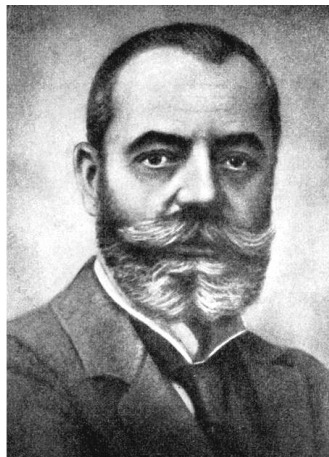


Infocommunication Radio communication (analog & digital)

Tamás Csapó

<csapot@tmit.bme.hu>

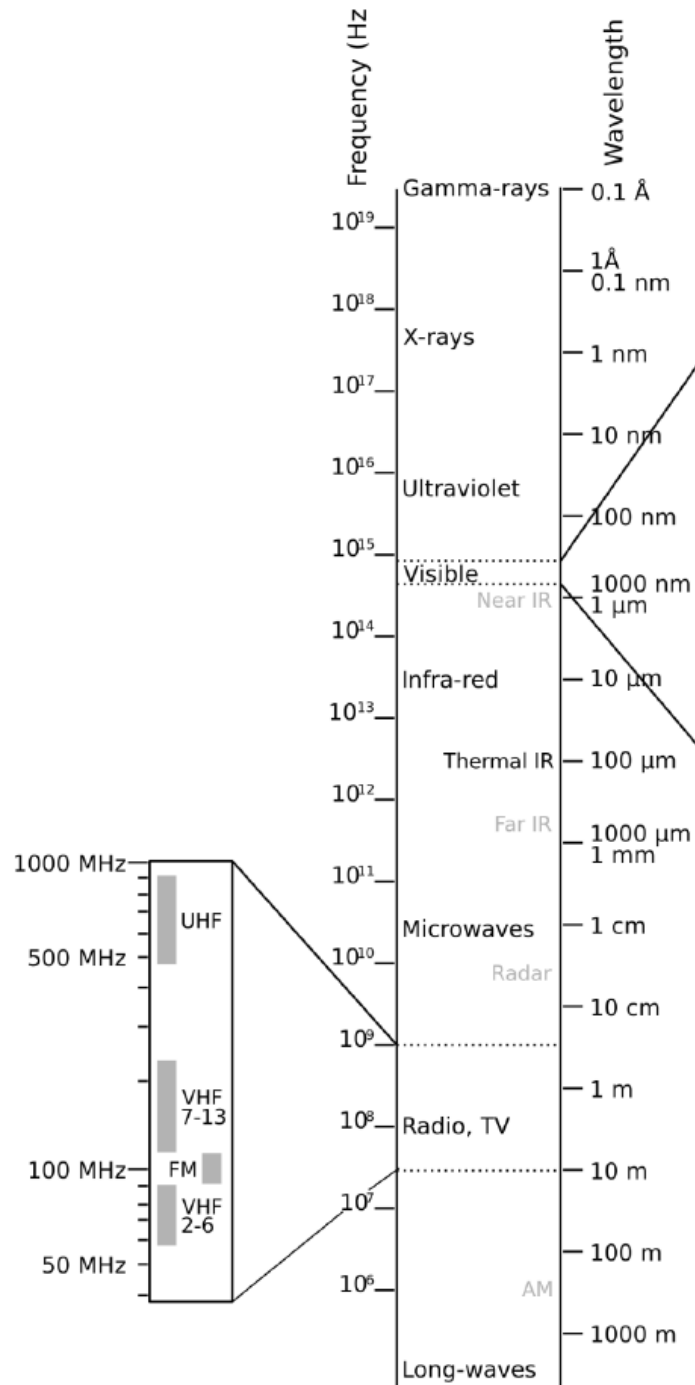
2018 Spring



Ányos Ányos
(1844 - 1899)



The electromagnetic (EM) spectrum



Source: OP



MR1-*Kossuth* Radio: The Power of Words



- Lajos *Kossuth* was a Hungarian lawyer, journalist, politician and Regent-President of the Kingdom of Hungary during the revolution of 1848–49. He was widely honored during his lifetime, including in the United Kingdom and the United States, as a freedom fighter and bellwether of democracy in Europe.

