## Contents

1 Introduction ........................................ 3

2 Digital Television ................................... 3

3 DVB-H versus UMTS .................................. 4

4 DVB-H and DVB-T ................................... 4
   4.1 Time slicing ..................................... 5

5 Mobile TV with DVB-T ................................ 5

6 Technology ......................................... 5
   6.1 Video Compression (MPEG) ....................... 5
   6.2 Modulation ....................................... 7

7 Current Situation in Switzerland ................. 7
   7.1 Covering ......................................... 7
   7.2 Bluewin TV mobile ............................... 7
   7.3 Receivers ........................................ 7

A Sources ............................................ 9
1 Introduction

DVB-H stands for Digital Television Broadcast for Handheld devices. It is a relatively new technology to bring Television to mobile phones. It was defined in 2004 by the DVB organization, which also specified the standard for the standard digital television (DVB-T: Digital Television Broadcast, terrestrial). Because DVB-H is such a new technology and will become important toward the Euro08 this summer, we choose this topic to look a bit deeper in this interesting topic during this PPS.

2 Digital Television

In 2003, Swisscom has begun with the rearrangement of TV broadcasting. Instead of the old analogue channels, there should be newer digital channels. The advantage of the new way of broadcasting TV signals is that we can broadcast more things by using the same bandwidth than we could with the old technique. In a usual analogue program, we can send one TV program with Dolby stereo sound and TV text. With a similar effort, we can send with digital TV broadcasting one high definition program or four standard definition programs or eight low definition programs, even with better sound. Also the way of transmitting the programs is better. With digital TV we have much less problems with interferences, than we had with the old analogue TV signals, therefor we can for example use the echoes in digital television for augmenting the reception quality, whereas with analogue broadcast echoes do disturb the quality. That’s the reason why we have sharp limits of the area where you can receive a digital program, in which the quality is everywhere the same; with analogue broadcast the quality gets worse and worse the farer away you are from the sender (see figure 1).

Swisscom did a huge effort in setting up the new technique. They planned to finish the digital TV net until 2007. In the maps (figure 2), you can see more
details for each regions in Switzerland

Figure 2: launch of DVB-T

Figure 3: shutdown of analogue TV

3 DVB-H versus UMTS

One may ask what’s the big thing about DVB-H, there was several years ago already the possibility to receive Television on mobile phones via UMTS. With UMTS there are two different possibilities to watch video on a mobile phone. The first is Video-on-Demand, where you can order an individual service and watch it like a video-stream on the internet. This is known as unicast. There is also the possibility to receive a running live-video-stream, which is the same for all users and the users cannot influence the starting time. That’s what we call multicast. But still for every user an individual connection has to be set up, which will strain the channel. So if for example many people in one area want to watch a football game for example the mobile network will be overloaded. The difference with DVB-H is that we have a broadcast, which means that any person can receive a signal that’s sent by an emitter and there is no individual connection or channel that could be strained. As well the quality is less good with UMTS than with DVB-H where we have HD-quality. Still the service via UMTS will remain, because there is no possibility to have video-on-demand on a broadcast network. And probably for several years many people will still use Mobile TV on UMTS. UMTS can also be used as a back-channel for the DVB-H programs to submit login information, TV-votes, quiz and so.

4 DVB-H and DVB-T

DVB-H is a different form of the DVB-T standard, but there are many similarities. Therefor we can have a mixed multiplex, so both system share the same channel. That requires that we use the same modulation process. The main differences is the resolution of the transmitted picture and the algorithm used for compression for the video (MPEG4 versus MPEG2). The reason why DVB-H was introduced was the power consumption of the decoding process. DVB-T uses around 600 mW for the demodulating and decoding, this would
drain the battery very fast, so the main challenge in the development of DVB-H was to reduce the power consumption to less than 100 mW. Today we reached less than 40 mW. The technology behind this is called time slicing.

4.1 Time slicing

Because we have many services in one multiplex, we can use time-division multiplex (time slicing). This means that instead of laying one service on top of another and transmit them simultaneously, the services are all located in the same small band and are transmitted on a rotary base (see figure 4 for an illustration). So once the receiver knows, that every x seconds his service is transmitted it can go in stand-by in the time other services are transmitted. Time slicing requires, that in the relatively short time a service can occupy the channel, there is enough information transmitted to provide a video picture for the time when the receiver is in stand-by. In the time the receiver is in power-save mode it can as well scan for other channels in neighboring cells that provide the same service and guarantee a smooth change. This becomes important in DVB-H, because you don’t want to loose the signal when you move around with your mobile phone.

