Case studies for the award of the 700MHz/800MHz band: Finland

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Contents

Please note: This document is one of a series of case studies on approaches to awarding the 700MHz/800MHz band[1] for mobile broadband. The countries in this series are Australia, Finland, Germany, Mexico, and UK. Each case study is available as a separate document.[2]

[1] Across the world, two harmonised UHF bands have been identified for mobile broadband: the 800MHz band (790–862MHz) in ITU region 1 (Europe and Africa) and the 700MHz band (698–806MHz) in the rest of the world.
[2] The case studies, plus a summary document plus presentation, are available for download from the GSMA website at **http://www.gsmworld.com/our-work/public-policy/spectrum/digital-dividend/**

1 Finland: Summary

Finland was one of the first EU countries to take the decision to use the 800MHz band for telecommunications. In August 2007, it was the third EU country to achieve analogue switch-off (ASO) throughout the country, after Luxembourg (August 2006), Netherlands (December 2006), and before Sweden (December 2007), and Germany (December 2008).

In some countries it is necessary to "re-stack" DTT channels following ASO, to remove the channels from the band destined for telecommunications use. However, there was no need to do this in Finland, as the 800MHz band (channels 61 to 69, 790–862MHz) was not used for TV prior to the ASO. Furthermore, the ASO was achieved without the need to occupy those frequencies, even temporarily, for simulcasting.

It might be expected that a country in the vanguard of ASO, and with no TV in the 800MHz band, would also lead the field in the re-assignment of the freed spectrum. However, Finland did not announce plans to issue full spectrum licences in this band until late 2011. By this time, Germany, Spain and Sweden had already auctioned their 800MHz spectrum, Italy was in the auction process, and, France, Switzerland, Ireland and Denmark were expected to auction theirs (before 2Q 2012). Other EU countries were expected to follow later in 2012. Finland had authorised some trials with limited geographical scope, but had been inhibited from issuing definitive spectrum licences at 800MHz, due to its 1313km border with Russia.

The Russian Federation uses channels 61 to 69 (790–862MHz, precisely the band earmarked for telecommunications in Finland, and other EU countries) for aeronautical radio navigation services (ARNS) and military communications. Until recently, this has led bordering countries to avoid using this spectrum for applications other than their own ARNS and military communications, in order to make the management of interference near the border more straightforward. Until early 2011, it seemed to most observers that Russia's neighbours would have to wait until the Russian ASO (which was not expected before 2015, possibly even later) before they could use this spectrum band for mobile telecommunications throughout their territories.

A breakthrough came in the second half of 2011, when the Finnish Communications Regulatory Authority (FICORA) reached agreement with Russia's Federal Supervision Agency for IT, Communications and Media (ROSKOMNADZOR) regarding the 800MHz band. It is worth noting that Sweden, Poland, as well as the Baltic states Latvia, Estonia and Lithuania reached similar agreements with Russia during the summer of 2011, and Norway in late 2011. In mid-2011, 800MHz may have been only one element of many in Russia's negotiations with its Western European neighbours. For example, at around the same time, announcements were also made about cross-border co-ordination in the 900MHz band. In any country, band clearance can sometimes require economic compensation. The Finnish authorities noted at the time:

"[Russia's Minister of Communications and Media] announced that in Russia the shift to the use of the 800MHz band for mobile communications could occur very quickly if the telecommunications companies were willing to bear the cost of the transition. Failing this, the transition could take several years."

In addition to the Russian border issue, there were also potential sources of interference from inside Finland from military uses and from approximately 30,000 wireless microphones. The military use was publicly reported in 2009, and is expected to have declined. As in any country, these military applications will be able to co-exist with mobile broadband in the 800MHz band. In November 2011, the Ministry of Transport and Communications (LVM, by its initials in Finnish) has proposed granting a one-off sum of EUR5.4 million to compensate for expenses incurred to wireless microphone users from switching to alternative frequencies.

