

Consultation regarding assignment of licences in the 700 MHz band

Consultation from 31 January 2018 to 23 February 2018

PTS intends to hold a spectrum auction for available frequencies in the 700 MHz band (694–790 MHz). This consultation provides stakeholders with the opportunity to submit their views at an early stage of the planned procedure.

Comments are to be submitted in writing to 700MHzbandet@pts.se no later than 23 February 2018.

1. Objective of the assignment

The PTS Board of Directors has decided the following objectives for the assignment:

- a. The overall objective for the assignment is to prepare and implement assignment of block licences through a selection procedure focusing on making 2×20 MHz plus 20 MHz in the 694–790 MHz band available for mobile broadband. This is to be possible no later than during the first quarter of 2019.
- b. The assignment of licenses in the frequency band shall contribute to maximising the societal benefit over time. Among other things, this means the ability to use assigned spectrum effectively. It also means that the conditions and rules set for the licences and the assignment are not more limiting than necessary to achieve the objectives.
- c. According to the PTS Spectrum Strategy, PTS' selection procedures prioritise preserving or improving competition and coverage. The assignment is also to ensure that the common spectrum resource yields the corresponding value for the general public.

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- d. The assignment of the frequencies shall improve coverage that enables the using of different applications in areas where people normally stay or travel through, but where there is no coverage at all (today and probably also at the time of assignment) or where coverage and capacity do not correspond to user demand regarding basic mobile communication with a data rate of at least 10 Mbit/s.
- e. The use of terrestrial television broadcasting shall continue to enjoy relevant and adequate protection following the assignment.

The objectives have been adopted on the basis of the Government's goals formulated in the broadband strategy presented by the Government on 18 December 2016. The broadband strategy, *A Completely Connected Sweden by 2025 – a Broadband Strategy*¹, contains a mobility goal stating that all of Sweden should have access to reliable and high-quality mobile services by the year 2023.

2. Time schedule

The preliminary time schedule for assignment contains the following reference dates:

23 February 2018	Consultation response deadline
April 2018	Draft decision on the limitation of the numbers of licences in the 700 MHz band and open invitation to apply circulated for comment
4 July 2018	Decision on the limitation of the numbers of licences in the 700 MHz band and open invitation to apply
4 December 2018	Start of auction
January 2019	Licences assigned

¹ Reference number: N2016/08008/D

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3. Geographical extent of the licences

PTS intends to assign national block licences in the 700 MHz band.

The frequency band 700 MHz is an EU harmonised band for terrestrial systems capable of providing wireless broadband electronic communications services. The band has good propagation characteristics and could improve coverage for mobile telephony and mobile broadband in Sweden.

Deployment with many radio transmitters in order to achieve good mobile coverage is normally done most effectively if the licence holder is given responsibility for frequency planning. This focus is also in line with the PTS Spectrum Strategy.² Therefore, in order to make the best use of the opportunities of the 700 MHz band, PTS intends to assign national block licences in the available frequency range.

4. Scope of licences (frequency blocks)

PTS intends to assign available frequency blocks in the 700 MHz band as follows:

Two licences of 2×5 MHz and for FDD (Frequency Division Duplex), exemplified as FDD1 and FDD2 with green in the image below.

One licence of 2×10 MHz for FDD with a coverage and deployment requirement, exemplified as FDD3 with pink in the image below.

Four licences of 1×5 MHz and for SDL (Supplemental Down Link), shown as SDL1-4 with purple in the image below.

The placing of the blocks might be determined in the auction (see Section 7).

694-703	703-708	708-713	713-718	718-723	723-728	728-733	733-738	738-743	743-748	748-753	753-758	758-763	763-768	768-773	773-778	778-783	783-788	788-791
Skyddsband	Marksänd tv tom 2018-12-31	FDD1	FDD2	FDD3		SDL1	SDL2	SDL3	SDL4	Marksänd tv tom 2018-12-31	FDD1'	FDD2'	FDD3'					

In accordance with the PTS Spectrum Strategy, the block size and channel plan should facilitate both current and potential future usage. A block size of 2×5 MHz is an accepted and standardised minimum building block to provide for possible technologies in these regards. It is PTS' assessment that 2×5 MHz

² PTS-ER-2014:16 PTS Spectrum Strategy

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blocks yield the best conditions for an effective use of the frequency range in the 700 MHz band. Individual bidders in the auction thereby have an opportunity to ensure that their own operational needs are satisfied by choosing between bidding for one or more blocks.

