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Huawei response to the PTS consultation
”*Konsultation tilldelningsprojekt 2,3 och 3,5 GHz-banden”*

Huawei welcomes the opportunity to comment on this important consultation. As one of the leading 5G market players we follow with high interest the ongoing preparations of the release procedures for the 3400-3800 MHz pioneer band for 5G, as well as other “lower” bands, and in particular the approach of PTS.

As regards 2300-2400 MHz band, we note that it is an important band for 5G because it is the lowest already globally harmonized TDD band and is widely used in many countries around the world. This frequency band can be used in both small and macro cells to provide additional capacity and improve coverage.

As regards 3400-3800 MHz, the European 5G pioneer band, we emphasize that the band is critically important for the introduction of 5G services on a wide scale based on *national licenses*, and furthermore that there are also other frequency bands such as 3800-4200 MHz that could be suitable for *national, regional* or *local licences*. We welcome PTS´s initiative in this regard!

As regards the options related to local usage of frequencies, PTS proposes two types of licences: local indoor/outdoor licences linked to property ownership, and area licences where the applicant specifies the geographical area. More specifically, Huawei understands that PTS is considering the following options:

- Alternative 1, property-linked licences only in 3700-3800 MHz
- Alternative 2 Option 1, property-linked and area licences in 3700-3800 MHz, with 40 or 50 MHz reserved for each of the two types
- Alternative 2 Option 2, property-linked licences in 3700-3800 MHz and area licences in 3800-4200 MHz.

Huawei would like to first comment on PTS´s overall policy approach to these important ranges of spectrum below 6 GHz, and then on some of the specific points of the proposed scheme.

3400-3800 MHz is the core 5G band for public mobile services

It has been stated by mobile manufacturers as well as mobile operators at numerous occasions, including at the previous consultation on 5G spectrum held by PTS in March 2018, that the availability of large contiguous spectrum blocks per operator (80...100 MHz) is critically important for the efficient introduction of 5G services. At this occasion we will just refer to ECC Report 287 which provides a detailed justification for this key requirement.

We therefore believe that the optimal spectrum assignment scheme of C-band in Sweden should be based on the whole 3400-3800 MHz 5G pioneer band authorized for nationwide use.

This would potentially enable each of the four existing national operators in Sweden to acquire a contiguous 100 MHz wide spectrum block. It should be further noted that the possible option of two or more operators running a common 5G network does not result in the need of only 80…100 MHz per network but would necessitate the availability of 80…100 MHz of spectrum per an MNO to respond to the total capacity requirements within the same network.

We are concerned that local area and property-based licensing in the 3700-3800 MHz portion will undermine the wide consensus in Europe on using 3400-3800 MHz as the core band for 5G public networks, and that such an approach may hinder the rapid development of the 5G mobile communications industry in Sweden.

More specifically, Huawei believes that authorisations via local/property-based licenses in 3700-3800 MHz may easily lead to fragmentation of spectrum usage, reduce spectrum utilization efficiency, increase spectrum utilization cost, and weaken frequency use value. We note that based on historical experiences of spectrum management, once fragmentation occurs it is a challenge to refarm the frequency band in the future.

Access to spectrum by vertical industries

Huawei is in favour of using 5G technologies to meet the digital transformation needs of vertical industries including Industry 4.0. One major advantage of the 5G architecture is the 'slicing' concept. Network slicing allows verticals to avoid CAPEX and OPEX of dedicated infrastructures and devices, by creating a "network factory" where an MNO can assign – via software – different slices of its core and radio network resources to diverse verticals

Another approach is one where the vertical user leases spectrum from the MNOs and deploys its own network at its premises. Leasing has already been successful in Europe in facilitating access to 4G spectrum by verticals, and could be equally successful for 5G. To facilitate adoption, it is recommended to remove all regulatory barriers from leasing/secondary markets.

Huawei acknowledges that some vertical users – such as Industry 4.0 – wish to have direct access to spectrum for private 5G networks, but without relying on the spectrum leasing from the MNOs. However, smart manufacturing or Industry 4.0 requires high reliable connectivity and communication to support various kinds of applications. According to current requirement study from smart manufacturing (e,g, Augmented Reality/Virtual Reality, Auto configuration of Robots by cloud, massive wireless sensor network, etc…) data rate requirements may be up to 1 Gbit/s to support group of device connection.

The 3700-3800 MHz block might not be the best home for these applications. We see a better opportunity to reserve larger bandwidth for the local/regional type of use in other bands, such as 3800-4200 MHz or the upper mmWave bands. Therefore, we welcome PTS´s proposal to open part of 3800-4200 MHz for this type of use. We remind PTS that 3800-4200 MHz is a 3GPP band and that it will be widely supported as well.

