



900 MHz band refarming case study

Sweden

29 November 2011

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1. Introduction

The purpose of this paper is to present a case study on the Swedish process of refarming the 900 MHz mobile band for documenting and sharing experience on what has happened in an actual refarming case.

This paper will not contain any assessments on whether the process carried out or the outcome of it is optimal or whether improvement potential can be identified. Furthermore, this paper does not intend to and it does not express any views or positions of the GSMA and/or the mobile industry.

It seems like the main information on and documentation of the different stages of the process taking place between 2008 and 2011 is published by the regulator PTS. PTS have also published the consultation documents and the consultation responses. PTS published its final decisions. PTS informed the public about the complaint filed and PTS did inform the public about the complaint being rejected. The sources and the information is available in a mix of Swedish and unofficial translations to English. The references included in footnotes of this case study provide links to the English translations where available and reverts to the sources in Swedish when English translations are not available. Using the case study to understand the Swedish 900 MHz band restructuring process does not depend upon the reader understanding Swedish.

The case study has been developed by Kristin Due Hauge and Swedish operators have been involved in reading and commenting on the draft. GSMA would like to thank HI3G/Hutchinson, Tele2, Telenor and TeliaSonera for their cooperation, for being very positive and supportive throughout the process and for their approval of the case study prior to GSMA releasing it.

2. Executive summary

The Swedish 900 MHz band refarming process include both a process of renewing incumbents licenses, expanding the 900 MHz mobile band from 2X30 MHz to 2X35 MHz, assigning additional bandwidth for incumbents, introducing a new 900 MHz band licensee via a process of incumbents transferring parts of its bandwidth to the new entry licensee via a trading arrangement approved by PTS before finally lifting the GSM only restrictions simultaneously for all five 900 MHz band licensees in May 2011.

The PTS have designed the new technical conditions of the 900 MHz band licenses so that mobile technologies that can technically co-exist can be deployed by the licensees. PTS have implemented technology neutral usage rights which is only restricted by (i) the legally binding European Union harmonisation instruments for the 900 MHz band, (ii) technical conditions implemented to reduce the risk of harmful interference between the 900 MHz band licensees and the spectrally adjacent licensees (such as the GSM-R operator) and, (iii) the condition of 900 MHz band licensees must adjust their use of frequencies to international coordination agreements concluded by PTS (namely the coordination agreements with regulators in Denmark, Finland and Norway). From May 2011 mobile technology choices and the incumbents timing for implementing their technology upgrades are commercial decisions subject to the requirements on coordinating with your spectral neighbours to manage interference risks.

The first phase of the Swedish 900 MHz band restructuring process was about renewing incumbent's licenses and granting them some additional bandwidth. Renewal of the licenses and assignment of some additional bandwidth was granted based on their need for the spectrum for continuing the provision of GSM services which was considered very important to the Swedish society and its consumers. Assignment of some additional bandwidth were possible after the band was expanded from 2X30 MHz to 2X35 MHz. PTS concluded continued use for securing GSM services being offered and renewing the incumbents licenses were the most efficient use of the 900 MHz band resources.

The second phase of the Swedish 900 MHz band restructuring process was about two incumbent operators each transferring 2X2.5 MHz of spectrum to the mobile operator without access to 900 MHz band spectrum and then the five 900 MHz band licensees engaging in swapping spectrum to reconfigure the band for contiguous spectrum for each licensee based on the band being divided into seven blocks of 2X5 MHz. HI3G became the fifth 900 MHz band licensee controlling 2X5 MHz of bandwidth through the secondary market transaction. The transaction was given approval of the PTS after they had concluded that the transaction was likely to enhance competition in the Swedish market. In the process of reconfiguring the 2X35 MHz 900 MHz band all four incumbents had to move spectrally and consequently engage in adjusting their existing networks etc.

The third phase of the Swedish 900 MHz band restructuring process was to lift the GSM technology restrictions simultaneously when the reconfiguration of the band was finalized.

Probably the most unique component of the Swedish 900 MHz band restructuring process was the initiative of the four incumbents and the existing mobile operator with no 900 MHz band spectrum when they discussed and developed a consensus proposal used for submitting a joint application to the PTS for the four incumbents to renew their licenses and for two of them to engage in the spectrum trading transaction which introduced the fifth 900 MHz band licensee in Sweden. PTS encouraging the mobile operators to engage in developing consensus and using voluntary approaches and market based tools is also something that characterises the Swedish 900 MHz band restructuring process between 2008 and 2011.

3. 2008: the initial stage

The Swedish regulator PTS started focused work on future use of the 900 MHz band by spring 2008. The expiry of existing licenses by 31 December 2010 has by PTS been mentioned as the issue triggering the timing of this work.

The policy objectives for the work have been described as safeguarding consumer interests by securing continued extensive coverage, promote existing GSM use, promote efficient use of the spectrum and promote technology developments for the band.¹

By November 2008 the five operators in the Swedish market, TeliaSonera, Swefour, Tele2, Telenor and HI3G, filed a joint application for usage rights in the 900 MHz band for the next licensing term. The application was about license renewal for the four incumbent 900 MHz band licensees and an arrangement on partial trading of usage rights to be able to introduce the 2100 MHz band and UMTS/HSPA based operator HI3G as the fifth licensee in the 900 MHz band. The arrangements of the joint application meant that five operators, and not only the four incumbents, could be accommodated.

a. About the joint application from five mobile operators

On 20 November 2008 Swefour, Tele2, Telenor, TeliaSonera and HI3G filed a joint application on renewal of 900 MHz band usage rights, amending terms and conditions for allowing deployment of other mobile technologies in parallel with GSM and seeking PTS approval of partial transfer of spectrum usage rights from Tele2 and Telenor to HI3G. The 900 MHz band incumbents requested their renewed usage rights to expire on 31 December 2025.²

i. Arrangement on distribution of spectrum between licensees

The five applicants requested PTS to assign the 900 MHz bandwidth as follows:

- Tele2: 925-927.5/880-882.5 MHz (2X2,5 MHz)
- Telenor: 927.5-930/882.5-885 MHz (2X2,5 MHz)
- Swefour: 930-935/885-890 MHz (2X5 MHz)
- Tele2: 935-942.5/890-897.5 MHz (2X7,5 MHz)
- Telenor: 942.5-950/897.5-905 MHz (2X7,5 MHz)
- TeliaSonera: 950-960/905-915 MHz (2X10 MHz)

¹ English: <http://www.pts.se/en-gb/News/Press-releases/2009/Pressmeddelande/> Swedish: <http://www.pts.se/sv/Nyheter/Pressmeddelanden/2009/Pressmeddelande/>

² Sources include info provided by PTS in their decision: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