With reference to the opportunities of the 700 MHz band to contribute to good coverage for mobile telephony and broadband services, PTS wants to create the best circumstances for being able to fulfil the conditions of the coverage and deployment requirement. The licence that is associated with a coverage and deployment requirement is therefore proposed to cover 2×10 MHz.

5. Term of licence

PTS intends to set the term of licence up to and including 31 December 2040.
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Based on an overall assessment of demand, commercial life span, technological development and investment period, PTS makes the assessment that 20–25 years can be considered a well-balanced term of licence for the 700 MHz band. A term of licence of 20–25 years is a sufficiently long period to create a real demand, and for an undertaking to get a return on their investment. At the same time, a term of licence of 20–25 years is a sufficiently short period for a possibly limited commercial life span and an expected accelerating technological development.

In PTS' assessment, a term of licence set at 20–25 years is suitable, primarily in order to give the licence holder a sufficient investment security. The period of validity is also calculated to spread out the licence expiry dates for mobile broadband operating in different frequency bands.

In each selection procedure, PTS can make adjustments to preserve or improve competition and coverage. From this perspective, it is advantageous if the terms of licence for block licences in different frequency bands up for assignment expire at least one year apart, as this allows both PTS and the stakeholders to adapt their actions according to earlier assignments. A term of licence running until 31 December 2040 ensures an even flow of spectrum assignments.

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6. Requirement for coverage and deployment

PTS intends to set a coverage and deployment requirement for a licence of 2×10 MHz.

a. Purpose

The purpose of the coverage and deployment requirement is to improve the outdoor coverage of voice and data services (at least 10 Mbit/s) in areas where there are consumers^{3,4}. The deployment is however also expected to lead to improved indoor coverage near the new mast sites.

On 18 December 2016, the Government presented a new broadband strategy, *A Completely Connected Sweden by 2025 – a Broadband Strategy*⁵. This contains, inter alia, a mobility goal stating that all of Sweden should have access to reliable and high-quality mobile services by the year 2023. The mobility goal is designed to meet the expected demand for broadband that people might reasonably have outside the home or workplace.

As can be seen from the PTS report on the government commission to investigate future usage of the 700 MHz band⁶, PTS considers it justified to set a coverage and deployment requirement for a licence in the 700 MHz band, primarily with the aim of increasing access to mobile communication services in areas where there are consumers. Henceforth, this document will refer to *coverage and deployment requirement as coverage requirement*. The word *coverage requirement* thus also encompasses deployment.

A coverage requirement should therefore be specified in accordance with the following points of departure.

- The outdoor mobile area coverage for voice and data services (at least 10 Mbit/s) is to be improved in areas where consumers usually are staying.
- The requirement is only to include areas where there is currently no commercial interest in expanding mobile communication infrastructure.
- Areas where improved coverage yields the greatest consumer benefit and where infrastructure investments lead to the greatest societal benefit are to be prioritised.
- The effects shall be measurable and possible to follow up.

³ When PTS uses the term consumer in this consultation document, it includes all users of the services that may be facilitated using the assigned frequencies.

⁴ The coverage requirement contributes to achieve the Government's mobility goal, which is stated in "A Completely Connected Sweden by 2025 – a Broadband Strategy".

⁵ Reference number: N2016/08008/D

⁶ PTS-ER-2015:15

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In order to achieve the purpose of the coverage requirement based on the points of departure above, the proposal is to prioritise areas around roads, areas where consumers live and work as well as where there are concentrations of holiday homes. PTS has therefore defined a number of prioritised areas, which are described in more detail later on in this document.

Even if the coverage and deployment requirement is intended to improve outdoor coverage for voice and data services (at least 10 Mbit/s) in areas where there are consumers, the new mast sites are also expected to lead to an improved indoor coverage in the surrounding area.

b. Coverage requirement specifications

PTS will set a maximum amount for coverage, the cap amount. Winning bids up to no higher than the cap amount constitute the coverage requirement amount. This amount shall be used by the licence holder to deploy new masts. If a winning bid exceeds the cap amount, the excess is to be paid in the form of auction proceeds.

The bidder who obtains a licence associated with a coverage requirement shall cover a selection of the prioritised areas, chosen independently by the licence holder, until the coverage requirement amount has been exhausted. The requirement should be specified like this to enable it to be fulfilled in an effective manner.

PTS intends to specify the coverage requirement in the following way:

- By establishing new masts, the licence holder shall achieve new coverage within prioritised areas.
- The licence holder may independently choose where to place the new masts. A selection of the prioritised areas shall be covered until the coverage requirement amount has been exhausted.
- Voice and data services (at least 10 Mbit/s) shall be provided.
- The cost of newly established masts will be allowed to be deducted from the coverage requirement amount, in accordance with the terms and conditions.
- The cost of establishing new masts shall be distributed over the counties in accordance with a previously defined plan.
- The coverage requirement may be fulfilled through the use of other, already assigned frequency bands (harmonised within the EU for wireless broadband services) with equivalent performance and capacity.
- The coverage requirement shall be completely fulfilled no later than 2024.