Next, we provide our specific comments to the elements PTS is consulting on, on 2.3 GHz and 3.4-3.7 GHz and on 3.7-3.8 GHz parts respectively. We copy the elements formulation in Swedish, as published on the PTS website, with our translation into English (in red).

Exempel på frågor som PTS i detta skede utreder är:
Examples of questions that PTS at this stage is investigating are:

För frekvensbanden 2,3 och 3,4–3,7 GHz:
For the frequency bands 2.3 GHz and 3.4-3.7 GHz:

Om PTS ska/bör införa ett utbyggnads- och täckningskrav och hur ett sådant i så fall bör vara utformat
Whether PTS should introduce the deployment- and coverage related requirements and how such requirement in that case should be formulated

Huawei supports a deployment requirement, in order to avoid spectrum speculation.

Blockstorlek, auktionsformat och tillståndstid
Block size, the auction format and license period

As mentioned above, Huawei believes that large contiguous spectrum blocks, preferably in the order of 80…100 MHz, are crucial for efficient deployment of 5G.

Huawei calls upon PTS to provide four comparable in size (i.e. 80…100 MHz) contiguous spectrum blocks which would be authorized in the form of national licences and would satisfy the key capacity needs for 5G services in the bands below 6 GHz in the Swedish market. Huawei has been consistently advocating the position that these four blocks would best be provided within the 3400-3800 MHz band, the European 5G pioneer band. If nevertheless PTS finally decides to put 3700-3800 MHz band aside for local licensing, Huawei suggests that the whole spectrum available in 2.3 GHz range would be auctioned as one contiguous block in the same award process with the 3400-3800 MHz band.

Huawei further points out that providing large contiguous blocks to different national operators in comparable frequency ranges (e.g. in the bands below 6 GHz) has been a practice in other countries, and is deemed to provide a reasonable balance in the available spectrum resources for 5G to different market players from the competition perspective.

Huawei further supports either longer licenses, 20 years, or the possibility for extensions in both 2.3 GHz and 3.5 GHz spectrum ranges.

Konkurrensfrämjande åtgärder såsom ett ev. införande av spektrumtak eller utestängning
Competition stimulation measures such as introducing a spectrum cap

See our response to the question above.

Tekniska villkor inkluderande
Technical conditions including:

- **villkor för att skydda andra användare banden**
  conditions to protect bands used by other users;

We expect that a key challenge in both 2300–2400 MHz and 3400–3800 MHz will be to avoid interference between different spectrum users. We propose PTS not to place any substantial restrictions on the national licensees in these bands in addition to the requirement of fulfilling the harmonized European LRTC (least restrictive technical conditions).

We request however PTS to mandate the synchronisation of networks that are deployed in the same geographical area. Coordination between national deployments and property-based local deployments may be advisable in some cases, see our response to the questions below.

- **villkor för synkronisering**
  conditions for synchronization;

The purpose of synchronised operation is to prevent BS-BS and MS-MS interference scenarios. Synchronised operation avoids performance degradation due to such interference without requiring additional mitigation techniques such as additional filtering (that may be challenging to implement in AAS BSs and MSs), inter-operator guard bands, geographical separation between base stations, etc.
Synchronised operation therefore simplifies operators' network deployments since less coordination for BS radio planning is required among synchronised operators.

According to ECC Report 281 dealing with 3400-3800 MHz band, the synchronised operation can be ensured by BS which adopt the ECC baseline out-of-block power limit which is aligned with 3GPP SEM and will be implemented by all base stations without requiring additional filtering.

As stated in ECC Report 281: "Several LTE-TDD networks are currently providing services to millions of end users with hundreds of thousands of BSs deployed in the field adopting synchronisation and alignment of UL / DL transmissions between operators using adjacent frequency blocks. Such networks provide proven experience in the field that should be considered as the starting point for the definition of the regulatory framework for 5G-NR."

Huawei therefore recommends PTS to mandate the synchronisation both in 2.3 GHz and 3.5 GHz spectrum ranges as a licence condition. In order to implement this requirement efficiently,

the licensees should cooperate so as to achieve timely inter-operator agreements. Such agreements should include the following items:

- a common phase clock reference (e.g. UTC), accuracy/performance constraints with permanent monitoring and agreed remedies in case of accuracy loss;
- a compatible frame structure to avoid simultaneous UL / DL transmissions
- mechanisms to ensure the periodic review of the agreed conditions.

If the licensees fail to reach agreements, PTS may need to get involved in the process to ensure fair and timely agreements. Further guidance on the options PTS may consider in this regard is provided in the new draft ECC Report (currently in the process of approval for public consultation, and the number is not known at the time of submission).

It should be however noted that deployments that are isolated from other networks by distance or building entry/exit loss should not be forced to synchronise. This is also investigated in the draft ECC Report referred to above.

