination and compromise the regulatory aims set forth in section 2(2) TKG.

279 The Chamber is equally unconvinced by the proposal of rights prolongation or individual assignment in certain cases along the lines of a spectrum reserve. Circumstances of appropriate nature or sufficient weight in support of a spectrum reserve have not come to the Bundesnetzagentur's notice. The fact is that all current mobile operators have spectrum in the bands above and below 1GHz, so there is no need to be apprehensive about the asserted irreversible disadvantages for operators and, in due course, consumers.

280 Award proceedings accommodate the regulatory aim of expediting the rollout of high-speed next-generation public telecommunications networks (section 2(2) para 5 TKG). Providing spectrum on a technology-neutral basis in award proceedings will create incentives to encourage prompt and efficient use of the spectrum for high-speed mobile broadband networks. Prolonging usage rights would not be as effective in ensuring the

swift rollout of high-speed next-generation public telecommunications networks. A suitable channel arrangement based on 5 MHz or multiples of this is conducive to broadband rollout and would not be available should the usage rights for the 2 GHz band be prolonged.

281 Award proceedings are suited to securing efficient spectrum use as envisaged in section 2(2) para 7 TKG. Award proceedings can serve to determine which of the parties seeking assignment are best placed to make efficient use of the spectrum to be assigned. Just how to determine whether an assignee is suitable in this sense is a matter which depends on the type of proceedings and the rules applied. As explained above, however, the fact that the proceedings are in competitive form creates incentives for network rollout, which in turn promotes the efficient use of spectrum.

282 The Chamber also wishes to make the following point: a so-called "Mobile Pact" – as called for in the comments – is not equally suited to pursuing the regulatory aims set forth in the TKG. It would mean that all or part of the scarce spectrum available would be excluded from competition-based proceedings. This could result in a foreclosure of the market (a "closed shop“) and raise questions of telecommunications law and cartel law. The TKG lays down that the Bundesnetzagentur must take decisions through its Ruling Chambers by way of an administrative act (section 132(1) 2nd sentence TKG). Awarding spectrum on the basis of a contract in public law would therefore be foreign to the essence of the TKG.

2.2 Re II: Choice of award proceedings as provided for by section 61(1) TKG

The following comments were made:

283 There was strong majority support for the choice of award proceedings. It was pointed out in this connection that it was extremely important to use the proceedings that had proved to be tried and trusted in 2010 and 2015.

284 Award proceedings in auction form could in principle, it was said, take account of the regulatory aims for consumer interests under section 2(2) para 1 and 2 TKG in respect of choice, quality and price advantages.

285 Auction proceedings were suited to the task of determining spectrum value objectively with due regard for the relevant external factors. In addition, the procedures employed would create incentives for using spectrum efficiently and as quickly as possible, so as to provide consumers with innovative services at affordable prices. In particular, the constraints related to spectrum assignment should also be designated as external factors in award proceedings. Desirable factors such as competition over the conditions of shared use of spectrum, the possibilities for regional spectrum use, filling white spots, offers tailored to demand, and the cooperation of all operators in closing gaps had an influence on the assessment of frequency value.

286 The conditions of an auction made it possible for every participant to take the constraints attached to the award of spectrum into account. It was thus possible for a competitive price to be found for the scarce spectrum resources.

287 Tender proceedings did not represent an alternative. Auction proceedings should however not be organised or structured in such a way as to maximise state revenues, even if the revenues were, in certain cases, earmarked for broadband rollout. The fact that the bulk of the proceeds went to the funding of Deutsche Telekom's broadband rollout – and thus to a highly probable participant in possibly forthcoming auction proceedings – itself had the effect of distorting competition during auction proceedings and tended to result in higher bids.

288 The draft document for consultation referred to the explanatory memorandum of the 2004 TKG, from which it concluded that auction proceedings were suited to promoting optimal and economical use of spectrum resources. This was in effect an attempt to counter present-day challenges relating to spectrum regulation with out-dated

approaches, without stopping to ask whether such a stance had in the past achieved the effect hoped for.