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c. Method to define prioritised areas

The total coverage provided by mobile operators is to form the basis for analysing the existing coverage, with the exception of coverage from the 450 MHz band. The data PTS uses for this is the total coverage reported by the mobile operators in the annual survey of access to mobile communication networks.

PTS intends to identify gaps in the coverage on two levels: areas that lack outdoor coverage for voice and data, and areas that lack outdoor coverage for data. In both cases, the assumption is that a handheld terminal is used.

Gaps in the coverage located near a road, household, enterprise or holiday home constitute areas that are to be prioritised. When it comes to areas where outdoor coverage for voice and data is lacking, PTS is proposing that the criteria to prioritise them should be that there is a road within 1 km *or* that there are households, enterprises or holiday homes nearby. When it comes to areas where there is a lack of data coverage, they are proposed to be prioritised when there is a road within 1 km *and* there are households, enterprises or holiday homes nearby. Since data coverage requires a higher signal strength than voice services, the areas without data coverage also include areas that have outdoor voice coverage. PTS is therefore of the opinion that it is not proportional to require new mast sites where there is already outdoor voice coverage, unless there are any permanent residents or holiday homes nearby.

A certain part of the coverage requirement amount shall be used for providing coverage within prioritised areas that lack outdoor coverage for voice and data services (10 Mbit/s), prioritised area – type 1. The remainder of the coverage requirement amount may also be used within prioritised areas that only lack outdoor coverage for data services (10 Mbit/s), prioritised area – type 2.

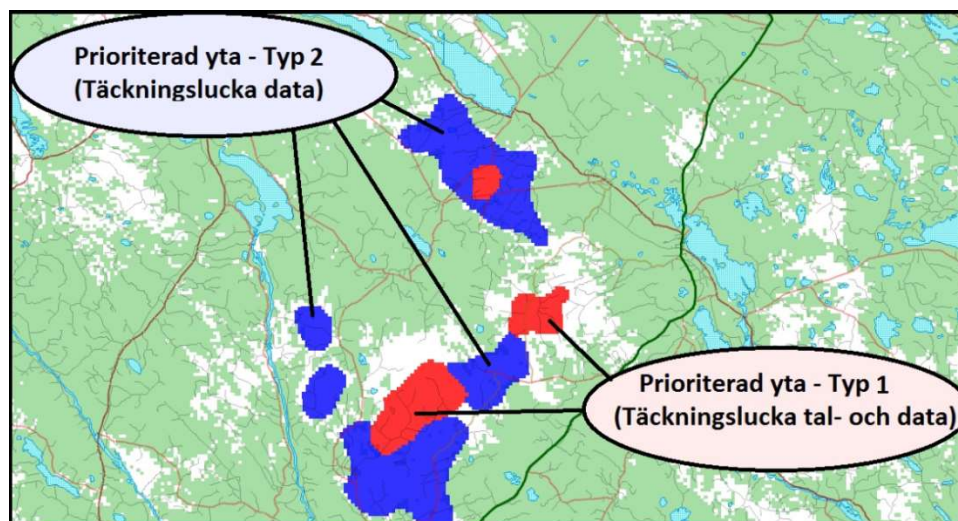


Figure 1: Example of what the prioritised areas might look like. The red area represents prioritised area type 1 (area that lacks coverage for voice and data services), the blue area represents prioritised area type 2 (area that lacks coverage for data services).

The prioritised areas will be presented in the consultation on the draft decision on the limitation of the numbers of licences and open invitation, and may come to be revised. The areas will be finally presented in the decision on the limitation of the numbers of licences and open invitation to apply.

d. County-wise distribution of the coverage requirement amount

The proportion of prioritised areas differs from county to county. 50 per cent of the coverage requirement amount is to be distributed over the counties that have the highest proportion of prioritised areas. These 50 per cent are to be distributed proportionally between the counties according to the prioritised areas in each county. The county-wise distribution ensures that the licence holder will not concentrate the deployment to some counties, but will construct coverage in all counties with a large proportion of prioritised areas.

e. Requirement for new masts

The coverage requirement shall primarily be realised through the establishment of new masts. Within the scope of the coverage requirement, co-location is not allowed in existing mobile masts, whose coverage has constituted a basis for identifying the prioritised areas. Co-location into another, existing infrastructure may only occur if this constitutes a more cost-effective alternative.