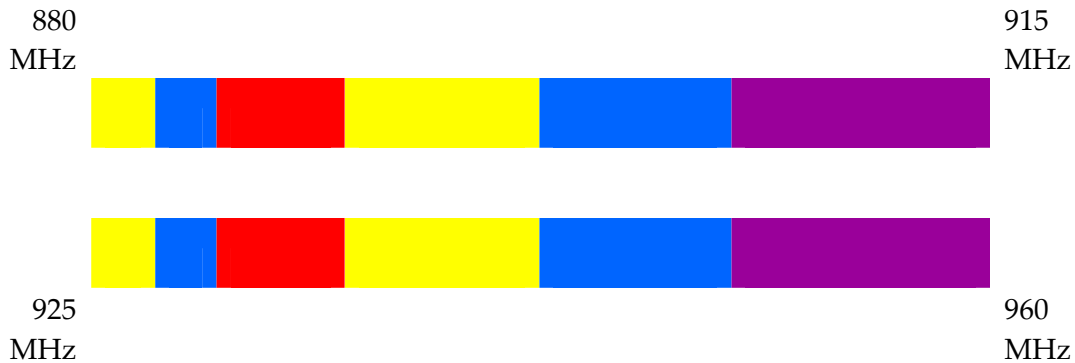


Figure1: the distribution of frequencies between licensees as proposed in the joint application from the five mobile operators put forward to PTS

ii. Expiry date for renewed licenses

The four incumbents applied for renewed 900 MHz band licenses with the expiry date of 31 December 2025.

iii. Technology neutrality, service neutrality

The five applicants requested PTS to lift the technology restrictions and allow 900 MHz band frequencies to be used for provision of electronic communications services. Or, if this technology neutral and service neutral approach was not possible for PTS to implement, the applicants requested PTS to approve deployments of GSM900, UMTS900 and LTE using the assigned frequencies.

iv. Timing

The applicants requested adjusted terms and conditions to come into force (i) 12 months after PTS made the decisions, or (ii) three months after the decisions have entered into final force (in case of complaint(s) being filed and therefore decisions coming into force being postponed).

v.

Tele2, Telenor and TeliaSonera also requested PTS to terminate the terms and conditions on obligations to offer public mobile services to all consumers within the defined geographical coverage area within two years after commercially having launched the services (the application was about renewing licenses for on-going operations where services was launched many years ago and not about spectrum for launching a new network and new services).

vi. Partial transfer of usage rights

Telenor, Tele2 and HI3G requested PTS to approve transfer of the usage right for the 925-927.5/880-882.5 MHz band (2X2.5 MHz) from Tele2 to HI3G and the 927.5-930/882.5-885 MHz band (2X2.5 MHz) from Telenor to HI3G and that HI3G was awarded the usage rights for those frequencies from the point in time where the redistribution of frequencies in the 900 MHz band came into effect.

vii. Conditional applications

The applicants made their joint application conditional upon each other basically meaning that the PTS should either fully approve or fully reject the application:

- The applicants made the application subject to the licence period only to be determined to apply to a date earlier than up to and including 31 December 2020.
- The applicants made the requested distribution and redistribution of frequencies between operators subject to PTS revoking the conditions on service offerings in current licenses.
- The applicants made their application subject to PTS approving the transfer of frequencies from Tele2 and Telenor to HI3G.

However, if PTS would not grant any of the licensee's technology neutral and service neutral usage rights, the applicants requested PTS to only reject this part of the applications.

viii. Reasoning of the applicants

The applicants did put forward their reasoning when filing the joint application to PTS:

- Swedish consumers depend upon GSM services and provision of GSM services depends upon using the 900 MHz band. GSM have extensive coverage in Sweden. At the end of 2007, GSM networks served 7.8 million subscribers (Swedish population is about 9 million). The migration of subscribers to the UMTS networks will absolutely not be completed by 2010.³
- The licensees claimed having made, and continue to make, extensive infrastructure investments in GSM networks, which do not allow for a reasonable rate of return on investments within the remaining licence period. According to the applicants they would be adversely affected by substantial operational and financial problems if licences were not renewed.
- Technology upgrades and innovations of UMTS900 and LTE are good for society and such investments depend on the certainty a license renewal would provide.
- Should the 900 MHz band usage rights be awarded to new licensees the rollout of any new GSM network would take several years and in the meantime consumers

³ Operators also mentioned PTS in the 'LRIC model' for mobile networks noting that a considerable proportion of the total amount of traffic will be carried by the GSM networks far beyond 2010 means PTS are very much aware of Swedish consumers will continue to depend on GSM far beyond 2010.

would suffer from lack of GSM services. Consumers using international roaming services when visiting Sweden would be affected by lack of GSM service offerings. Machine-to-machine services developed for GSM technology depends upon continuity of GSM services.

- The statements of the travaux préparatoires indicate that the applicable Swedish legal framework contains a presumption for licence renewal.

The applicants request for technology neutral and service neutral usage rights was based on references to the European Commission's statements in the review of the sector specific directives on electronic communication networks and services and the Spectrum Policy of the Swedish regulator PTS. The applicants concluded that no international provisions preventing PTS from issuing technology neutral and service neutral 900 MHz band usage rights existed. Applicants claimed PTS could, at least, approve deployment of UMTS/HSPA and LTE in the 900 MHz band in addition to the existing GSM/EDGE/GPRS deployments.

The joint applicants referred to the consensus reached between the 900 MHz band incumbents and the operator in the Swedish market with no usage rights in the 900 MHz band (HI3G) on partial transfer of 900 MHz band frequencies would lead to a very high level of spectrum efficiency and enhance competition. The joint applicants did claim introducing HI3G as a 900 MHz band licensee would eliminate the risk of the competitive disadvantages described in the report entitled *Effektivare signalering* ('More effective signals') (Official Government Report, SOU 2008:72).

Finally, the applicants argued the decisions on making the 900 MHz band usage rights technology neutral and service neutral and the decisions and transactions necessary for introducing HI3G as new 900 MHz band licensee should be coordinated timing wise so all 900 MHz band licensees were given the opportunity to adapt to new frequency arrangements of the band and avoiding giving any of the licensees any advantages or disadvantages regarding the regulatory aspects of the go-to-market timing issue.

4. 2009: the public consultation phase

On 30 January 2009 PTS published a press release⁴ on the public consultation procedure for draft decisions on 900 MHz band license renewals.

On 4 February 2009 PTS published the draft decisions on the 900 MHz band license renewal and deadline for submitting responses was 4 March 2009.⁵

The drafts published for public consultation was mainly about:

- Renewal of the 900 MHz band licenses aiming at continuing the existing mobile service provisions based on the extensive and existing 900 MHz band based coverage of the mobile networks.
- Expanding the 900 MHz band by including spectrum in the so-called “E GSM band” so that full 2X35 MHz of bandwidth would be made available for operators and help accommodating the new entry 900 MHz band licensee HI3G into the band.
- Adjustment of terms and conditions to allow deployment of new mobile technologies for mobile broadband in parallel with existing GSM based operations.
- Approving partial transfer of spectrum usage rights from Tele2 and Telenor to HI3G.

