DSO — the Swedish experience

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One of the most interesting, complicated, intriguing and political questions for the upcoming years in Europe will be the question of how to handle the spectrum in the UHF band (470 - 862 MHz). Up to now, this has been the frequency space used for analogue television but with the approaching analogue switch-off, this will change.

In Sweden, the last analogue transmitter was shut down a year ago and the process for a new spectrum allocation is up and running at full speed. This article takes a closer look at the situation in Sweden.

In Sweden, digital terrestrial transmissions started relatively early. Sweden was actually the second European country to launch DDT services, in March 1999, just a couple of months after the UK. During the subsequent years, it was expanded to five multiplexes (muxes), providing national coverage. Mux 1 is the Public Service (PS) bouquet with an outstanding coverage of 99.8% of the Swedish population. Muxes 2 - 4 cover some 98% of the population and Mux 5 about 70%. Today there are 30+ channels in the digital terrestrial network, most of them on subscription from the pay-TV operator Boxer. However, there is also a free-to-air choice comprising the PS channels and some commercial and local channels.

In 2005, the close-down of the three analogue channels started. SVT had two channels – SVT1 on VHF and SVT2 on UHF – and the commercial broadcaster TV4 had one channel in the UHF band. During the close-down period, SVT, TV4, Teracom and the "Swedish Digital Commission" joined forces and launched a massive information campaign to prepare all households for the coming switchover. It was a sequential switch-off, area by area and, in October 2007, the very last analogue transmitter (in the south of Sweden) was switched off.

Overall, it was quite a smooth transition to digital and it went much easier then some might have thought in advance. This could partly be explained by the long period of parallel transmissions (simulcating) that were provided for the Swedish population to prepare for the digital age of television.

About 25% of Swedish households are dependent on terrestrial reception, but if 2nd and 3rd TV sets are included, this figure rises. The penetration of cable is about 55% in Sweden and the majority of cable networks are still analogue. Satellite services are available in 25% of the households.

In the all-digital age of television, any broadcaster that wants to transmit on the terrestrial network in Sweden has to apply for a licence in any of the muxes 2 - 5. From 2008 onwards, this is being handled by the Swedish Radio & Television Authority *(Radio & TV-verket)*, whereas previously it was handled directly by the government. There is no auction process; instead, the Radio & Television Authority has the difficult task of creating a diverse mix of different types of channels, i.e. it is more of a so-called "beauty contest". The licence period is six years and the broadcaster can choose either a free-to-air or subscription model, the latter using a common CA card.

At the moment there is only one terrestrial pay-TV operator in Sweden (Boxer), but a change in the regulations in 2007 has opened up the market for other operators to establish themselves in the DTT marketplace. The digital network itself is operated by Teracom, a state-owned PTT operator. Mux 1 is dedicated to public service transmissions from SVT. It is free-to-view and regulated directly by the government.

The digital dividend

So now we come to the difficult question of the "digital dividend": How big is it?

Sweden, like many other countries in our region, was granted seven national muxes in the UHF band at the Geneva planning conference in 2006 (GE06). We have five muxes in operation at present and have closed down two analogue UHF networks. Therefore the digital dividend would come to two muxes.

However, the EU has another definition, where the digital dividend is the frequency space left when the analogue services are converted to digital. According to this definition, the digital dividend in Sweden works out at 6½ muxes.