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f. Permitted to use other frequency bands

It shall be allowed to fulfil the coverage requirement by expanding into other, already assigned frequency bands under certain circumstances. Frequency bands that may be considered shall be harmonised within the EU for wireless broadband services and have a performance⁷ and a capacity that corresponds at least to what can be achieved by using 2×10 MHz LTE with 2×2 MIMO in the 700 MHz band.

g. Requirement for access to voice and data services (at least 10 Mbit/s).

The requirement for access to voice services means that it shall be possible to use a handheld terminal to connect a call outdoors, and that the connection can be maintained with good voice quality without being cut off. When using other, already assigned frequency bands, the requirement regarding coverage for voice services may also be realised through the use of current voice telephony technologies such as GSM, WCDMA or VoLTE.

The requirement for access to data services means that it shall be possible to use a handheld terminal to receive data at a rate of at least 10 Mbit/s and to send data. The minimum rate of 10 Mbit/s is an estimate of the downlink bit rate that a consumer can typically expect under normal network load conditions. Capacity and performance⁸ within the coverage area shall at least correspond to 2×10 MHz LTE with 2×2 MIMO in the 700 MHz band.

h. Deduction model

After having verified deployment in the prioritised areas, the licence holder may deduct the investments from the coverage requirement amount.

For every new mast which has been established as a result of the coverage requirement, and which has been approved by PTS, the licence holder may deduct a standard amount. In addition to the standard amount, the licence holder may deduct their actual costs for connection to the electricity grid, i.e. the connection fee invoiced by the grid operator in question, up to an amount set by PTS. Apart from the standard amount and actual costs for connection to the electricity grid, licence holders may not deduct any further costs.

⁷ As regards speed and latency.

⁸ As regards speed and latency.

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In order for a mast to be deducted from the coverage requirement amount, it must be operational and provide coverage according to certain conditions that will be presented in the consultation on the draft decision on the limitation of the numbers of licences and open invitation to apply, and may come to be revised.

i. The coverage requirement shall be fulfilled no later than 2024

The coverage requirement shall be fulfilled no later than 31 December 2024. A gradual deployment is to take place according to the following model:

<i>2019–2023:</i>	<i>Deployment plan including nominal radio plan</i>
<i>31 Dec. 2021:</i>	<i>25 % of the amount for prioritised areas</i>
<i>31 Dec. 2022:</i>	<i>50 % of the amount for prioritised areas</i>
<i>31 Dec. 2023:</i>	<i>75 % of the amount for prioritised areas</i>
<i>31 Dec. 2024:</i>	<i>100 % of the amount for prioritised areas</i>

In order to ensure that the schedule is followed, PTS intends to request reports from the licence holder at regular intervals in regard to the deployment plans on which the coverage requirement deployment will be based.

7. Assignment method

a. Auction format

PTS intends to assign block licences in the 700 MHz band through a simultaneous multi-round auction (SMRA) with a right to switch bids.

For licences with a coverage requirement, bids up to the cap amount are not to be paid in the form of auction proceeds.

PTS is investigating the possibility of holding the auction with frequency generic blocks, with licence placement being decided according to special rules.

PTS is of the opinion that an auction in multiple rounds is suitable for this assignment since it makes the bidders aware of how other bidders value the objects in the auction (price discovery). The fact that there are several different types of objects to be auctioned (FDD blocks with and without a coverage requirement, and SDL) also makes a Simultaneous Multi-Round Auction (SMRA) more suitable than other auction formats (e.g. clock auction),

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SMRA with a right to switch bids has previously been used by PTS in spectrum auctions (the 2,6 GHz and 800 MHz bands), for which reason several market undertakings have knowledge of this auction format. A limited right to switch bids between the objects allows bidders to move their bids between objects when they change price, but still binds the bidders to their bid if they have obtained what they bid for (i.e. have not been outbid in any part of their bid).

For the coverage requirement block, PTS sets a cap amount, with bids in addition to the cap amount being paid in the form of auction proceeds.

PTS is investigating the opportunity to hold the auction with frequency generic blocks. This would give PTS an opportunity to ensure that the bidders obtain consecutive blocks (where more than one is purchased), at the same time as reducing the risk of strategic bidding, such as signalling, and of the price of specific blocks being driven up.