- **villkor för att möjliggöra delning**
  conditions enabling sharing.

Huawei does not support that sharing of spectrum between mobile networks is mandated by regulations either in 2.3 GHz or in 3.5 GHz spectrum ranges (although if operators decide to share, regulations should facilitate it). As regards the option of sharing between mobile networks and other users, Huawei does not see such spectrum sharing as the baseline authorisation option, but if it appears to be the only way forward in certain circumstances, we believe that PTS must strive for a simple and robust solution. Using geographical restrictions between existing users and new users is probably the simplest and most robust way for spectrum sharing if it is unavoidable.

We comment next on the specific questions raised by PTS in a separate consultation document *"Förslag för tilldelning av lokala tillstånd i 3,7–3,8 GHz från 2023 och framåt"* dealing with local block licences.

För frekvensbanden 3,7–3,8 GHz (Lokala blocktillstånd):
For frequency band 3.7-3.8 GHz (Local block licences):

Lämplig tilldelningsmetod för lokala blocktillstånd. Se särskilt dokument med underlag om lokala blocktillstånd.
Appropriate award method for the local block licences. See the document about local block licences.

Särskilda frågor på dokument om lokala blocktillstånd
Specific questions in the document on the local block licences:

1) Vilken av de förslagna lösningarna ser ni bäst tillfredsställer de behov som finns på marknaden?
Which of these proposed solutions, in your opinion, would satisfy the needs of the market in the best way?

For the reasons explained above, we would prefer a solution where 3400-3800 MHz is reserved for national use and local/regional licences are assigned in the 3800-4200 MHz block. If this is not possible, we recommend Alternative 2 Option 2 as this allows for larger channels for both the property-based and local area based users.

2) Vilka för- respektive nackdelar ser ni med de olika alternativen?
What advantages and disadvantages do you see in the various options?

We think Alternative 1 is too restrictive as only the property owners would be allowed to use a high value 100 MHz block. Furthermore, we think that tying spectrum access to real state ownership could be problematic and needs careful consideration. There are scenarios where this approach may not work, for instance a shopping centre or an office building with one owner but multiple tenants. In addition, this approach will require PTS to be informed of changes in property ownership, so it can change the name of the spectrum licence holder. We think this is burdensome and out of the remit of PTS.

The main disadvantage of Alternative 2 Option 1 is the reduced bandwidth available for the different applications.

3) Ser ni att fastighetsbaserade tillstånd kan användas för att möta behov av 5G-konnektivitet för FWA och lokala yttäckande nät? Anser ni i så fall att det behövs ytterligare regler för att möjliggöra detta?
Do you think that property-based authorization can be used to meet the needs of 5G connectivity for FWA and local area networks? If you think so, would further specific rules be needed to allow for this?

Property-based licences would be useful for certain scenarios, such as Industry 4.0, but they will not help operators willing to provide city-wide or regional FWA or mobile services.

4) Vad gäller alternativ 2 option 1, ser ni att det finns möjlighet för rimligt störningsfri delning av frekvensutrymme i 3,7–3,8 GHz-bandet mellan lokala fastighetsbaserade nät och lokala yttäckande nät?
As for Alternative 2 in Option 1, do you think it will be possible to share spectrum in the

3.7-3.8 GHz band between local property-based networks and local area networks, on a reasonably interference-free basis?

According to PTS´s plan, local property-based networks and local area networks would be on adjacent channels and this provides a certain limitation on interference, however it may not be sufficient to guarantee interference free operation in particular if the property-based networks are used outdoors. We recommend PTS to consider carefully the field strength limits for outdoor property-based licences, and who would be the priority user in case interference appears.

More generally, we would welcome clarity from PTS on how it plans to manage interference between property-based networks, area networks and national networks. PTS mentions a field strength limit at the property boundary. What would be the value? PTS also mentions that the size of the block in 3700-3800 MHz would be 80-100 MHz. Does this mean that there will be a 20 MHz guard band between national and local networks?

5) Om bandet delas enligt alternativ 2 option 1, är det tillräckligt med 40-50 MHz per användning/tillståndstyp?
If the band is assigned according to Alternative 2 of Option 1, would it be sufficient to provide 40-50 MHz per use / licence type?

We think this is likely to be insufficient, both for property-based industrial applications and for local area networks. We think industrial applications will require at least 100 MHz. We expect that city-wide or regional FWA or mobile networks will have spectrum needs similar to the national licensees, i.e. around 100 MHz.

6) Har ni andra förslag på hur behoven för olika användningar skulle kunna tillgodoses?
Do you have other suggestions on how the needs of different uses can be satisfied?

We encourage PTS to consider 3400-3800 MHz for national licences, and 3800-4200 MHz for all other small area applications: property-based, regional or local licences, however not excluding national licences in this portion of C-band as well.

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