In November 2011, the LVM initiated a consultation on the auctioning of the 800MHz band, the main features of which are:

- *A channelization plan in line with that adopted in other EU countries*. Six 2×5MHz lots.
- *A cap of 4×5MHz per operator*, to encourage a competitive market structure and avoid concentration of spectrum in the hands of too few operators.
- *Timing*. The auction could be held by the end of 2013.

- *Coverage obligations.* Winning bidders will be required to construct their networks within three years of the start of the license period. One lot will be required to cover 95% of the population.

It is expected that bidders will seek as much reassurance as can be provided (within the constraints of military confidentiality) regarding interference from military applications at 790–822MHz and 838–862MHz (or channels 61 to 64 and 67 to 69). It has been proposed by the Council of the State (government) that military use in this band should cease by the end of 2013.

2 Finland: Detailed case study

2.1 Overview of process adopted by the regulator

Finland completed its switch-off of analogue TV in August 2007. The transition period had lasted six years, and was characterised by a relatively smooth process of accommodating existing TV broadcasters on DTT multiplexes. Prior to the transition, the country already enjoyed a cable TV penetration of around 50% of households. In any country, the higher the penetration of cable, the less controversial and difficult the process of DTT transition becomes, as there are fewer households requiring enticement (or subsidy) to buy a new receiver.

Figure 2.1 below, provides a timeline of the main events that are of greatest relevance to the creation (and planned award) of the 800MHz band. As can be seen, in 2011 there was a correlation between events in Finland and related announcements in Russia, indicating that Russia had finally decided to take action to make its aeronautical radio-navigation services (ARNS) compatible with mobile telecommunications.

Figure 2.1: Summary of major events associated with the 800MHz band in Finland

Year	Event
1998–2000	The Digital TV Working Group in the Ministry of Transport and Communications (LVM) designs and executes the DTT license award process. Test transmissions begin in 2000.
2001	National DTT broadcasting begins. By the end of the year, the main multiplex reaches 72% of the population [8].
2004	DTT coverage reaches 94% of the population.
2005	DTT coverage reaches 99.9% of the population.
2006	The first two EU countries achieve analogue switch-off: Luxembourg (Aug 2006), Netherlands (Dec 2006) [1].
2007	Finland becomes the third EU country to achieve analogue switch-off (Aug 2007), followed by Sweden (Dec 2007) [1].
2008	Germany becomes the fifth EU country to achieve analogue switch-off (Dec 2008) [1].
2008	Finland assigns the 790–862MHz band to mobile communications, following the standard EU channelization plan.
2010	The wireless microphone consultation process begins [7].
2011	Russia's State Commission for Radio Frequencies (SCR) meets in March, announces the results of ground and flight tests on compatibility between ARNS and DTT [9].
2011	An agreement is reached with Russia. A mobile network can be constructed with full coverage at the distance of 55km from the Russian border in the 800MHz frequency band. In the best-case scenario, the base station may be built at the distance of 12km from the border and customers may use terminal devices at the distance of 4km from the border.
2011	FICORA granted the first radio licences for testing (LTE networks) at the beginning of July.
2011	Russia's SCR confirms the frequency band 791–862MHz (and others) as LTE bands [10].
2015	Analogue switch-off is expected to take place in Russia.

2.2 Justification for clearance of the 800MHz band

Moving terrestrial TV out of the 800MHz band was not an issue in Finland, because the band was mainly used for defence and radio microphones. In 2007, 790–822MHz and 838–862MHz (or channels 61 to 64 and 67 to 69) were