289 There was therefore, in particular, no substance to the argument that a successful bid proved that the company was ready and able to make optimal use of the spectrum to be assigned and would seek to ensure cost-effective and economical use. This standpoint ignored the fact that the course taken by the past spectrum auctions in 2010 and 2015 was determined less by rational, technical and economic considerations than by the needs of strategic bidding. The result was predatory competition aimed at achieving a strategic edge over rival companies on the downstream retail markets, which could also have the particular effect that, taking the economy as a whole, spectrum was being used neither economically nor efficiently. A reduction in the level of competition would, moreover, hardly be in the interest of consumers.

290 Furthermore, the factor that decided how quickly assigned spectrum was used was the funds available. Cost-intensive award proceedings, by taking investment resources out of the market, were detrimental to the speed of network rollout and thus in conflict with the aim of upholding consumer interests.

The Chamber has ruled as follows:

291 The Chamber is ordering that assignment of the spectrum in the 2 GHz and 3400 MHz - 3700 MHz bands be preceded by auction proceedings, section 61(1) and (2) TKG.

292 Auction proceedings secure the regulatory aims set out in section 2(2) TKG. Under section 61(1) first sentence TKG, award proceedings may take the form of auction or tendering proceedings. According to section 61(2) first sentence TKG, as a general rule auction proceedings as laid down in section 61(4) TKG are to be conducted except where an auction is not likely to secure the regulatory aims as set out in section 2(2) TKG. Thus there remains no scope for discretion as far as the legal consequences are concerned. On this the Federal Administrative Court has stated the following (cf Federal Administrative Court Ruling 6 C 13/11 of 10 October 2012, margin no 33):

> *"The Bundesnetzagentur does not have any discretionary powers in determining the proceedings given that, under section 61(2) first sentence TKG, auction proceedings are to be conducted as a general rule except where such proceedings are not likely to secure the regulatory aims. In this respect, however, the Bundesnetzagentur does have certain scope for discretion as far as the factual elements of the norm are concerned. This is justified by the need for a complex process of weighing up the regulatory aims and balancing out conflicting public and private interests to determine the suitability or lack of suitability of auction proceedings.“*

293 Under the regime framed by by the statutory regulations, section 61(2) first sentence TKG establishes auction proceedings as the rule to which exceptions may be made. The wording of the law expressly states that "as a general rule" auction proceedings are to be conducted, except where such proceedings are not likely to secure the regulatory aims according to section 2(2) TKG. Auction proceedings can achieve the statutory aim of award proceedings, namely to select those bidders who are best placed to use the spectrum efficiently. The explanatory notes to section 61(4) TKG (section 59(5) of the government draft of 2004, Bundesrat printed paper 755/03, page 109) state the following in this context:

> "*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*."

294 The Chamber's position in this connection is that the purpose of the auction proceedings is to determine which bidder is best placed to use the spectrum efficiently. The auction proceedings provided for in the Telecommunications Act are not – contrary to the view expressed by some respondents – directed at making or maximising a profit. As for comments that costly auction proceedings deprived the market of investment resources, slowed down the rollout of networks and were thus in conflict with the aim of upholding consumers' interests, the Chamber points out that:

295 Past auctions do not support the respondents' argument. There is nothing to indicate that companies which have invested large sums in the acquisition of spectrum then invest less in network rollout than companies which have acquired fewer spectrum usage rights with correspondingly lower payment obligations.

296 It should also be noted that payment obligations resulting from past award proceedings probably play a subordinate role, measured against total turnover, and are thus not likely to be pivotal in deciding on investment in network rollout. Two auctions have been held in the last eight years, with total proceeds of 9.4bn euros. Total turnover in the mobile business came to more than 200bn euros in the same period, which means the operators' auction costs were less than 5 percent of total turnover (see the Bundesnetzagentur's Telecommunications Activity Reports for 2014/2015 and 2016/2017). In the Chamber's opinion the decisive factors for investment in network rollout are the company's business model, general demand trends and the level of competition on the market.