Source: http://en.wikipedia.org/wiki/Lajos_Kossuth

- MR1-Kossuth Radio is the news-talk station in Hungary with the greatest tradition and with the richest content. Well balanced, authentic news programmes, information in all the important topics, current affairs and national debate.

Source: http://www.radio.hu/index.php?option=com_content&task=blogcategory&id=75&Itemid=117³



MR2-*Petőfi* Radio: Very music



- Sándor ***Petőfi*** was a Hungarian poet and liberal revolutionary. He is considered Hungary's national poet, and was one of the key figures of the Hungarian Revolution of 1848. He is the author of the Nemzeti dal (National Song), which is said to have inspired the revolution in the Kingdom of Hungary that grew into a war for independence from the Austrian Empire.

Source: http://en.wikipedia.org/wiki/Sándor_Petőfi

- The new MR2-Petőfi Radio was launched in 2007. It is now a music station providing a wide selection of the most current and popular European and international music.

Source: http://www.radio.hu/index.php?option=com_content&task=blogcategory&id=75&Itemid=117⁴



MR3-*Bartók* Radio:

The radio of classical music



- Béla ***Bartók*** was a Hungarian composer and pianist. He is considered one of the most important composers of the 20th century; he and Liszt are regarded as Hungary's greatest composers (Gillies 2001). Through his collection and analytical study of folk music, he was one of the founders of comparative musicology, which later became ethnomusicology.

Source: http://en.wikipedia.org/wiki/Béla_Bartók

- MR3-Bartók Radio is focusing on classical music and provides music documentaries, jazz, drama and art programmes. Being the classical music station in Hungary, MR3-Bartók Radio is deeply committed to sharing the joy of classical music with listeners, while acknowledging that classical music is an essential source of pleasure of our everyday life.

Source: http://www.radio.hu/index.php?option=com_content&task=blogcategory&id=75&Itemid=117⁵



Digital information in FM radio:

RDS = Radio (Broadcast) Data System

- Program Service
- Program Identification
- Alternative Frequencies
- Program Type
- Radio Text
- Traffic Announcement
- Traffic Program
- Traffic Message Channel
- Clock Time



Digital Audio Broadcasting (DAB)

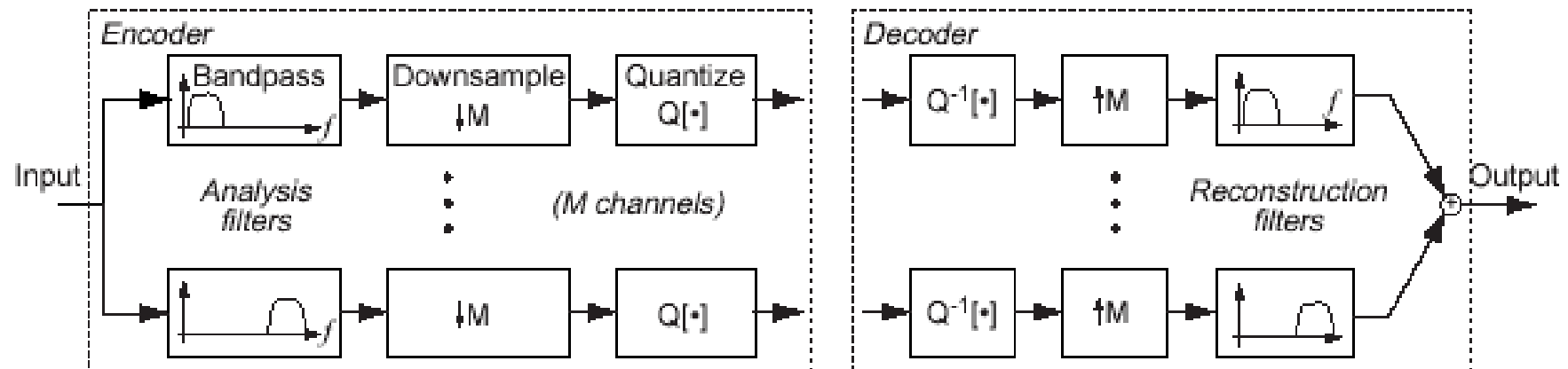
- VHF/Band III: 174-240 MHz
UHF/L-band: 1452-1492 MHz
- Modulation: OFDM + DQ-PSK:
 - 1536 sub-carriers, 1 kHz „distance”
 - 1537 kHz bandwidth
- MPEG-1 / Layer II Audio
- Sampling frequency: 48 kHz
- Quantization: 16 bits
- DAB+: MPEG-4/AAC+ (no demand) →
20 channels, 96-128 kbps (PCM would be 1.5 Mbps)