The starting point:

- Tele2: 2X7.2 MHz Expiry by 31 December 2010.
- Telenor: 2X7.2 MHz Expiry by 31 December 2010.
- TeliaSonera: 2X7.2 MHz Expiry by 31 December 2010.
- Swefour: 2X6.8 MHz Expiry by 31 December 2017.⁶

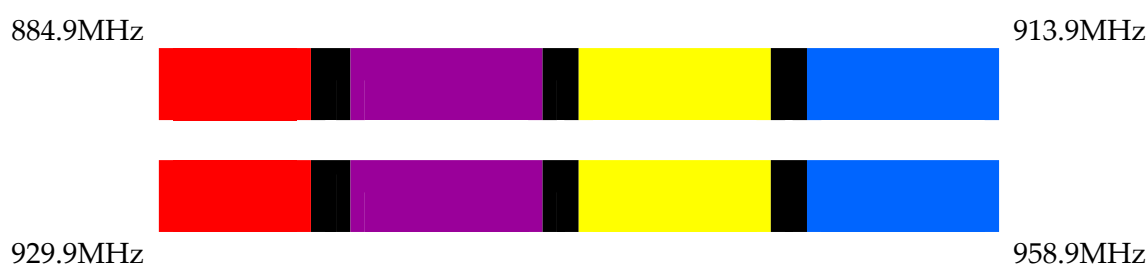


Figure2: the distribution of the approximately 2X30 MHz bandwidth before the licence renewal and refarming process.

⁴ English: <http://www.pts.se/en-gb/News/Press-releases/2009/Pressmeddelande/> Swedish: <http://www.pts.se/sv/Nyheter/Pressmeddelanden/2009/Pressmeddelande/>

⁵ Swedish: <http://www.pts.se/sv/Dokument/Remisser/2009/Samrad-om-forslag-till-beslut-rorande-tillstand-i-GSM-900-bandet--08-12019/>

⁶ But the exact assignment of frequencies and the terms and conditions attached was due to expire 31 December 2010.

The existing licenses added up to approximately 2X30 MHz of bandwidth. The internationally harmonised 900 MHz mobile band consists of 2X35 MHz of bandwidth. PTS did propose to expand into the full band of 2X35 MHz when putting forward the proposals for public consultation.

The fifth operator in the Swedish market, HI3G, did run its UMTS/HSPA based business using frequencies in the 2100 MHz band when the application for use of 900 MHz band frequencies were filed jointly by the five operators.⁷ Sweden has allocated 2X60 MHz of the 2100 MHz band to mobile aligned with the EU harmonisation of this band. At the time of filing the joint application for 900 MHz band usage rights there were three licenses of 2X20 MHz in the 2100 MHz band assigned. The two other 2100 MHz band usage right holders was Svenska UMTS Licens AB (frequencies utilized by Tele2 and TeliaSonera) and Telenor. Swefour was the only 900 MHz band incumbent without access to 2100 MHz band frequencies.

The documents published by PTS for the public consultation:

- Proposed decision⁸
- Consultation letter⁹
- Draft 900 MHz band license, HI3G¹⁰
- Draft 900 MHz band license, Swefour¹¹
- Draft 900 MHz band license, Telenor¹²
- Draft 900 MHz band license, Tele2¹³
- Draft 900 MHz band license, TeliaSonera¹⁴

a. About the proposed decision

In their proposed decision PTS did comment on the spectrum management regime should aim at lower the entry barriers for operators and promote technology development and development of the markets. PTS added that regulations must be balanced against operator's flexibility to move in the directions of technology upgrades and service developments based on commercial interests and that this e.g. should include the opportunity to transfer usage rights (both fully and partial transfers was mentioned). Furthermore, PTS commented on the proposal put forward by the five operators in their joint application was an approach to technical cooperation and coordination of use of frequencies between operators that would promote spectrum efficiency in the use of the 900 MHz band but also lead to improved offerings of 3G services and increased competition in the Swedish mobile market.

⁷ HI3G did have spectrum usage rights in the 2600 MHz band when the joint application was filed.

⁸ Swedish: FÖRSLAG PÅ BESLUT, <http://www.pts.se/upload/Remisser/2009/08-12019-beslutsforstag-900mhz.pdf>

⁹ Swedish: missiv, <http://www.pts.se/upload/Remisser/2009/08-12019-missiv-samrad-20090204.pdf>

¹⁰ Swedish: <http://www.pts.se/upload/Remisser/2009/08-12019-forslag-tillstand-900mhz-hi3g.pdf>

¹¹ Swedish: <http://www.pts.se/upload/Remisser/2009/08-12019-forslag-tillstand-900mhz-swefour.pdf>

¹² Swedish: <http://www.pts.se/upload/Remisser/2009/08-12019-forslag-tillstand-900mhz-telenor.pdf>

¹³ Swedish: <http://www.pts.se/upload/Remisser/2009/08-12019-forslag-tillstand-900mhz-tele2.pdf>

¹⁴ Swedish: <http://www.pts.se/upload/Remisser/2009/08-12019-forslag-tillstand-900mhz-teliasonera.pdf>

PTS's assessment of new terms and conditions put forward in the proposed decision document:

- The distribution of 900 MHz band spectrum proposed by the five operators in their joint application was acceptable.
- The approach to more technology neutral and service neutral approach put forward by the five operators in their joint application was acceptable.
- The requirements on service offerings would be amended so that it would be about some basic provisions of voice services only.
- The coverage requirements of the networks would continue to be imposed on operators even when moving to a more technology neutral and service neutral approach.
 - PTS put forward a statement on coverage requirements being set so that each operator must maintain coverage equal to what they had a time of renewed licenses being issued.
 - The coverage requirements could be met using spectrum in the 900 MHz band, the 1800 MHz band and the 2100 MHz band.
 - The coverage requirements would be upheld until 2015 and then they would be subject to review, possibly be prolonged.
- Technical conditions aiming at preventing harmful interference would be imposed.
 - The need for protecting spectrally adjacent GSM-R services was in particular mentioned (GSM-R services operates in the frequency bands 876-880/921-925 MHz in Sweden and consequently PTS stated that limitations on signal strength would be imposed on licensees in the 900 MHz band).
 - Existing use of the frequency band 871-875/916-921 MHz (the band below the GSM-R band) would mean 900 MHz band licensees would have to accept some risks of interference.

i. International harmonisation and technology availability assumptions

The PTS proposed decision document referred to the 900 MHz band being internationally harmonised through legally binding European Union instruments. Furthermore, PTS mentioned the work on spectrum harmonisation carried out by the cooperation between regulators in the Conférence Européenne des Administrations des Postes et des Télécommunications (CEPT) context.¹⁵