Frequency generic blocks mean that equivalent blocks are seen as the same type of object. The bidders bid on the types of objects they are interested in. The placement of objects won is then determined in a placement round, according to special rules. The use of frequency generic blocks in the 700 MHz band would enable bidders to bid for four objects as follows:

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No.	Object	Contains the following blocks
1	FDD block without a coverage requirement	2 FDD blocks à 2×5 MHz
2	FDD block associated with a coverage requirement	1 FDD block à 2×10 MHz
3	SDL1	1 SDL block à 5 MHz
4	SDL2-4	3 SDL blocks à 5 MHz

This would mean that SDL1 is separated from SDL2-4 and that the coverage requirement block is separated from the other FDD blocks. The blocks within objects 1 and 2 may come to be placed within the entire frequency amount for FDD (within 713-733/768-788 MHz), as long as there is compliance with the condition of consecutive spectrum.

Bidding on the various objects takes place in the same auction system and in the same way.

PTS will present detailed auction rules in connection to the consultation on the draft decision on the limitation of the numbers of licences and open invitation to apply.

b. Lowest bid

PTS intends to apply a lowest bid in the auction in order to avoid a drawn-out bidding war.

In auctions with several bidding rounds, it is suitable to set a lowest bid at which the auction can start in order to avoid a protracted auction. A lowest bid that is too low risks protracting the auction, which might entail unnecessary delays and costs for both bidders and PTS. At the same time, if the lowest bid is too high, it may exceed some bidders' initial valuation of the frequencies. This might cause them not to see it as worthwhile to participate in the auction and thereby miss the opportunity to discover their valuation through interaction with other bidders (price discovery). Therefore, a lowest bid that is too high could lead to the frequencies not being assigned to the potential bidder with the highest valuation of the frequencies.

PTS intends to set a lowest bid for the auction. PTS will present the level of the lowest bid in connection to the consultation on the draft decision on the limitation of the numbers of licences and open invitation to apply.

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c. Bank guarantees

PTS intends to require collateral in the form of bank guarantees in order for an applicant to participate in the auction.

The requirement to provide bank guarantees constitutes a way to secure, to a proportional extent, the state's requirement for the payment of auction proceeds. In addition, the collateral requirement reduces the risk of frivolous bidding. In previous spectrum auctions, PTS has required bidders to provide collateral in various formats. A collateral requirement is also the norm in international contexts.

The intention is for the amount of an applicant's bank guarantee to be tied to the proportion of the spectrum that the bidder is entitled to bid on during the auction (bidder eligibility). The minimum amount of the bank guarantee for being able to participate in the auction will be presented in the consultation on the draft decision on the limitation of the numbers of licences and open invitation to apply.

8. Technical conditions**a. As few limiting conditions as possible**

PTS intends to combine the licences in the 700 MHz band with as few limiting conditions as possible, in order to facilitate an effective usage of the frequencies, today as well as tomorrow, with flexibility for technical developments.

The provisions of the Electronic Communications Act mean that limiting conditions in licences to use radio transmitters, where applicable, shall be justified. Thus, the point of departure is that licences shall be combined with as few limiting conditions as possible, which is also expressed in the PTS Spectrum Strategy. The EU Member States may also not apply national licensing conditions that are more limiting or more taxing for the licence holder than those issued pursuant to the decision regarding technical implementation measures for the 700 MHz band. The conditions that will be associated with the licences in the band shall be designed in accordance with these provisions and guidelines.

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b. Conditions to protect other users of the 700 MHz band and usage in adjacent frequency bands.

PTS intends to design the technical conditions in order to facilitate coexistence of licence holders for wireless broadband services in the 700 MHz band, relatively different applications in the same band and to protect uses in adjacent frequency bands. The technical conditions are defined in the form of a *Block Edge Mask* (BEM) whose levels derive immediately from Commission Implementing Decision (EU) No 2016/687 of 28 April 2016⁹ (Commission Implementing Decision).

As an EU Member State, Sweden must adhere to the Commission Implementing Decision. In some cases, the member states will be allowed to implement national licensing conditions that are less limiting to the licence holder. PTS proposes that it shall be possible, under special circumstances, to implement less limiting conditions for:

1. The radiated power of base stations within the licence holder's own frequency block
2. The radiated power of terminals within the licence holder's own frequency block

The Commission Implementing Decision contains alternative technical conditions for the parts of the 700 MHz band covered by national options. This gives Member States the opportunity to choose conditions on the basis of use. PTS does not intend to provide the frequency range 698–703 MHz and 733–736 MHz with any extended protection, but intends to propose the technical conditions that entail as small a limitation as possible for the frequency blocks that are currently subject to assignment.

⁹ Commission Implementing Decision (EU) 2016/687 of 28 April 2016 on the harmonisation of the 694–790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union.