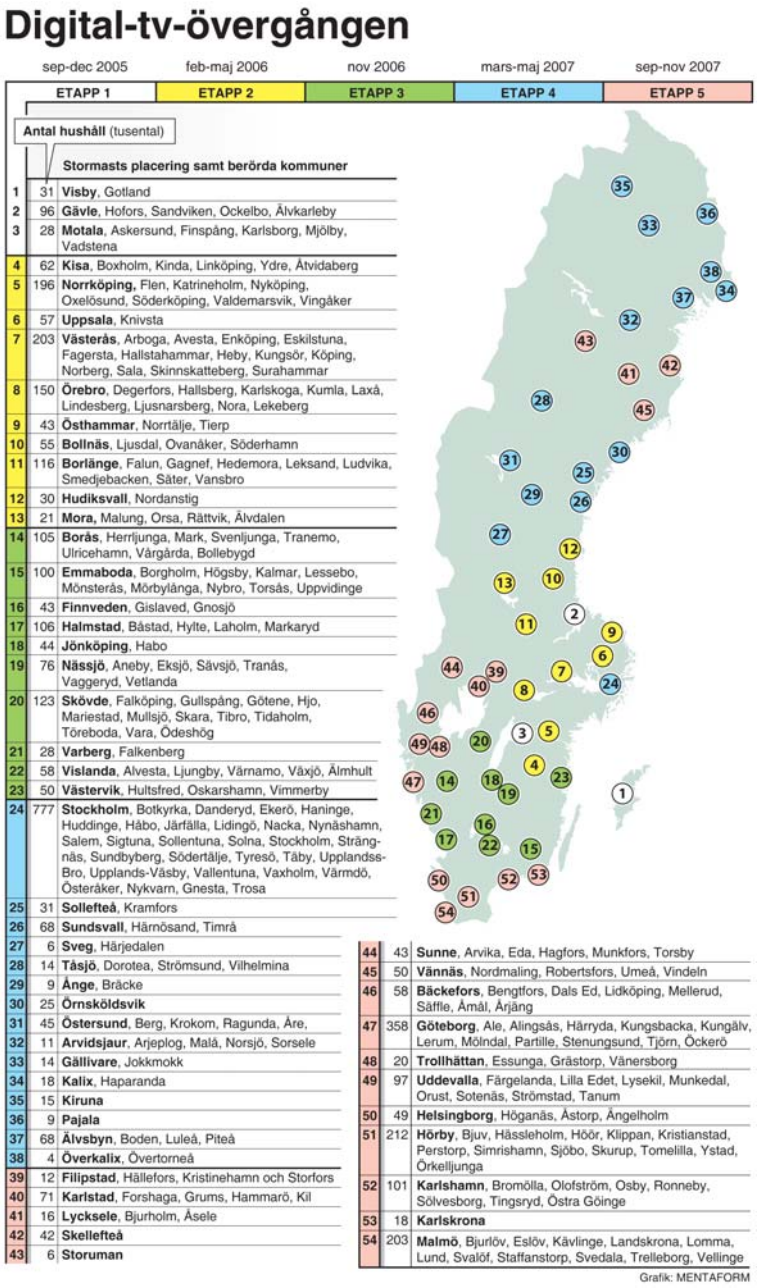

Figure 1
The five stages *(Etapp)* **of digital switchover in Sweden**

One could argue about this, but the fact remains; in the UHF band, Sweden has five muxes containing some 30+ TV channels, the majority of them for pay-TV services. All of them are broadcast in standard definition and coded in MPEG-2. A maximum of only two more muxes are available for further expansion or new services, and at this point we have not taken into consideration the very large demand and lobbing activity from the telecom industry for more spectrum, preferably in the attractive UHF band.

And this is why all the broadcasters with licences to broadcast on the Swedish DTT network joined forces in September 2007 and came up with a proposal. In short, we suggested that the government should let the TV industry use the complete UHF band until 2014. In return, we would use the extra frequency space to make a complete migration to MPEG-4 and maybe even DVB-T2, both more efficient ways of using the valuable spectrum.

With this plan, it would make it easier to release bandwidth to the telecom industry at a later stage – and still have the possibility of developing the terrestrial network and introducing HDTV. We believe that this would be a win-win situation for everybody and would also fit in with the European timetable for reusing the digital dividend.

The idea here, of course, is to take advantage of the fact that Sweden is very advanced in this process and could use this advantage, over the rest of Europe, to "upgrade" the terrestrial network by using the extra frequencies available after digital switchover. This upgrade should even make it possible to release more frequency space later on to the telecom industry than is possible today.

On the 19th of December 2007, the Swedish government announced their decision regarding the digital dividend. They decided that the upper part of the UHF band should be cleared of television broadcasts, thereby making it possible to introduce other types of communication services. The first step was to give the Swedish regulator PTS *(Post & Telestyrelsen)* an assignment to investigate a new frequency plan that would accommodate six muxes below 790 MHz. This work was scheduled to be finished by December 2008.

This means that transmitters working above channel 60 must be moved down and fitted into the space between 470 and 790 MHz. It also means that a new frequency plan must be done for the future 6th mux. This work is currently in progress and we do not foresee any big problems. There are only a handful of main transmitter sites that use frequencies above channel 60 and they could later be moved quite easily. A little more tricky are all the gap-fillers that SVT is using to achieve the 99.8% population coverage. There are some 500+ gap-fillers and 34 of them operate above 790 MHz.