Based on the international process of harmonising the 900 MHz band for mobile which have been going on since 1987, and the developments that took place internationally at the time where PTS put forward their proposal, the PTS concluded that since both UMTS900 and LTE were standardised in a way that could utilize 2X5 MHz channels the new way of structuring the 900 MHz band should be based on 5 MHz channels. Furthermore, PTS noted that adding up those 5 MHz blocks of spectrum into larger contiguous bandwidths for licensees should

¹⁵ PTS refers to: The legally binding EU Directive 87/372/EEC. The EU Recommendation 87/371/EEC. ERC Decision (94)01 on the frequency bands to be designated for the coordinated introduction of the GSM digital pan-European communications system; ERC Decision (95)03 on the frequency bands to be designated for the introduction of DCS 1800; ERC Decision (97) 02 on the extended frequency bands to be used for the GSM Digital Pan-European Communication System; ECC Decision (06)13 on the designation of 900/1800 MHz bands for terrestrial IMT-2000/UMTS systems.

be possible to facilitate opportunities for potential deployment of wider carriers in the future.

ii. Legal basis for renewal of licenses and awarding additional bandwidth

PTS made it clear that the Swedish Act on Electronic Communications did not contain explicit rules on what should happen when a license expire. There was no legal right for any existing licensee to have a license renewed.

When preparing the adoption of the Swedish Act it was expressed that the presumption should be that when licenses expire a new license should be awarded, potentially with revised terms and conditions if this would promote efficient utilization of the frequency resources.¹⁶ Consequently, the PTS referred to that unless the existing licensee's use of the 900 MHz band frequencies would be in breach of the efficiency criteria there should be a presumption for renewal of the incumbent's licenses.

PTS concluded that the existing GSM networks importance for the Swedish society, its citizens and the Swedish economy, and the vital role the use of the 900 MHz radio frequencies plays in this context, mean renewal of the incumbent's licenses should happen.

PTS stated that the renewal presumption for the incumbent's licenses did not include any right to avoid being spectrally moved, any right to maintain their bandwidth (amount of spectrum) or any right of being awarded additional bandwidth. The joint application from the five mobile operators did imply the incumbents expanding their bandwidth from 2X7.2 MHz to 2X10 MHz (2X2.8 MHz of increased bandwidth per operator). The Swedish Act on Electronic Communication contain a rule that makes it possible for PTS to consider additional assignment to an licensee if spectrum have been reserved for future use and the additional assignment is for purposes that is very important to society to e.g. mobile operators.¹⁷

Based on the international developments regarding what was considered the most relevant use of the full 2X35 MHz mobile band in the 900 MHz band, and based on the opportunity the Swedish legal framework contains on awarding additional bandwidth to users considered to use it for services that are important to society, and based on their conclusion that use of the expanded 900 MHz band for mobile would be in-line with the efficiency criteria of their legal framework, PTS concluded that awarding the additional bandwidth to the mobile operators should be done.

¹⁶ This presumption is expressed in a document that formally is relevant for interpretation of the Swedish Act: Prop. 1992/93:200, s. 219 ff. jämfört prop. 2002/03:110, s. 151 f.

¹⁷ Chapter 3, section 6.

iii. Legal basis for approval of partial transfer of spectrum usage rights

The Swedish Act on Electronic Communications regulation of transfer of spectrum usage rights¹⁸ usually means PTS will approve a transfer unless it have negative impact on competition or the transfer of the right will have unwanted effects on technical harmonisations.

PTS concluded that the transfer of radio frequencies would mean HI3G could add a 2X5 MHz of 900 MHz band usage rights to their existing usage right for 2X20 MHz in the 2100 MHz band leading to HI3G being in a position where more flexible use of their portfolio of spectrum usage rights would promote competition in Swedish market for mobile services and proposed to approve the transfer.

iv. Duration, expiry date

Based on the criteria's set out in the Swedish Act on Electronic Communication licenses must have fixed duration and for the 900 MHz band licenses PTS concluded that they should expire by end 2025.¹⁹

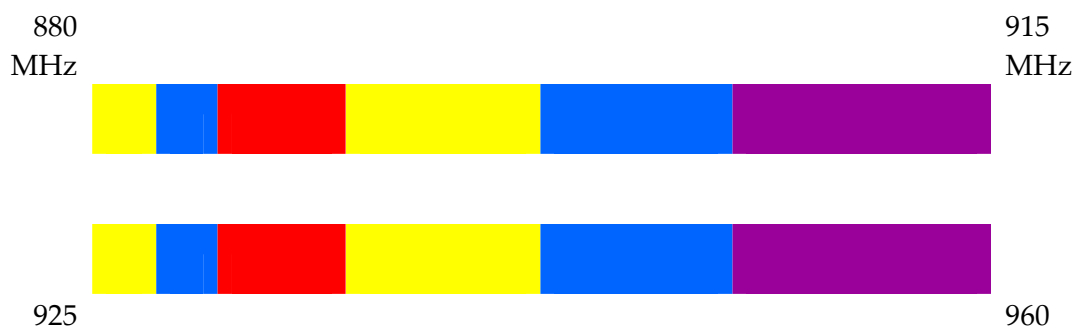
v. Entry into force of PTS' decisions

Decisions made according to the Swedish Act on Electronic Communication usually come into force when they are made and PTS did not suggest deviating from this principle. However, the five applicants had requested PTS to postpone the coming into effect for the decision of technology neutrality and service neutrality to ensure all 900 MHz band licensees would have the same timing for regulatory approval for starting deployment of new mobile technologies and PTS accepted this request.

vi. Restructuring the 900 MHz band – the configurations

The 900 MHz band, the first step:

- Renewal of the incumbents licenses
- Expanding the 900 MHz band to 2X35 MHz
- Award of additional spectrum to incumbents



¹⁸ Chapter 3, section 23.

¹⁹ Chapter 3, section 12.

MHz

MHz

Figure 3: Tele2: 925-927.5/880-882.5 MHz, Telenor: 927.5-930/882.5-885 MHz, Swefour: 930-935/885-890 MHz, Tele2: 935-942.5/890-897.5 MHz, Telenor: 942.5-950/897.5-905 MHz, TeliaSonera: 950-960/905-915 MHz

The 900 MHz band, the second step, 12 months after the PTS decision comes into effect, or in case of e.g. a complaint was filed, three months after the final decision was made:

- Transfer of usage rights from Tele2 and Telenor to HI3G introducing the fifth licensee in the band
- Refarming: the GSM only restrictions to be lifted and replaced with a more technology neutral and service neutral spectrum usage rights