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The radiated power from base stations within a licence holder's own frequency block

Radiated power from base station transmitters and repeaters in downlink direction within the licence holder's own frequency block may not exceed

64 dBm/5 MHz EIRP¹⁰ in the direction where the effective antenna height¹¹ is lower than 50 m, and

67 dBm/5 MHz EIRP in the direction where the effective antenna height is 50 m or higher.

In primarily rural areas, it may be interesting for the licence holder to be able to use larger cells, compared to in urban areas, which is facilitated by the somewhat higher radiated power of 67 dBm. Consequently, PTS intends to apply two levels, just as in the 800 MHz band, for the highest permissible radiated power (within the licence holder's own frequency block), which depend on the antenna height.

The radiated power from terminals within a licence holder's own frequency block

The licence holder's terminal installations outside urban areas¹² may transmit with a higher average power than 23 dBm EIRP for terminals designed to be fixed or installed and as TRP¹³ for terminals designed to be mobile or nomadic. However, the usage is conditioned upon no interferences being caused to other radio usages and on the fulfilment of applicable obligations to other countries.

PTS intends to allow the licence holder's terminal installations outside of urban areas to transmit with a higher average power than 23 dBm, as is the case in the 800 MHz band. A fixed terminal installation may for example entail connecting a directional antenna to the terminal to improve transmission and reception possibilities. The assignment of frequencies in the 700 MHz band could thus to some extent contribute to fulfilling the Government's goal of fixed broadband to households.

¹⁰ EIRP: equivalent isotropically radiated power

¹¹ Effective antenna height is calculated as the antenna height over the average level of the ground, where the average level of the ground indicates the average altitude above sea level in a direction 0 to 3 km from the antenna

¹² 'Urban area' refers to areas with more than 200 residents and where the distance between houses is less than 200 metres, in accordance with the definition used by Statistics Sweden.

¹³ TRP: total radiated power.

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Support for allowing a power higher than 23 dBm is found in the Commission Implementing Decision and is expressed as follows: “Administrations may relax the in-block power limit in certain situations, for example fixed terminal stations in rural areas provided that protection of other services, networks and applications is not compromised and cross-border obligations are fulfilled.”

The radiated power from terminals in the frequency band 470–694 MHz

Radiated power from terminals, expressed as EIRP or TRP, in the frequency band 470–694 MHz may on average not exceed -42 dBm/8 MHz, regardless of bandwidth and radiated power within the licence holder’s frequency block.

In case the licence holder chooses to use a higher radiated average power than 23 dBm within their own frequency block or a bandwidth greater than 10 MHz, this licence holder shall report to PTS how the requirement of -42 dBm/8 MHz is to be achieved.

In accordance with CEPT Report 53, the requirement of -42 dBm/8 MHz under 694 MHz is only unambiguously defined for bandwidths up to 10 MHz and a frequency separation (between the centre frequencies for terrestrial television and terminals) at 18 MHz.

The standard¹⁴ for terminals in the 700 MHz band (703–733 MHz) sets two values for radiated power under 694 MHz, -42 dBm/8 MHz for bandwidths up to 10 MHz and -25 dBm/8 MHz respectively for bandwidths greater than 10 MHz (regardless of placement within 703–733 MHz). However, the latter level of -25 dBm/8 MHz does not allow for a satisfactory protection of terrestrial television under 694 MHz.

For these reasons, PTS intends to formulate conditions that ensure that the requirement of -42 dBm/8 MHz under 694 MHz is achieved independently of bandwidth and radiated power within the licence holder’s own frequency block to provide terrestrial television within the frequency band 470–694 MHz with satisfactory protection.

Support for the second paragraph of the box above can be found in the draft implementation decision:

“If Member States wish to allow the deployment of WBB system on a national basis with a bandwidth greater than 10 MHz and in case unwanted out-of-block power higher than -42 dBm/8 MHz is generated in the band below 694 MHz, they should consider:

¹⁴ 3GPP TS 36.101 V15.0.0 (2017-09)

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- (a) either implementing the greater WBB system bandwidth starting at a frequency higher than 703 MHz so that the required limit of out-of-block power is still met;
- (b) and/or applying mitigation techniques according to note (3).

(3) Examples of potential mitigation techniques which may be considered by Member States include using additional DTT filtering, reducing the in-block power of the terminal station, reducing the bandwidth of the terminal station transmissions, or using techniques contained in the non-exhaustive list of potential mitigation techniques given in CEPT Report 30.”

c. Sharing conditions

PTS intends the licensing conditions to facilitate sharing through

- 1) local and temporary licences (no longer than six months) for other uses, and
- 2) the use of a future standardised regulation framework and/or sophisticated technology.