297 It is therefore not apparent that auction proceedings will lead to any of the disadvantages asserted by respondents for broadband rollout by taking away funds needed for network rollout.

298 According to section 61(2) second sentence TKG, auction proceedings may not be suited to securing the regulatory aims where spectrum has already been assigned without auction proceedings for the usage designated in the Frequency Plan or where an applicant can demonstrate a preference on the basis of statutory provisions for the spectrum to be assigned. While the two cases given as examples are not exhaustive ("in particular"), they are also not obligatory ("may"). Their occurrence may generally mean that auction proceedings may not be suited, but by no means necessarily lead to the inadmissibility of auction proceedings. Given particular reasons, the decision in favour of auction proceedings can nevertheless be justified.

299 All the spectrum made available for award for mobile broadband has so far been awarded in auction proceedings. A preference on the basis of statutory provisions as referred to in section 61(2) second sentence TKG is also not apparent here.

300 Auction proceedings are also suited to securing the regulatory aims as set out in section 2(2) TKG.

301 Auction proceedings constitute objective, open, transparent and non-discriminatory proceedings for the reallocation of spectrum in a competitive environment. Auction proceedings in particular accommodate the mandate to ensure the availability of infrastructure as set out in Article 87f of the Basic Law while promoting sustainable competitive markets for telecommunications services and networks in rural areas as well.

302 One of the comments made was that auction proceedings did not safeguard consumer interests. The Chamber's position is that auction proceedings are the appropriate award proceedings in terms of the regulatory aim of safeguarding consumer interests as set out in section 2(2) para 1 TKG. Awarding spectrum in incentive-based auction proceedings enables optimal spectrum allocation and gives the operators maximum flexibility to accommodate their own business models and meet the interests of consumers in terms of price, quality and choice. Awarding the spectrum in auction proceedings creates

incentives to encourage prompt use of the spectrum for the provision of innovative services in a competitive environment in the interest of the consumers.

303 In response to the arguments that auction proceedings were also guided by strategic motives which aimed at pushing rivals out of the market and that in the end this was of no benefit to consumers, the Chamber points out that:

304 A relatively large quantity of spectrum is made available. A large quantity enables as many bidders as possible to acquire spectrum for their business models. If one assumes that the first frequency block obtained at auction has the greatest value for the bidder and that subsequent blocks have less value, every further block makes it less likely that a block of spectrum will be acquired purely for the purpose of driving out a business rival. In the event of conduct in breach of bidding strategy rules, the total price, including that for the spectrum needed in any circumstances, would be raised disproportionately (demand reduction effect).

305 The drafting of award conditions and auction rules is however a matter dealt with in other decisions of the President's Chamber (Decisions III and IV). Their aim is to put a stop, as far as possible, to the violation of rules to the detriment of third parties. The Chamber intends to take up the suggestion of respondents and make use of the proven rules applied at the last auction proceedings.

306 Auction proceedings are the appropriate award proceedings in terms of the regulatory aim of securing fair competition and promoting sustainable competitive markets for telecommunications services and networks and for associated facilities and services, in rural areas as well, as set out in section 2(2) para 2 TKG. Auction proceedings provide both existing mobile operators and new entrants with equal access to the spectrum resources in open, non-discriminatory and transparent proceedings in the interest of the consumers. Auction proceedings provide maximum transparency and flexibility for all bidders in respect of the value and usage interdependencies between the various bands at 2 GHz and 3400 MHz - 3700 MHz.

307 It was asserted by respondents that the possible financing of broadband funding would entail the bulk of the auction proceeds going to one potential bidder and that this would have a disruptive effect on competition during the auction proceedings. In reply the Chamber must make it clear that the federal funding programme is designed to be technologically neutral. It is therefore open to every operator to push ahead with broadband rollout and to receive funding from public broadband funding. The Bundesnetzagentur is not responsible for the structuring and award of the funds.