allocated to military use [11]. Reallocating the band for new uses was also indirectly inhibited by the nearby Russian ARNS. If the issues of military use, microphones and Russian ARNS could be resolved, then the economic case for clearing the band to make way for telecommunications would have been an easy one to make. When the Ministry of Transport and Communications (LVM, by its initials in Finnish) turned its attention to this matter in 2007, [11] the switch-off of analogue TV was imminent; it had already been demonstrated that there was sufficient spectrum at frequencies below 790MHz to accommodate the five initial DTT multiplexes foreseen in the country's plans for DTT, even after taking into account the requirement for simulcasting during 2002–2007. In 2007, the LVM announced its intention to carry out feasibility studies into alternative potential uses of the 800MHz band. In June 2008, the Government decided to assign the 800MHz band to mobile broadband networks. The feasibility studies were not publicised, but were explained in detail by the authorities in the same way as the UK and French governments (to give two examples) went about publishing their justifications for the clearance of the band. However, the economic arguments are similar in any country, to do with the anticipated sharp increase in the number of mobile broadband subscriptions, and the consequent economic harm that would result from restricting the amount of spectrum available for extra mobile network capacity.

2.3 Obstacles faced during band clearance

In this section, we discuss a few of the challenges faced by Finland during the process of clearing the 800MHz band.

2.3.1 Adoption of set-top boxes

In the two years leading up to ASO in September 2007, there were repeated expressions of concern in the communications media about the number of households without digital receivers. A survey commissioned by the LVM in August 2005 found that only around 33% of Finnish homes were prepared for the switchover [12]. With only two years remaining of the six transition years (decoders went on sale in 2001), it might have been hoped that the proportion of households with a decoder would have exceeded 66%. Concerned about the rate of adoption, there were reports at the time that the LVM was considering financial support to the poorest families to acquire a digital decoder. However, in practice, we are not aware of any such support being made widely available. It appears that many Finnish households simply left it until the last moment to acquire a decoder. In the end, only approximately 18,000 households were without a decoder at the time of the switch-off (less than 1% of households).

The fact that the LVM conducted specially designed, quarterly surveys in the period before the switch-off (the August 2007 survey previously mentioned was one of these) indicates that it was monitoring DTT take-up closely. The survey was designed to measure penetration of DTT, cable and satellite decoders, with a sample size giving a margin of error of 2.5% for these statistics.

In addition to its statistical monitoring programme, the Finnish government set up a website to promote the switchover called "DigiTV". It contained consumer advice, antenna installer recommendations, coverage maps and other practical information on the transition that was easy to access and colourfully presented.

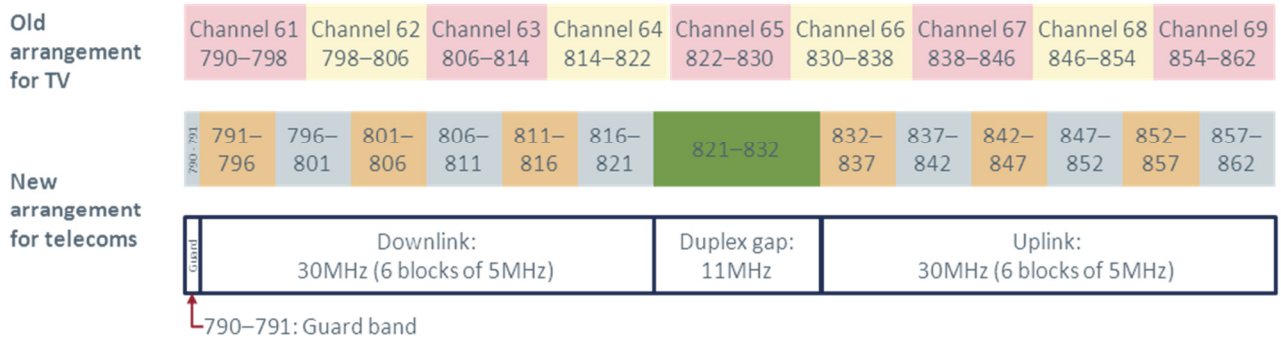
2.3.2 Clearing wireless microphone use

The clearing of wireless microphones from the 800MHz band in Finland provides an example of a consultative process with industry to find practical solutions to the problems of the future coexistence and coordination of microphones and mobile broadband in this band. In 2010, representatives of the user groups of radio frequencies were invited to a hearing regarding the likely need to move these microphones to another band. Subsequently, 17 consultation responses were received. The microphone users pointed out the significant cost of renewal of their equipment, and the practical problems in finding sufficient alternative frequencies. The government then modified its plans and circulated these to the consultation group for a further set of comments. Following this consultation process, the transition period for radio microphones was extended to 31 December 2020. In future, these microphones should operate in the frequencies that are used for high power broadcast TV (174–230MHz and 470–790MHz), or else use the 'duplex gap' (required to separate the up-link and down-link communications in FDD-LTE, the flavour of LTE likely to be used by most mobile operators in this band) at around channel 65.