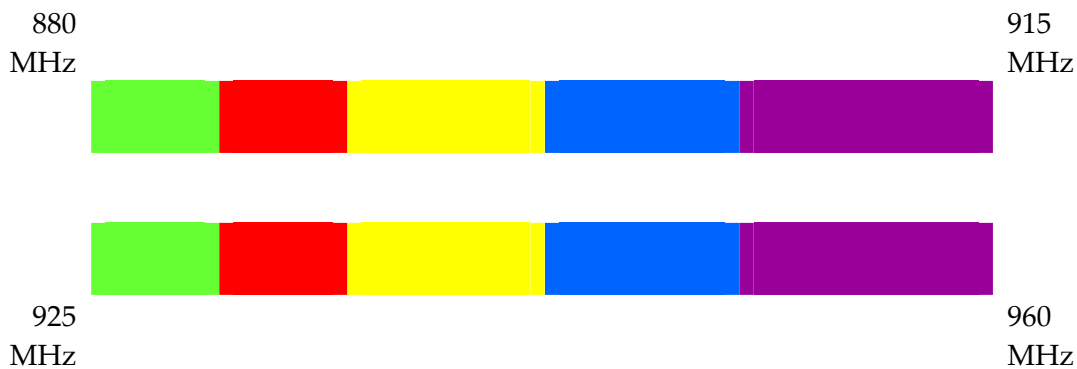


Figure 4: HI3G: 925-930/880-885 MHz, Swefour: 930-935/885-890 MHz, Tele2: 935-942.5/890-897.5 MHz, Telenor: 942.5-950/897.5-905 MHz, TeliaSonera: 950-960/905-915 MHz

b. Consultation responses received by PTS

The main message to PTS from interested parties responding to the public consultation was about PTS making sure the 880-915/925-960 MHz frequency band were used for public mobile services to promote efficient use of the frequency resource.

PTS also received comments on competition aspects²⁰: stakeholders questioned whether the existing mobile operator's use of the 900 MHz band would promote competition, it was argued by some stakeholders that the E-GSM band should be reserved for interested parties that can develop the GSM infrastructure to cover local needs and provide coverage based on national roaming and stakeholders argued use of spectrum for niche applications.

In addition, PTS received comments on technical aspects aimed at handling potential harmful interference risks²¹: stakeholders claimed it was important to protect the 960-1215 MHz frequency band, which is used by aviation and stakeholders argued protection of the GSM-R frequency band from the risk of interference was the vital issue including implementing guard bands when commercial operation of UMTS900 would be possible. The

²⁰ <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf> (page 5)

²¹ <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf> (page 6)

issue of protecting the scientific research use of the frequency band 925-935 MHz in the geographical area around Kiruna was pointed at by stakeholders.

Finally, PTS received comments on legal aspects²²: stakeholder commented on the presumption for license renewal should not cover the aspect of moving from GSM only usage rights to technology neutral and service neutral licenses. Furthermore, the stakeholder claimed there should be no award of additional bandwidth to incumbents and no approval of partial trading but rather an award, auction or beauty contest, set up by PTS for the additional bandwidth.

²² <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf> (page 6)

5. 2009: the decision phase

On 13 March 2009 PTS made its decision on expanding the 900 MHz band to full 2X35 MHz and awarding additional bandwidth to mobile operators and the decision of lifting the technology restrictions on GSM only so that the band could be refarmed and used for other mobile technologies in addition to GSM.²³

The documents published by PTS were:

- Decision 900 MHz²⁴
- 900 MHz band license, Hi3G²⁵
- 900 MHz band license, Telenor²⁶
- 900 MHz band license, Tele2²⁷
- 900 MHz band license, TeliaSonera²⁸
- 900 MHz band license, Swefour²⁹

a. PTS on policy objectives

As a general comment on policy objectives the PTS in their decision document stated that:

The provisions of the Electronic Communications Act (2003:389) (LEK) aim to ensure that private individuals and public authorities shall have access to secure and efficient electronic communications and the greatest possible benefit from affordable services. Efficiency is the fundamental platform for Swedish spectrum management. Technological development, sound competition and international harmonisation are all keywords for assessing what is to be deemed to constitute this type of efficient management of resources. With these starting points, there is good potential for benefiting end users/consumers.

For a number of years now, the 900 MHz frequency band has been one of the best utilised frequency bands in Sweden. This use gives individuals and public authorities access to secure and efficient radio communications and a good range of qualitative radio services. For this reason, when applying the provisions of LEK, special consideration should be taken of the GSM networks' overall benefit to society and how well the application:

²³ The decision documents on 900 MHz band license renewal was published by PTS on their website by 17 April 2009.

²⁴ <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf> Legally binding document in Swedish: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-beslut-900mhz-090313.pdf>

²⁵ <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-hi3g-march-2009.pdf> Legally binding document in Swedish: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-tillstand-900-hi3g-090313.pdf>

²⁶ <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-telenor-march-2009.pdf> Legally binding document in Swedish: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-tillstand-900-telenor-090313.pdf>

²⁷ <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-tele2-march-2009.pdf> Legally binding document in Swedish: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-tillstand-900-tele2-090313.pdf>

²⁸ <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-teliasonera-march-2009.pdf> Legally binding document in Swedish: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-tillstand-900-teliasoneramobile-090313.pdf>

²⁹ <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-swefour-march-2009.pdf> Legally binding document in Swedish: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-tillstand-900-swefour-090313.pdf>

- enables the continued operation of and investment security for existing GSM networks,
- enables a demand assigned transition from GSM to UMTS or LTE,
- ensures continuity in the range of qualitative telephony and broadband services, and
- prevents the risk of competition being distorted in the mobile radio market in question.³⁰

b. About the decisions

i. Renewal of usage rights for incumbents

PTS decided that the 900 MHz band spectrum usage rights should be renewed.

PTS refers to the fact that the Swedish Act on Electronic Communications does not explicitly regulate the procedure for renewal of licenses or state that existing licensees have a 'statutory right to extend' a license. Then PTS went on to referring to 'the legislative history'³¹ that includes "*statements that presumption should mean that a new licence is granted in conjunction with the term of the licence expiring – possibly on other conditions, if necessary, considering the interests of efficient frequency use.*"³²

Once again PTS made it clear that even if an presumption for renewal existed the licensees had no right to maintain its spectral placing in the band or to be assigned same bandwidth, same amount of spectrum, in the renewal of licenses award process.

ii. Expanding the band to 2X35 MHz and award of additional bandwidth to incumbents

In its decision on expanding bandwidth per licensee and award additional bandwidth to incumbents PTS refers to the additional bandwidth as "*reserve contingency space for the development of existing and new radio uses*" and further elaborates on this based on sources for interpreting and applying the rules of the Act on Electronic Communications³³ by stating "*this type of contingency space may involve operations of a nature that are clearly beneficial to society; for example, police activities and large radio networks (e.g. 'mobile telecommunications networks'), which require additional capacity for future growth*".³⁴

³⁰ Page 8 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

³¹ PTS refers to Government Bill 1992/93:200, p. 219 ff., cf. Government Bill 2002/03:110, p. 151 f when using the term "the legislative history". Based on the type of documents PTS refers to this means statements in official documents where reasoning behind the draft Act on Electronic Communications were explained for decision makers in the adoption of the Act process. Under a legal system such as the Swedish those documents are considered relevant and important when interpreting and applying the Act – it is sources for interpretation of the rules.