Perceptual coding

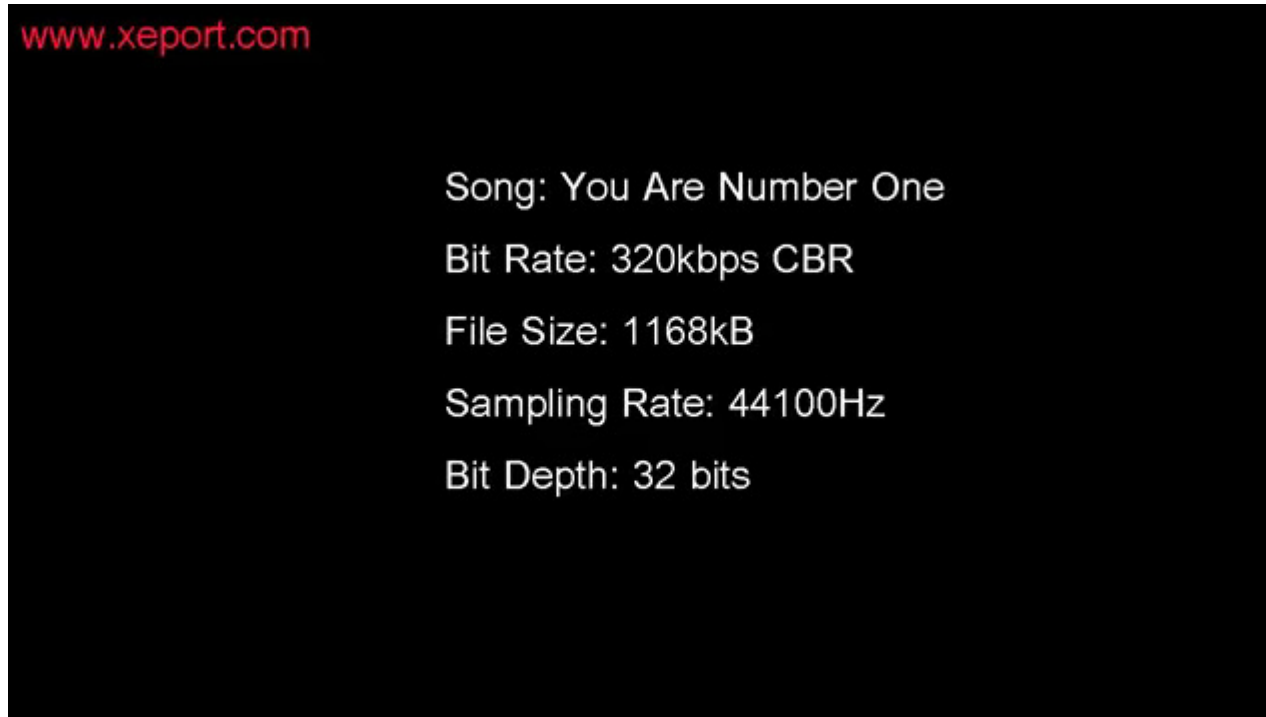
- Goal: compress audio (e.g. music) without quality loss
- Use properties of hearing
 - Critical bands
 - Hearing limitations
 - Masking
 - Time domain
 - Frequency domain

Subband coding

- Analysis filter bank, M bandpass filters
- Quantize separately in different bands
 - quantization noise stay within band; gets masked