308 Auction proceedings are in particular suited to securing fair competition and promoting sustainable competitive markets. Auction proceedings provide both existing mobile operators and new entrants with non-discriminatory access to the spectrum resources.

309 Auction proceedings are suited to expediting the rollout of high-speed next-generation telecommunications networks as envisaged in section 2(2) para 5 TKG. The successful bids in an auction create incentives to encourage prompt use of the spectrum for mobile broadband in line with demand, enabling the costs of purchasing the spectrum to be recouped as quickly as possible.

310 Auction proceedings are suited to ensuring efficient spectrum use as envisaged in section 2(2) para 7 TKG. Auction proceedings are suited to promoting optimal and economical use of the resources and create incentives to encourage the use of the most efficient possible radio systems and consequently the best possible use of the spectrum resources in a competitive environment.

Information on legal remedies

Actions against this notice may be filed with the administrative court in Cologne, Appelhofplatz, 50667 Köln, Federal Republic of Germany. The action must state the appellant, the respondent and the matter to which the action relates. It should specify the remedy pursued and state the facts and evidence justifying the action. Under section 137(1) TKG legal actions do not have suspensory effect.

The action and all supporting documents should be accompanied by a sufficient number of copies for all parties concerned.

Bundesnetzagentur für Elektrizität, Gas,
Telekommunikation, Post und Eisenbahnen

The President's Chamber

Bonn, 14 May 2018

Dr. Eschweiler	Homann	Franke
Vice Chair	Chair	Vice Chair

* In case of divergent interpretation of the German and English text, the German text shall prevail.

Abbreviations

5G	5th generation of mobile communications/wireless systems
AAS	Active Antenna System (defined in the latest draft of the CEPT Report 67 as: "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, e.g. a narrow beam towards a user.")
ABl.	Official Gazette of the Bundesnetzagentur
BEM	Block Edge Mask
BKG	Federal Agency for Cartography and Geodesy
BOS	Public protection and disaster relief agencies
BWA	Broadband Wireless Access
CEPT	Conférence Européenne des Administrations des Postes et des Télécommunications / 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 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 and 9.1.8)
eMBB	Enhanced Mobile Broadband
EU	European Union
FDD	Frequency Division Duplex
FS	Fixed Services
FSS	Fixed Satellite Services
GHz	Gigahertz (unit of frequency)
GOW	Geodetic Observatory Wettzell
IMT	International Mobile Telecommunications
IoT	Internet of Things
IT	Information Technology
ITU / ITU-R	International Telecommunication Union (in the radiocommunication sector – ITU R for short – there is discussion of technical developments in radio-communications, reports are compiled and recommendations issued to the administrations.)
kHz	Kilohertz (unit of frequency)
KMU	Small and medium-sized enterprise (SME)
LTE	Long Term Evolution (4th generation mobile technology)

M2M	Machine-to-Machine
MFCN	Mobile/Fixed Communications Networks
MHz	Megahertz (unit of frequency)
MNO	Mobile Network Operator
MSS	Mobile Satellite Services
MVNO	Mobile Virtual Network Operators
OFDM	Orthogonal Frequency-Division Multiplexing
PMSE	Programme making and special events (radio applications supporting audio and video transmissions for programme making and special events)
RSPG	Radio Spectrum Policy Group (high-level advisory group that assists the European Commission in the development of radio spectrum policy)
SDL	Supplementary Downlink (frequency used in connection with other mobile frequency bands to support additional data transmissions from base stations to terminal equipment)
TDD	Time Division Duplex
TK	Telecommunications
TKG	Telecommunications Act
TRP	Total Radiated Power
UMTS	Universal Mobile Telecommunications (3rd generation mobile technology)
WLL	Wireless Local Loop (point-to-multipoint radio relay)
WRC	World Radiocommunication Conference