³² Page 9 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

³³ Chapter 3, Section 6, first paragraph, item 5 of LEK

³⁴ Page 10 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

PTS concludes that harmonising the 900 MHz band for continuing mobile use clearly is efficient use of the spectrum. As basis for this conclusion PTS points at; (1) the current extensive use in Sweden, (2) how important current use is for the Swedish society, (3) how important current use is for the provision of mobile broadband services in Sweden and (4) the international developments on harmonisation of this band for future deployment of technologies such as UMTS900 and LTE including the developments of amending the legally binding instruments of the European Union³⁵.

PTS stated in their Decision that:

*“With regard to expected technological development in the band, the owners of the radio networks involved have a need and a justified claim for assignment of the unoccupied frequency space, and consequently priority rights in relation to the other interested parties per se. Having the ambition to intend to assign and use the entire bandwidth of 2*35 in the 900 MHz band appears to be an effective solution presented by the applicant from a technical point of view.”³⁶*

PTS decided that the additional bandwidth the incumbents had applied for should be awarded. In their joint application the incumbents did put forward a request for expanding their bandwidth from 2X7.2 MHz to 2X10 MHz. This could be done by PTS deciding to expand the 900 MHz band to the full 2X35 MHz internationally harmonised band (the 900 MHz band used to be 2X30 MHz in Sweden) and by PTS closing the 0.2 MHz guard band gaps between licenses.

iii. Approval of partial transfer of usage right

PTS approved Tele2's and Telenor's transfer of totally 2X5 MHz of 900 MHz band spectrum to HI3G.

In its decision PTS states that lifting technology restrictions so that other mobile technologies than GSM can be deployed in the 900 MHz band can lead to competitive advantages for 900 MHz band incumbents and disadvantages for operators with no 900 MHz band license. PTS concluded that rolling out mobile communications services in the 900 MHz band is considerably less expensive than doing so in the 2100 MHz band. PTS stated that:

“The partial transfer of certain frequency space is thus a precondition for dealing with the risk that competition between UMTS operators may become distorted.”³⁷

³⁵ EU Council Directive (87/372/EEC). The non-legally binding EU Recommendation (87/371/EEC) is also relevant.

³⁶ Page 11 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

³⁷ Page 11-12 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

We can conclude PTS did consider the transfer of 900 MHz band spectrum from Tele2 and Telenor to HI3G an 'ensuring competitive playing level field tool' before approving deployment of other mobile technologies than GSM in the 900 MHz band.

iv. International harmonisation and assumptions on technology availability for channel plan arrangement

PTS concluded that for deployment of future technologies such as UMTS900 and LTE in the 900 MHz band a technical structure of the band based of 2X5 MHz block or multiples of 2X2.5 MHz is the best starting point. PTS also recognises that making it possible for licensees to have assignments of contiguous blocks must happen for the opportunity to deploy the wider carriers of the newest mobile technologies.

PTS noted that the licensees will have to cooperate and coordinate with their spectral neighbours. Furthermore, PTS noted that licensees engage in arrangements that will allow adding up blocks of spectrum for deploying wider carriers than a 5 MHz carrier also are likely to become a reality.³⁸ PTS commented on the spirit on technical cooperation already seemed to be in place among the operators and went on to state that *"any further dividing up of the band appears to be ineffective from a technical perspective"* before concluding that dividing the band into blocks of spectrum as proposed in the joint application from the mobile operators *"may be deemed to meet the requirements for an efficient use of frequency"*.³⁹

v. Duration, expiry date

PTS decided that the renewed license will expire by 31 December 2025. This was the expiry date the five mobile operators did request in their joint application. It means the renewed license was given duration of 15 years (measured from the decision came into force and until expiry).

vi. Entry into force of PTS' decisions

PTS decided that the decision was given immediate effect regarding the licenses that was renewed and the consent issued for the partial transfer of spectrum usage rights in the 900 MHz band. In their joint application the five mobile operators did request that the agreed reconfiguration of the band and the conditions on more technology neutral and service neutral usage rights should entry into force at a later point in time and at same day for the five operators that would have 900 MHz band usage rights after the reconfiguration of the band process was finalized and PTS approved their request.

vii. Technology and service restrictions lifted

PTS aimed at ending up with more technology neutral and service neutral licenses.

³⁸ Page 10-11 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

³⁹ Page 11 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

PTS' decision:

- For twelve months, or alternatively for the period of three months after a final decision had been made following a complaint case, the licensees use of their 900 MHz band licenses was restricted to GSM only.
- After the twelve months, alternatively three months after a final decision had been made following a complaint case, the GSM only restrictions were lifted and replaced with more neutral technical conditions allowing the licensees to deploy GSM/EDGE/GPRS, UMTS/HSPA and mobile technologies that can co-exist (such as e.g. LTE).

PTS did include an option for 900 MHz band licensees to engage in private coordination agreements which may also be used to deviate from the technical requirements of the licenses. 900 MHz band licensees may negotiate and conclude private coordination agreements, e.g. with their spectral neighbours, which means deviating from the maximum radiated power limits etc. defined in the licenses.

PTS decided to minimize the regulation of services that licensees must provide and ended up with imposing only a condition requiring all licensees to offer a voice service (without specifying technology to be used).

viii. Coverage requirements reviewed

PTS stated that the importance of GSM networks to Swedish society means the 900 MHz band licences must continue to contain coverage requirements.⁴⁰

The conditions imposed were about requiring all licensees to maintain their current geographic and population coverage if they choose to upgrade their technology. This means the licensees must ensure same coverage as for GSM if they chose to change technology. But coverage requirements can be met using the 900 MHz band, the 1800 MHz band and the 2100 MHz band or a mix of those bands and by using their preferred mix of technologies.

The coverage requirements imposed expires by 31 December 2015. PTS may extend the coverage requirements beyond 2015 at a later point in time. According to PTS they did choose this solution because it is difficult to foresee future developments in society, demographics and costs in order to maintain coverage so re-examining such conditions makes most sense.⁴¹

In its Decision PTS stated that:

⁴⁰ Page 13 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

⁴¹ Page 13 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

“In order to promote the coordinated use of infrastructure and primarily considering the fact that different networks (which were originally set up for specific services using specific technology) are ‘amalgamating’, it should be possible to satisfy the coverage requirement by utilising infrastructure that uses the 900 MHz, 1800 MHz as well as the 2.1 GHz bands. This enables the licence holder to utilise frequencies that provide the best coverage while meeting the interests of interoperability.”⁴²

ix. Technical conditions for minimizing harmful interference

Technical conditions aimed at minimizing risks of harmful interference were imposed.