The primary licence holder’s use shall be prioritised and protected.

All newly assigned licences should, in accordance with the PTS Spectrum Strategy¹⁵, be future proofed in regard to the possibility of sharing the frequency band. PTS should consider this in the issuing of all licences, and should combine the licences with appropriate conditions, which allow for predictability and the possibility of facing future technology developments. PTS is to promote more effective spectrum use in relation to the national economy, for example through more effective sharing of radio spectrums between different users and use cases.¹⁶

Much like in the current regulations pertaining to already assigned block licences, there shall be a possibility to issue local and temporary licences (no longer than six months) for another usage in the frequency band. That usage can for example be local mobile broadband networks, local wireless networks, temporary video links or wireless microphones. Local and temporary licences can also be issued to a licence holder for wireless broadband services in the 700 MHz band within another licence holder’s frequency band. It is primarily during a deployment period that PTS deems there to be greater possibilities for sharing in this mode. In connection to PTS receiving an application to use a radio transmitter, the authority will contact the primary licence holder to get

¹⁵ P. 24, Principle 2.

¹⁶ PTS Spectrum Strategy page 21, Principle 1

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information on existing or planned upcoming deployment in the geographic area.

Sharing facilitated through the use of a future standardised regulatory framework and/or sophisticated technology (e.g. concepts like LSA¹⁷ with database support) are also conceivable. In the event that such regulations are introduced, which cannot be excluded during the proposed term of licence, information regarding the primary license holder's use needs to be made available. Concerned undertakings need to participate in further dialogue on suitable formats for this, if or when it comes up (i.e. when a standardised regulatory framework has been established). However, the formats for making information available shall not entail a disproportionately taxing administration for any party.

The use that the licence holder has, based on the licences assigned through this auction, is to be prioritised and protected. In this context, the licence holder's right to lease frequencies should also be observed.

d. Conditions to safeguard the reception of terrestrial television

The licence holder may not cause interference to the reception of terrestrial television in the frequency band 470–694 MHz for households with registered residents at the address in question.

PTS intends to propose the following conditions for what should be considered as interference to the reception of terrestrial television:

- The signal level from a base station, repeater or the licence holder's terminal installation within the frequency block in question (dBm/5 MHz) exceeds the signal level from the television transmitter within the concerned television channel (dBm/8 MHz) by more than 41 dB

or

- The signal level from a base station, repeater or the licence holder's terminal installation within the frequency block in question, when measured, exceeds -6 dBm/5 MHz (overloading) at the affected household.

The conditions for what is to be considered interference to the reception of terrestrial television apply only if the measured field strength from the television transmitter for the concerned television channel exceeds $44 + 20 \log_{10}(f/500)$ dB μ V/m/8 MHz (f is the centre frequency in the channel concerned) 10 metres above the ground at the affected household.

¹⁷ LSA: *Licensed Shared Access*

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The licence holders are to establish a mutual collaboration in order to immediately offer a joint point of contact where interference reports regarding terrestrial television in the frequency band 470–694 MHz can be made. The contact point should be coordinated with the already existing contact point for the 800 MHz band.

The licence holders shall, free of charge, investigate and remedy any found interference to television broadcasting in a suitable way. PTS makes the assessment that filters on the television receiver should be the primary measure to remedy problems with signal level interference and overloading.

In accordance with one of the assignment objectives adopted by the PTS Board of Directors, PTS shall provide terrestrial television under 694 MHz with a relevant and adequate protection against harmful interference from the new usage in the 700 MHz band. According to PTS' assessment, the technical regulations provided in the CEPT and found in the Commission Implementing Decision do not provide sufficient protection. The regulations therefore need to be supplemented in the same way as for the 800 MHz band.

In the work to develop the technical conditions for the new usage in the 700 MHz band with regard to protection of terrestrial television, PTS has considered the existing technical conditions of the licences in the 800 MHz band, experiences from PTS' supervision relating to interference cases between mobile services and terrestrial television broadcast reception, as well as coexistence studies carried out by the ITU working groups.

Indications from the broadcast community hint at a possible unreported number of interference cases to terrestrial television as a result of the LTE deployment in the 800 MHz band. Coexistence studies carried out by the ITU working groups also show that television receivers generally have a somewhat lower ability to handle interference from mobile system than what was previously known. It is therefore reasonable to assume that in many cases, an aggregate interference level may arise when the 700 MHz band is deployed in areas that already have a deployed usage in the 800 MHz band. Additional experiences from PTS' supervisory activities show that none of the interference cases in which LTE interference of terrestrial television has been proven has fulfilled the 800 MHz band conditions' definition of interference, when measuring the signal from the base station.