Another helpful spin-off from the consultation was the (informal) confirmation that the number of radio microphones in use is significant (c.30,000) – certainly significantly greater than the number officially licensed. Equally useful were discussions about how these devices can be re-tuned: users pointed out that some of them can be re-tuned to

694–790MHz, thus keeping them in a band alongside an application with which microphones had always co-existed: terrestrial TV. It had been the intention of the designers of the EU harmonised band plan for the 800MHz band to migrate microphones (and other non-telecoms uses) towards the duplex gap at 821–832MHz (see Figure 2.2). By holding the consultation, the LVM was able to gauge the extent to which the devices in Finland would be able, in practice, to be re-tuned to suit the EU's harmonised plan, or whether they would have to be replaced with new devices. In November 2011, the LVM proposed granting a one-off sum of EUR5.4 million to compensate for expenses incurred to wireless microphone users from switching to alternative frequencies [20].

Figure 2.2: Harmonised channel arrangements for the 790–862MHz band [Source: adapted from [13] by Aetha]



2.3.3 Military use

In addition to the Russian border issue, there were also potential sources of interference from within Finland, from military uses. In 2007, 790–822MHz and 838–862MHz (or channels 61 to 64 and 67 to 69) were allocated to military communications. [11]. It has been proposed by the Council of the State (government) that military use in this band should cease by the end of 2013.

2.4 Protection of other/neighbouring spectrum uses

2.4.1 Russia

It might be expected that a country in the vanguard of ASO, and with no TV in the 800MHz band, would also lead the field in the re-assignment of the freed spectrum. However, Finland did not announce plans to issue full spectrum licences in this band until late 2011. By this time, Germany, Spain and Sweden had already auctioned their 800MHz spectrum, Italy was in the auction process, France, Switzerland, Ireland and Denmark were expected to auction theirs (before 2Q2012). Other EU countries were expected to follow later in 2012. Finland had authorised some trials with limited geographical scope, but had been inhibited from issuing definitive spectrum licences at 800MHz, due to its 1313km border with Russia [17].

The Russian Federation uses channels 61 to 69 (790–862MHz, precisely the band earmarked for telecommunications in Finland, and other EU countries) for aeronautical radio-navigation services (ARNS) and military communications. Until recently, this has led bordering countries to avoid using this spectrum for applications other than their own ARNS and military communications, in order to make the management of interference near the border more straightforward. Until early 2011, it seemed to most observers that Russia's neighbours would have to wait until the Russian ASO (which is not expected before 2015, possibly even later) before they could use this spectrum band for mobile telecommunications throughout their territories.

A breakthrough in the process came during the second half of 2011, when Finland's telecommunications regulator FICORA reached agreement with Russia's State Commission for Radio Frequencies (SCR) regarding the 800MHz band. Under the agreement, a mobile network can be constructed with full coverage up to 55km from the Russian border. In the best-case scenario, the base station may be built at the distance of 12km from the border, and customers may use terminal devices at the distance of 4km from the border [5]. This agreement is encouraging, not only because of its terms, but also because it shows that a productive dialogue on a modern spectrum management issue has taken place between the authorities either side of the border.