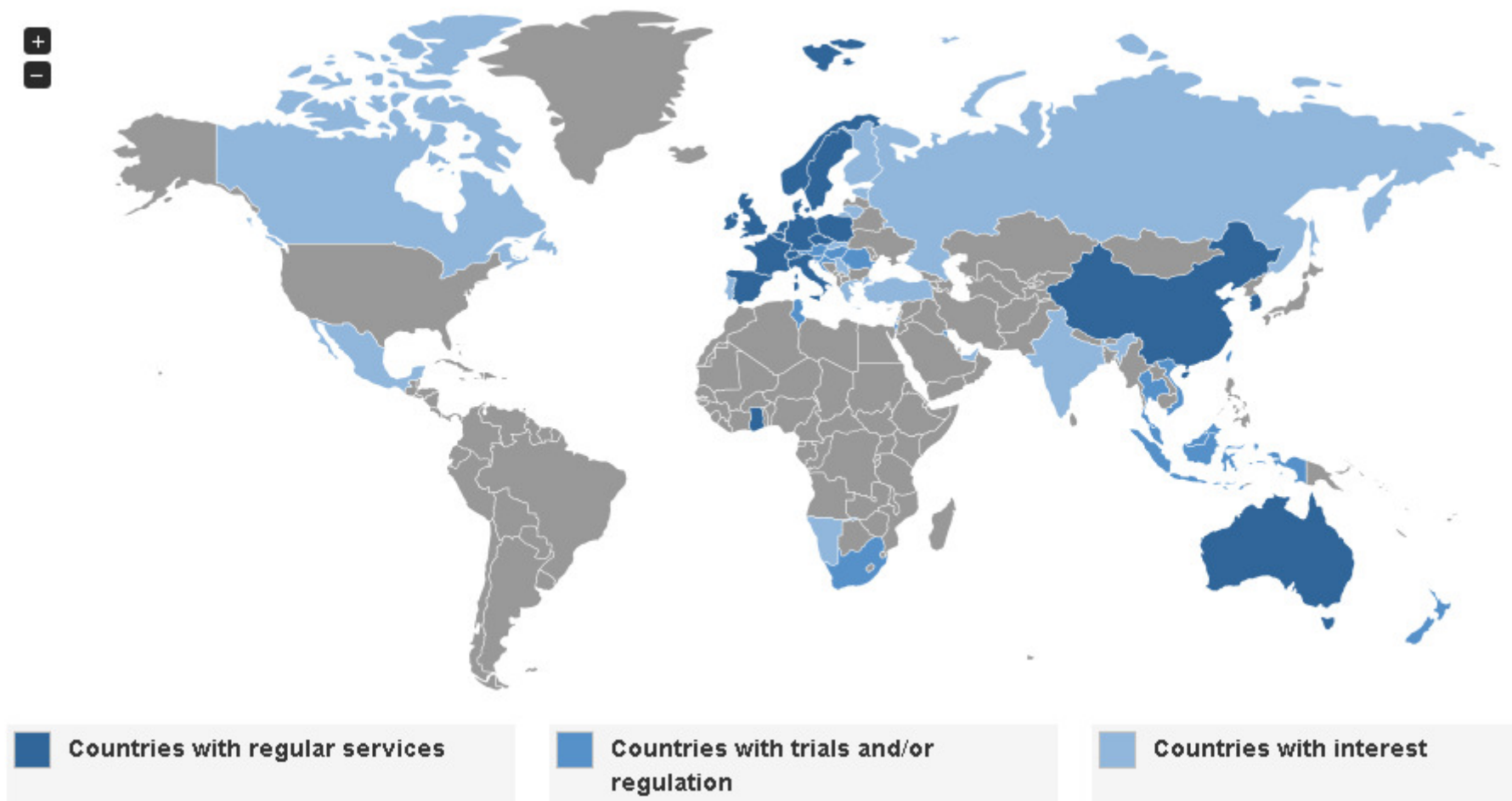
MP3 Bit Rate vs. Audio Quality



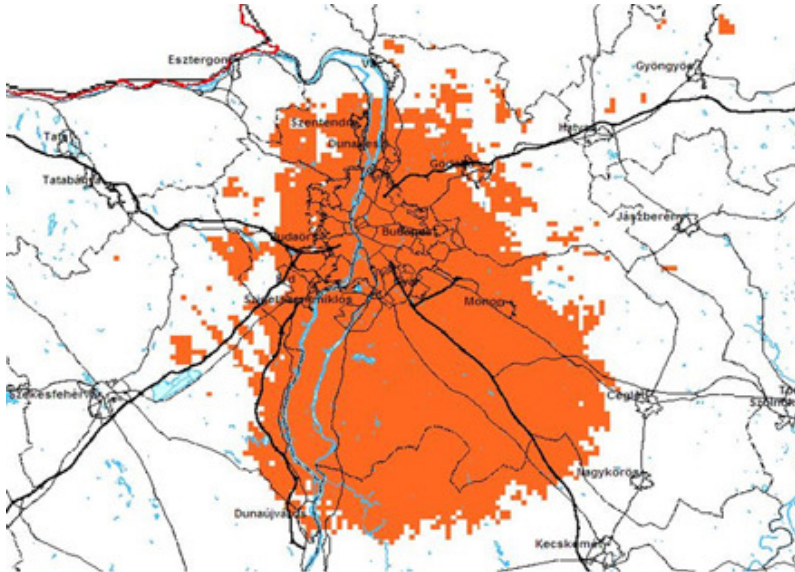
Digital Radio Mondiale (DRM)

- LF, MF and HF -> long-distance propagation
- 9 kHz raster
- Modulation: OFDM + N-QAM
- Codec: MPEG-4, 6.1 – 34.8 kbps
- relatively high quality (compared to AM)
- Sensitive to the Doppler effect

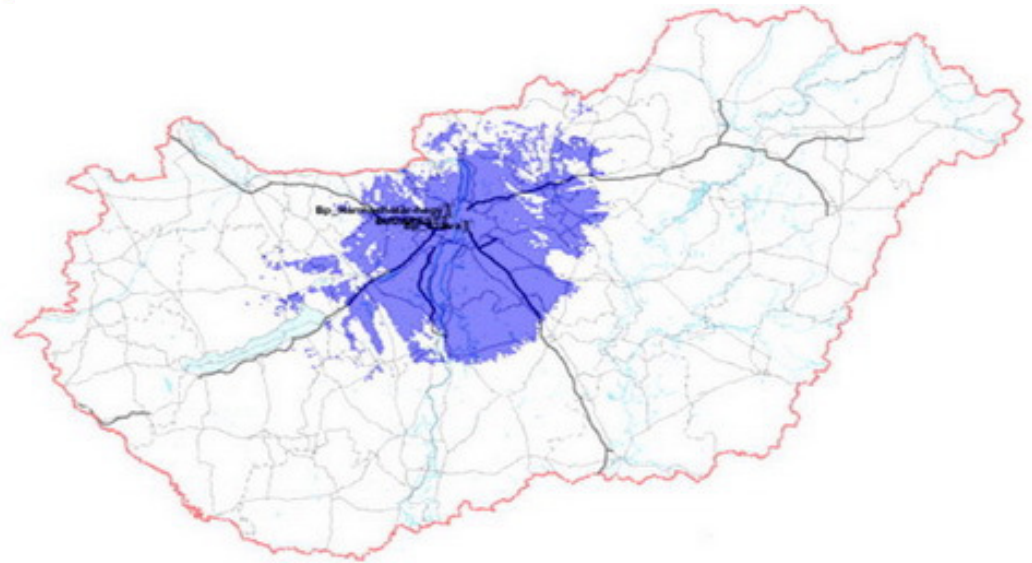
Coverage of DAB/DAB+/...



Coverage of DAB+ (Hungary)





Source:
<http://www.ahrt.hu/hu/digitalis-radio-magyarorszagon>



Source:
<http://www.frekvencia.hu/t-dab-hng.htm>

FM switch-off

- Norway has 99.5% DAB coverage
- FM switched off in 2017
 - (around two-thirds of people opposed the switch...)
 - **Norway reports stable listening figures following DSO**
10.04.2018 - Norway - 
The proportion of daily listeners on national channels has increased from 56.9 per cent in January 2018 to 57.4 per cent in March. The total listening time has increased over the same period from 71 to 74 minutes. "It has always been expected that radio broadcasting will stabilise from 2018. We can probably expect more stable listening figures in the future," says Director of Media Authority Mari Velsand.
From Medietilsynet:
[Read more...](#) 
- (in other countries: 2022-...)