PTS did pay attention to managing risk of harmful interference into GSM-R services in adjacent frequency band when setting technical conditions for deployments of other technologies than GSM in the 900 MHz band:

“...according to available studies regarding the co-existence of UMTS in the 900 MHz/1800 MHz bands and the use of adjacent frequency bands⁹, there is a risk that rolling UMTS out in the 900 MHz band will cause interference to the use of the GSM-R bands 876-880/921-925 MHz under certain conditions; that is, mobile telephony for rail traffic. The GSM-R bands are directly adjacent to the GSM bands. Considering the protection required for GSM-R and the risk of harmful interference, the signal strength for transmissions in the 900 MHz band must consequently be limited near railways.”⁴³

The annex of the licenses⁴⁴ technically defines the use of the 900 MHz band aiming at protecting GSM-R when the 900 MHz band licensee uses other mobile technologies than GSM.

Technically configuring the 900 MHz band with no external guard bands between the 2X5 MHz blocks creates a risk of some interference. In its Decision PTS stated that: *“...the UMTS standard will mean that the equipment will use a frequency space comprising a displaced 100 kHz in the adjacent higher frequency block. For this reason, it is crucial that the licence holders keep in force agreements that regulate the conditions for co-existence in conjunction with the use of UMTS in the band.”⁴⁵*

⁴² Page 13 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

⁴³ Page 12 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

⁴⁴ <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-hi3g-march-2009.pdf> ,
<http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-swefour-march-2009.pdf> ,
<http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-tele2-march-2009.pdf> ,
<http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-telenor-march-2009.pdf> ,
<http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-teliasonera-march-2009.pdf>

⁴⁵ Page 13 of the Decision Document: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-decision-900-mhz-march-2009.pdf>

Finally a general obligation to respect international coordination agreements are imposed upon 900 MHz band licensees: *“The licence holder shall plan frequencies in accordance with the coordination agreements applying from time to time that have been concluded with Denmark, Finland and Norway.”*⁴⁶

x. Spectrum usage rights awarded

The assignments for the next 12 months, or alternatively until three months after a final decision was legally binding should a situation of complaints occur, was about maintaining status quo:

Swefour	929.9-936.7/884.9-891.7 MHz	(2X6.8 MHz)
TeliaSonera	936.9-944.1/891.9-899.1 MHz	(2X7.2 MHz)
Tele2	944.3-951.5/899.3-906.5 MHz	(2X7.2 MHz)
Telenor	951.7-958.9/906.7-913.9 MHz	(2X7.2 MHz)

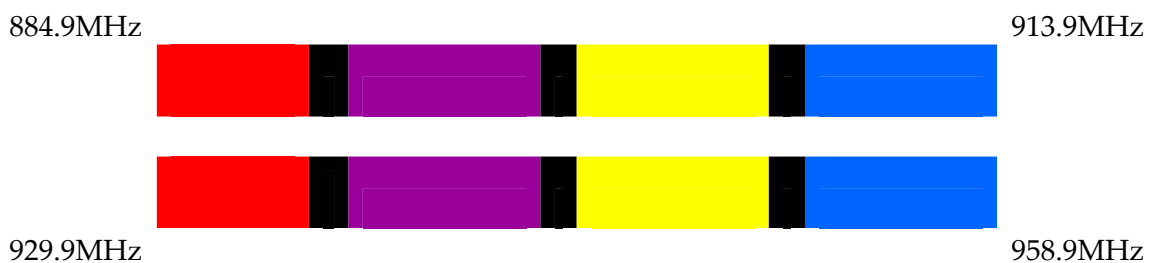


Figure 5: the distribution of spectrum between the four 900 MHz band incumbents and the external guardbands between licenses for the first phase of the process

After the twelve months, alternatively three months after a decision was legally binding following a complaint case situation, the 900 MHz band was expanded to 2X35 MHz, external guardband gaps between licenses was closed and the additional assignments for the incumbents happened.

⁴⁶ Same wording on page 2 of all the licenses: <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-hi3g-march-2009.pdf> , <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-swefour-march-2009.pdf> , <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-tele2-march-2009.pdf> , <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-telenor-march-2009.pdf> , <http://www.pts.se/upload/Beslut/Radio/2009/08-12019-licence-900-teliasonera-march-2009.pdf>

The distribution of spectrum between the 900 MHz band incumbents prior to the transfer of spectrum usage rights from Tele2 and Telenor to HI3G:

Tele2	925-927.5/880-882.5 MHz	(2X2.5 MHz)
Telenor	927.5-930/882.5-885 MHz	(2X2.5 MHz)
Swefour	930-935/885-890 MHz	(2X5 MHz)
Tele2	935-942.5/890-897.5 MHz	(2X7.5 MHz)
Telenor	942.5-950/897.5-905 MHz	(2X7.5 MHz)
TeliaSonera	950-960/905-915 MHz	(2X10 MHz)

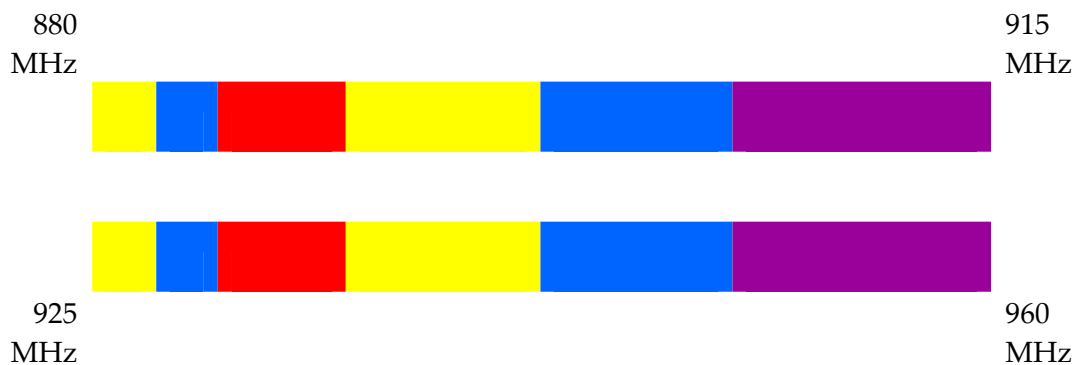
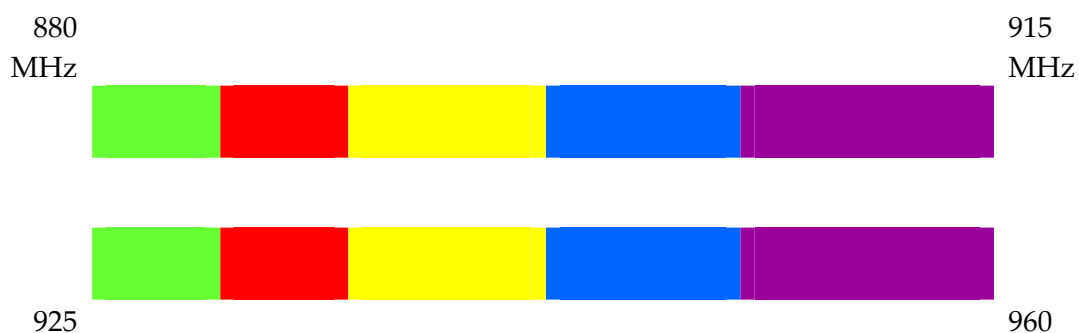