For these reasons, PTS intends to adjust the levels for signal level difference and overloading with 6 dB compared to the levels in the 800 MHz conditions

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for the corresponding frequency separation, so that the conditions for what is to be considered as interference to television will be the following:

- The signal level from a base station, repeater or the licence holder's terminal installation within the frequency block in question (dBm/5 MHz) exceeds the signal level from the television transmitter within the concerned television channel (dBm/8 MHz) by more than 41 dB.

or

- The signal level from a base station, repeater or the licence holder's terminal installation within the frequency block in question exceeds -6 dBm/5 MHz (overloading) when measured at the affected household.

The ban on causing interference to the reception of terrestrial television shall only apply to households that have registered residents at the address in question and where the measured field strength from the television transmitter for the concerned television channel exceeds

$44 + 20 \log_{10}(f/500)$ dB μ V/m/8 MHz (f is the centre frequency in the channel concerned) 10 metres above the ground at the affected household. This is in accordance with the same principle as in the licensing conditions for the 800 MHz band.

PTS finds that the licensing conditions for the 800 MHz band, where licence holders have the main responsibility for remedying interference to terrestrial television, have worked well in the years 2012–2017. The majority of all the reported interference cases have been possible to remedy. The Swedish Telecom Advisors' role as coordinator of the interference reports has also worked well. PTS therefore intends to formulate a commitment to remedy interference to the reception of terrestrial television, which will constitute a precondition for participating in the auction. The commitment is made in the application and will constitute a licensing condition pursuant to Chapter 3, Section 11, first paragraph, point 8 of the Electronic Communications Act.

The licence holders shall, free of charge, investigate and remedy any found interference to the reception of terrestrial television in a suitable way. PTS makes the assessment that filters on the television receiver should be the primary measure to remedy problems with signal level interference and overloading. Where a solution using a filter is chosen, PTS sees major advantages in such a solution also including all of the harmonised uplink band, i.e. filtering from 703 MHz and upwards.

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9. Measures relating to competition – spectrum cap

PTS does not intend to apply a spectrum cap for the frequencies in the 700 MHz band that is now being assigned.

PTS' overall opinion going into the assessments is to, as far as possible, allow the market to decide who is to be assigned what spectrum, based on need and demand. If there is a risk of competition problems in connection to assignment or use of the spectrum, measures to promote competition can be used. This could be done through the use of a spectrum cap.

As regards frequencies under 1 GHz, which have characteristics that make them particularly suitable for covering large areas, PTS makes the assessment that there is presently no obvious imbalance in spectrum holdings for the “big four” operators Telia, Tele2, Telenor and Tre.

The use of a spectrum cap means – all other things being equal – restricting the freedom of bidders and limiting the quantity of possible assignment outcomes. This leads to a risk of the spectrum not being transferred at an economically effective price. The lower a spectrum cap is set, the greater this effect becomes. PTS is essentially unable to assess the individual needs and individual demand that exist, and the value that different undertakings ascribe to spectrum in the 700 MHz band. It is only the bidders in the auction that can finally make this determination based on their respective strategies, priorities and financial resources. The interests of end customers are ultimately promoted by an effective distribution, and thereby use, of radio spectrums.

PTS wishes to underline that its design of rules for assigning radio spectrums always aims to promote the interests of end users. Healthy competition on the Swedish market for mobile telephony and mobile broadband creates conditions to enable consumers to get the best possible deal out of high-quality mobile services at advantageous prices.

For mobile operators, their total frequency holdings, “the spectrum portfolio”, are a very important input. An operator that wants to be active on the market and offer competitive services needs a well-balanced spectrum portfolio. That said, it is not only the mobile operators' respective spectrum holdings on a market that determine the competition situation on that market. The operators' choice of strategies as regards, e.g. network expansion, radio planning or focus on various customer groups means that the need for radio spectrum can be different for different operators. It should therefore not be an end in itself to

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stipulate assignment rules with the sole purpose of equalising any imbalances in spectrum holdings on the market.

Not setting a spectrum cap in the auction makes it possible, for example, for a new undertaking that does not already have any spectrum portfolio in Sweden to obtain 2×20 MHz in the FDD part of the band and thereby enter the market and be able to offer competitive services. PTS also does not wish to rule out that new technical applications in the 700 MHz band might be in need of large consecutive frequency bands.

PTS makes the same assessment as in the cancelled assignment of the 700 MHz band, namely that an operator should be able to acquire 2×20 MHz in the FDD part of the band. PTS finds it suitable not to set a spectrum cap for the frequencies in the 700 MHz band that is now being assigned.