The Digital Audio Broadcasting Journey from the Lab to Listeners - the Czech Republic Case Study

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Abstract. This paper describes the complex experiences and the results of the Digital Audio Broadcasting (DAB+) implementation in the conditions of the Czech Republic. It analyses the background of the EUREKA 147 program, its targets and to what extent they were reached. The main focus is concentrated on the evaluation of the real steps which had to be done during the implementation process before the first regular broadcasting could be started and the difficulties and issues it had been facing. The key point became experimental broadcasting “DAB Prague”. It demonstrated the advantages of this new platform and gave the opportunity to test its functions and physical behavior in real conditions, under the different parameter settings. The Important issue is the allocation of the band III by National Regulatory Authority and the capacity of DAB+ multiplexes. The paper also demonstrates the experience from the setup of the DAB+ headend. It describes the content solution in context of using non-entropic audio coding, setting the codec algorithms and the way to use accompanying multimedia services.

Keywords
DAB+, Digital Audio Broadcasting, EUREKA 147, multiplex, headend, non-entropic audio coding (MP2, AAC, SBR, PS)

1. Introduction

Digital Audio Broadcasting (DAB+) [1] represents one of the modern forms of terrestrial radio broadcasting. It is a complex of technological innovations developed in the late 1980s as a part of the European Commission’s investment program Eureka 147 [2], [3], supporting the competitiveness of European industry. The aim was to develop a more efficient broadcasting system for audio, text and visual content distribution to fixed, portable and mobile receivers. The system should have provided listeners with high quality of audio, separate transmission capacity for additional data and enable mobile reception even at higher speeds, while keeping receivers easy to use. It should also have ensured a more efficient use of the frequency spectrum and required lower power of transmitters. The new broadcasting system was developed in Europe at a time when there were no private stations in this part of the world. Its basic characteristics are thus better suited to the operation of large national territories, where it is more effective than spot coverage of individual cities and smaller areas. In February 1995, Digital Audio Broadcasting (DAB) was defined by the European Telecommunications Standards Institute (ETSI) in the standard ETSI EN 300 401 [1]. The Norwegian public service broadcaster NRK, the first in the world, began broadcasting on 1 June 1995 in the DAB system via the NRK Klassik.

In addition to the audio, the data channel is also transmitted in the DAB. It contains additional information, eventually the applications. The most important ones are: Dynamic Label (DL) is short text messages about broadcasted content with a length of 128 characters; Slideshow (SLS) is a series of JPEG, PNG or animated PNG images broadcasted as a carousel; Service and Program Information (SPI / EPG) is a radio alternative to an electronic programming guide, used for example in the DVB-T / T2 television system; Transport Protocol Experts Group (TMC / TPEG) brings extended traffic and travel information and services to drivers.

2. Key Innovations Used in DAB / DAB+

2.1 Lossy Digital Audio Compression

DAB employs, for audio coding, MPEG-1 Audio Layer 2, also known as MP2 or MPEG 2 (Moving Picture Experts Group) [4]. This is based on the earlier MUSICAM codec (Masking pattern adapted Universal Subband Integrated Coding and Multiplexing) that was invented by the German Institut für Rundfunktechnik (IRT) even before the Eureka 147 consortium was established. The bit rate is reduced by psychoacoustic coding of the signal in the time domain using the sub-band filter bank. MPEG 2 allows compression of digital audio signal in a wide range