Figure 6: the distribution of spectrum between the four 900 MHz band incumbents after expanding the 900 MHz band to 2X35 MHz, closing the guardband gaps between licenses and assigning the additional bandwidth to the incumbents

The last step of the process was to transfer 2X2.5 MHz of spectrum from Tele2 to HI3G and to transfer 2X2.5 MHz of spectrum from Telenor to HI3G. After the transactions were completed the assignments are as follows:

HI3G	925-930/880-885 MHz	(2X5 MHz)
Swefour	930-935/885-890 MHz	(2X5 MHz)
Tele2	935-942.5/890-897.5 MHz	(2X7.5 MHz)
Telenor	942.5-950/897.5-905 MHz	(2X7.5 MHz)
TeliaSonera	950-960/905-915 MHz	(2X10 MHz)



MHz

MHz

Figure 7: the distribution of spectrum between five licensees in the 900 MHz band after completion of all adjustments and transactions related to the renewal of incumbents licenses.

c. Refarming – more technology neutral usage rights for deployment of mobile technologies that can co-exist in the 900 MHz band

The process of renewing the licenses and getting to this configuration of the band accommodating five 900 MHz band licensees was also the preparations leading to refarming the band for deployment of other mobile technologies than GSM. As outlined in the joint application from the five mobile operators and approved by PTS lifting the GSM only restrictions and replacing them with more technology neutral conditions so mobile technologies that can co-exist may be deployed did happen simultaneously for the five 900 MHz band licensees.

From 24 May 2011 technology choices and the incumbents timing for implementing their technology upgrades are commercial decisions subject to the requirements on coordinating with your spectral neighbours to manage interference risks.

6. 2009-2011: the complaint phase

PTS Decision of 13 March 2009 on renewal of licenses, expanding bandwidth for licensees, lifting the GSM only restrictions and adjust terms and conditions for licensees in the 900 MHz band was subject to filing of a complaint. The competent court (Förvaltningsrätten) decided on 2 February 2011 to dismiss the complaint. This decision by the court came into force on 23 February 2011.

On the 2 March 2011 PTS published a press release informing the public about the complaint being dismissed and stating that there was no longer any uncertainty on future spectrum usage rights in the 900 MHz band.⁴⁷

Furthermore, on 2 March 2011 PTS announced that from 24 May 2011 the 900 MHz band licensees may deploy other mobile technologies than GSM in the 900 MHz band.

⁴⁷ PTS press release, Swedish only: <http://www.pts.se/sv/Nyheter/Radio/2011/Rattslig-klarhet-om-900-MHz-bandet/>

7. 2011: technical terms and conditions amended

On 6 May 2011 PTS published a consultation on adjustment of technical conditions aimed at minimizing and handling potential harmful interference between GSM-R and the deployment of various mobile technologies that the 900 MHz band licensees may do after 24 May 2011.⁴⁸ PTS published their proposals and the draft outlining the adjusted technical conditions for the five licensees in the 900 MHz band.⁴⁹

Following the deadline for responding to the consultation PTS published the consultation responses they received (a joint response from the five 900 MHz band licensees, a response from HI3G, a response from the GSM-R operator and a response from the international union of railways).⁵⁰ PTS also published their summary of the received consultation responses and their comments to those responses.⁵¹

On 4 July 2011 PTS announced an adjustment of technical conditions for the five 900 MHz band licensees aiming at minimizing harmful interference incidents for the GSM-R systems in the band spectrally adjacent to the 900 MHz mobile band. PTS stated on their website that deployment of new mobile technologies in the 900 MHz band would increase the risk of harmful interference for the GSM-R system.

In July 2011 PTS decided to split the responsibility for handling the harmful interference risk and potential episodes equally between the GSM-R operator and licensees in the 900 MHz band.⁵²

The usage right for GSM-R and the 900 MHz band for mobile are spectrally adjacent:

921-925	925-930	930-935	935-942,5	942,5-950	950-960
876-880	880-885	885-890	890-897,5	897,5-905	905-915
GSM-R	Hi3G	Swefour	Tele2	Telenor	TeliaSonera

Source: PTS Decision 4 July 2011 on adjusting HI3G's 900 MHz band license

Since deployments of other technologies than GSM in the 900 MHz band may happen after the GSM-only restrictions were lifted on 24 May 2011 PTS decided to adjust terms and

⁴⁸ PTS publishes documents, Swedish only: <http://www.pts.se/sv/Nyheter/Radio/2011/PTS-foreslar-skarpning-av-tekniska-regler-i-900-MHz-bandet/>

⁴⁹ Swedish: <http://www.pts.se/sv/Dokument/Remisser/2011/Samrad-av-andrade-villkor-for-skyddet-av-GSM-R-i-900-MHz-bandet/>

⁵⁰ Swedish: <http://www.pts.se/sv/Dokument/Remisser/2011/Samrad-av-andrade-villkor-for-skyddet-av-GSM-R-i-900-MHz-bandet/>

⁵¹ Swedish: <http://www.pts.se/upload/Remisser/2011/Radio/remissammanstallning-900-tillstandsvillkor-110704.pdf>

⁵² PTS website with statement and amended licenses, in Swedish only: <http://www.pts.se/sv/Dokument/Beslut/Spektrum/2011/Beslut-om-andring-av-tillstandsvillkor-900-MHz-bandet/>

conditions of all the 900 MHz band licensees. Consequently, some adjustments to the technical terms and conditions related to adjacency of GSM-R was done in the 900 MHz band licenses for HI3G, Swefour, Tele2, Telenor and TeliaSonera.⁵³ The GSM-R licensee did file a complaint against the PTS decision on amending technical terms and conditions and the process on handling this complaint might lead to adjusting the final outcome of this process. At the time of finalizing this case study the final outcome is not known.

⁵³ PTS Decisions, in Swedish only. HI3G: <http://www.pts.se/upload/Beslut/Radio/2011/11-5602-beslut-900-tillstandsvillkor-hi3g-110704.pdf> Swefour: <http://www.pts.se/upload/Beslut/Radio/2011/11-5603-beslut-900-tillstandsvillkor-swefour-110704.pdf> Tele2: <http://www.pts.se/upload/Beslut/Radio/2011/11-5604-beslut-900-tillstandsvillkor-tele2-110704.pdf> Telenor: <http://www.pts.se/upload/Beslut/Radio/2011/11-5605-beslut-900-tillstandsvillkor-telenor-110704.pdf> TeliaSonera: <http://www.pts.se/upload/Beslut/Radio/2011/11-5606-beslut-900-tillstandsvillkor-telia-110704.pdf>