Even the 6th mux should be possible to squeeze in. There will be some need for international coordination with our neighbours, particlularly involving the south and west coastal areas of Sweden which have a signal path over water to Norway, Denmark, Germany and Poland. This could be extremely difficult to address, but hopefully there will be a solution.

The 7th mux however is no longer possible to achieve in the UHF band. Instead, the government also decided that the VHF mux granted in the GE06 agreement could be used for television broadcasts. They also decided that the Radio & Television Authority now could grant licences for the 6th mux. These new services should be in standard definition but – and this is a new thing – they must be coded in MPEG-4, thus taking the first step towards a migration for all services.

During the spring of 2008, all the licences for muxes 2 - 5 were renewed. At the same time, the Swedish Radio & Television Authority also granted 10 new licences for mux 6. These licences were granted on the condition that MPEG-4 is used, and the plan is that they will all be in operation in early 2009. After that, there will probably be some decision on the VHF mux and hopefully it could be in operation during 2010.

This is also linked to the parliamentary decision in spring 2009 for new regulations and licences for the public service broadcasters, which might include something about HDTV. During 2009, there might also be some progress in the new use of the 800 MHz band.

From SVT's point of view, there are still several questions that need to be answered. For us, the possibility of providing HDTV services on the terrestrial network is very important. Our newest channel, SVT HD, is available both on cable and satellite, but we need terrestrial distribution to fulfil our requirement for covering the entire population. For this purpose, the new VHF mux is very interesting. Hopefully, this is where we could find the necessary space to introduce this next level of television. But still, the question of finance for this new capacity is far from solved. And in the long term, it would not be enough with only one mux for HDTV – it is absolutely necessary to develop the whole DTT network. The first logical step is of course MPEG-4, but DVB-T2 is probably close behind. In the end, our strategic goal is to fit all our channels in HD into one mux. If the new efficient coding

Abbreviations

DTT	Digital Terrestrial Television	**Mux**	Multiplex
DVB	Digital Video Broadcasting http://www.dvb.org/	**PTT**	Post, Telephone and Telegraph administration
		UHF	Ultra High Frequency
DVB-T2	DVB - Terrestrial, version 2	**VHF**	Very High Frequency

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Per Björkman specializes in video coding technologies and has been deeply involved in SVT's migration into file-based production systems – both for news and post production. He has also been engaged as a lecturer for university courses on Video & Images processing.

techniques will be enough, or if a reduction in the PS channels will be necessary, remains to be seen.

One could say that the digital dividend – defined as the space actually left over after analogue shutdown – has been equally divided between the TV and Telecom industries: one mux each. There will be no more changes of frequency allocation until 2015. What happens next therefore depends on how well the broadcasters manage to migrate to more spectrum-efficient technologies. This could enable new broadcast services, i.e. HDTV, and hopefully also more spectrum for new telecom services. Maybe there will be a 2nd digital dividend! We will definitely continue our discussions with the telecom industry and follow the technology developments on both sides.

So you might ask; "Did the Television industry win the battle for spectrum?". Well, maybe not completely, but more important, we did not lose. The government has set out some kind of framework for the next few years and we broadcasters feel that we have had some influence in that decision – probably much to do with the fact that we managed to speak up as a united industry. In the end it was very important that some sort of decision was made. If not, then a continuing intensive lobbying from the Telecom industry would probably have made it much harder for us, further down the road.

But there are still some difficult problems and tough challenges ahead. In this round, the Telecom industry got 72 MHz of bandwidth. Some people within the Telecom industry predict that the long-term need for spectrum in the future is 1 GHz. The DTT platform is a mature market and all six of the available muxes are in use. So what will be the driving force for replacement of MPEG-2 boxes with MPEG-4 equipment? Should PS broadcasters have a special role in this process? How will the business model change on pay-TV when there will be competition between different pay-TV operators? And most important; how will DTT stand in competition with other platforms such as cable, satellite and, not to forget, the growing IPTV industry.

Even if Sweden is ahead of most countries in Europe in this process, there are still a number of issues that needs to be handled carefully over the next few years.