5 Mobile TV with DVB-T

Even though DVB-H is much better suited for mobile TV, there are several project of different mobile phone companies to receive the classical DVB-T on mobile phones.

6 Technology

6.1 Video Compression (MPEG)

By transmitting videos digitally, we use a channel in which we can transmit a huge number of bytes per second. Even if we want to transmit a movie with low resolution, we will soon reach the limit of the bandwidth of our channel. For
this reason, we have to find a way to make these movies smaller. In DVB-T, we use MPEG 2 to do this, whereas in DVB-H, we use MPEG 4 part.
MPEG is an abbreviation for Moving Picture Experts Group. This is a team of about 350 people from universities, the industries and also from research institutions. This group has a big expertise in video, audio and picture compression. They define standards for encoding digital multimedia.
The first methods to make a movie smaller are based on compressing each single picture of a movie. The human eye is more responsive to brightness then to color. So, we can use algorithms which spend more space to save information about brightness and which save less information about color. If we do so, we already have reduced the size of a digital video file by utilizing the properties of the human eye. Another way to reduce the size of a file is when I don’t save every pixel separately. I would better save the pixels in the neighborhood of a pixel with similar color as one single pixel. By doing this, I can save a lot of space by saving for example the blue of the sky only in a few pixels. The advantage is of course, that I don’t see it, if I use good algorithms to do this. Normally, you use the JPEG algorithm for this. This algorithm uses the discrete cosine transform (DCT).
The other way to get a smaller size of a movie is if I don’t save every picture separately. It is better when I save a picture. In the next picture then, I can use the information of the preceding picture. Then I can only save the things which change in the movie. The MPEG algorithms have three types of frames to do this:
The I frame: The intra-coded (I) frame is a normal JPEG compressed picture. A movie with only this has a very bad compression.
The P frame: The predictive-coded (P) frame contains information of what in the new picture has changed with respect to the old picture. To do this, the old picture is divided in macro blocks. These macro blocks have the size of 16x16 pixels. When a program compresses the movie, it looks which macro block of the old I frame has moved. If the picture is moving, a macro block of the new picture is not in the same position as the old macro block any more. The program saves this motion offset. A movie player now has the information what moved in which direction to reconstruct the right picture for displaying it on the screen.
The B frame: The bidirectionally-predictive-coded (B) frames are a further development of the P frame. In the P frame, there you can only use information based on the information of the old pictures. But with B frames you can also use the information of future pictures. This provides an additional amount of compression.
MPEG 2 uses the methods, which I described to compress a movie. Typically every 15th frame is an I frame. The other frames are B and P frames. MPEG 4 uses these methods also but has further algorithms and methods to make the size of a movie shrinking much more!
Figure 5 shows how it works with this three kinds of frames. The first thing which is shown is a normal movie. It contains only I frames. The first further development is shown in the middle. There, you have I and P frames. The third line shows a modern video compression containing I, P and B frames.
6.2 Modulation

DVB-H uses the same modulation technique as DVB-T. DVB is broadcasted in the VHF III band and the UHF IV and V bands which were used already for analogue television. Every channel is split up in many subcarriers with the so-called COFDM (Coded Orthogonal Frequency Division Multiplex) Modulation. Every subcarrier is then modulated by QAM (Quadrature Amplitude Modulation). We don’t go into the technical details because this is done by another group in the PPS.

7 Current Situation in Switzerland

7.1 Covering

In July 07 Swisscom received the concession for DVB-H for Switzerland with the condition that until the Euro08 44% of the population are covered with DVB-H. So up to now one can receive DVB-H only in the host cities of the Euro08, being Zurich, Basel, Berne, and Geneva (see figure 6). Swisscom plans to cover 60% of the population until 2012.

7.2 Bluewin TV mobile

End of April 2008 Swisscom announced the launch for May 13 and gave the details of the pricing model. DVB-H is integrated in Bluewin TV mobile that contains as well the older UMTS based mobile television called Vodafone live!. So people without a DVB-H receiver or outside the covered area can use Bluewin TV mobile via UMTS on Vodafone live!. The costs for sporadic use are CHF 2.- per day or if you want to use the service more often you can get a subscription for CHF 16.- per month. With DVB-H you can receive 20 channels in HD quality, with Vodafone live! 30 channels in standard quality.

7.3 Receivers

At the moment there is only one mobile phone available in Switzerland with a DVB-H receiver, the Nokia N77 (see figure 7, Swisscom promotes this device too-
Figure 6: Covering with DVB-H as at May 13
gether with the new Bluewin mobile TV. In the second half of the year there will as well be the Nokia N96 and the Samsung SGH-P960 (see figure 8) available.

Figure 7: Nokia N77

Figure 8: Samsung SGH-P960

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