It is worth noting that Sweden and Poland, as well as the Baltic states of Latvia, Estonia and Lithuania, reached similar agreements with Russia during the summer of 2011,[3] followed by Norway later in 2011. 800MHz may have been only one element of many in Russia's negotiations with its Western European neighbours in mid-2011. For example, at around the same time, announcements were made about cross-border co-ordination in the 900MHz band as well [18]. In any country, band clearance can sometimes require economic compensation. The Finnish authorities noted at the time:

"[Russia's Minister of Communications and Media] announced that in Russia the shift to the use of the 800MHz band for mobile communications could occur very quickly if the telecommunications companies were willing to bear the cost of the transition. Failing this, the transition could take several years." [19]

Furthermore, Russia did not need full economic compensation from its own mobile operators (or foreign parties such as Finland, Poland and the Baltic States) for the costs of clearing the band: like any country, it had much to gain economically in any case by re-organising its ARNS, or removing it entirely to another band. Channels 61 to 69 are valuable to Russia for mobile telecoms, as well as also (potentially) to simulcast the 20 or so TV channels expected during the transition to DTT. Switching off the analogue signal is most difficult in countries with a high penetration of terrestrial TV viewers and a large number of channels in the standard 'free-to-air' package. Terrestrial television dominates other forms of TV distribution in Russia, with about 70% penetration, and as many as 19 analogue TV programming channels available in the largest cities [3]. The Russian authorities expect the DTT signal to reach 47 million (33%) of the population by the end of 2011 [4]. The proportion of households able to view the digital channels (that is, with a DTT receiver) will, as is usual in DTT switchover processes anywhere, be significantly lower than this.

Russia's SCR engaged in the first half of 2011 in a series of negotiations with its neighbours to facilitate (among other things) the deployment of mobile broadband networks in the 800MHz band. In order to do this, it would have assessed changes to the ARNS system usage near the borders. Little is publicly known about Russia's ARNS system. In any country, such systems have a variety of different types of transmitters, some on the ground and some on aircraft [14]. We do know that in March 2011, the SCR announced the results of ground and flight tests on compatibility between ARNS and DTT [9]. We also know that in September of the same year the SCR confirmed the frequency band 791–862MHz as an LTE band [10]. Russia took the decision in 2011 to make the ARNS compatible with LTE, and the neighbours are enjoying the benefits of that decision.

Regarding potential interference to Finnish mobile communications in the 800MHz band from Russian analogue TV, Russia (like any country) does not necessarily focus ASO on border areas. The Russian regions bordering Finland (Murmansk, Karelia and Leningrad Oblast) are in the second phase of the TV digitalisation programme, scheduled for 2011–12 [15]. The regions ahead of them, in the first phase of the programme (whose digitalisation began in 2010) are not close to European borders.

Finally, the date for ASO in Russia is uncertain. The government's official DTT transition website contains a re-assurance to viewers that switch-off could be later than 2015 [16]. Now, other countries' experience shows that ASO can also be accelerated, if governments so decide (Russia's has not taken that decision yet). The most meaningful expectation at the time of writing regarding the expectation of Russia's ASO is that it could be 2015 'plus or minus' one or two years.

2.5 Award mechanism for the 800MHz band

Following breakthrough on the issue of cross-border interference between Finnish wireless broadband and Russian ARNS, the Finnish government announced that it would move quickly to begin the award process [6]. In November 2011, the LVM initiated a consultation on the auctioning of the 800MHz band, the main features of which are [20]:

- *A channelization plan in line with that adopted in other EU countries*. Six 2×5MHz lots.
- *A cap of 4×5MHz per operator*, to encourage a competitive market structure and avoid concentration of spectrum in the hands of too few operators.
- *Timing*. The auction could be held by the end of 2013.
- *Coverage obligations.* Winning bidders will be required to construct their networks within three years of the start of the license period. One lot will be required to cover 95% of the population.

[3] At the time of writing, Sweden is the only one of these countries whose telecommunications regulator has published the text of the agreement [21]

As in any country, the military applications mentioned earlier in this report will either be able to co-exist with mobile broadband in the 800MHz band or be cleared from the band. It has been proposed by the Council of the State (government) that military use in this band should cease by the end of 2013.

2.6 References

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