Digital Radio - Possibility and Responsibility

Péter JÁKÓ, MTVA (Hungarian Public Media)

Why do we need digital radio?

- FM broadcasting is very popular and will exist for a long time. But…
- The FM spectrum is crowded in many countries.
- No possibility for new nationwide Tx networks.
- MTVA's 4 programmes on FM
- 3 other only on DVB and on the internet
- Demand for thematic programmes
- New platform for 7+ programmes needed.

Which platform to choose?

Requirements:

- Mobile and handheld reception
- Nationwide coverage
- Indoor & outdoor reception
- Free system
- Good sound quality

Options

- DAB+: ✓
  - Multiplex system
  - Ideal for organisations having several nationwide programmes
  - Huge receiver offer
  - Free
- DRM+:
  - More modern but simpler
  - Ideal for radios having a one or two programmes
  - Free
  - No receiver on the market
- Web-radio:
  - Widespread
  - Not free
  - Not economical yet (multicast not used)
  - Mobile internet reception not reliable yet

Quality

- Same or better quality
- Listeners are used to FM quality.
  - Coverage (nationwide indoor & outdoor reception)
  - Sound quality
- Good sound quality and coverage are crucial.

Sound quality

- Lossy audio coding on all digital radio platforms → efficiency
- Psycho-acoustical coding → reduced transparency
- Differing algorithms → different efficiency
- Lower bitrate → lower transparency

Sound quality

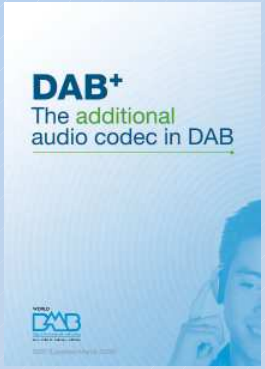
Hungarian DAB trial 20 years ago

- 256 kbit/s for classical music (near CD quality MPEG L2)
- Reduced to 224 kbit/s due to receivers

Regular DAB transmission

- 192 kbit/s in Germany, Switzerland, UK
- 6 programmes / multiplex
- Reduced to 128 kbit/s after 2000
- Complaints

DAB+

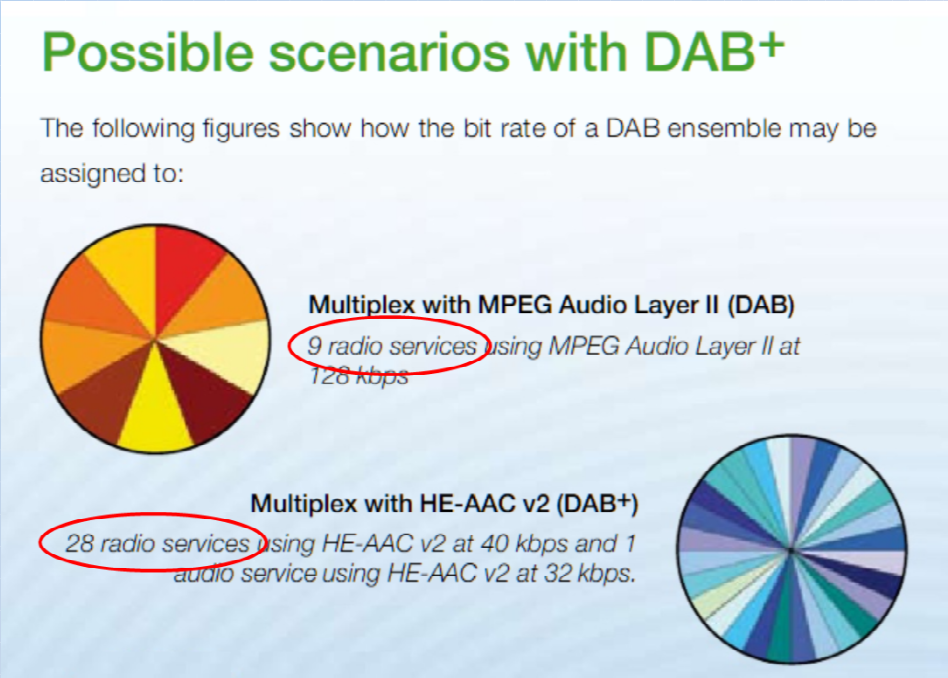


HE AAC

- Much more efficient than MPEG Layer 2
- Devised for low bitrate encoding
- WorldDMB Forum claimed:

  „A 40 kbps subchannel with HE-AAC v2 provides a similar audio quality (even slightly better in most cases) to MPEG Audio Layer II at 128 kbps."

- **Thus programme # can be tripled.**
- Is this true?



HE-AAC v2 (48 kbit/s) ? = L2 (128 kbit/s)

- Even non-expert listeners hear the difference

Bitrates

- Listening test: half bit rate, same sound quality →
- →Theoretically multiplex programme # can be doubled
- In DAB+ audio bitrates ≠ sub-channel bitrates
  - 10% Reed-Solomon FEC code
- DAB+ AAC and standard AAC are different
  - Transformation window length is 960 instead of 1024.

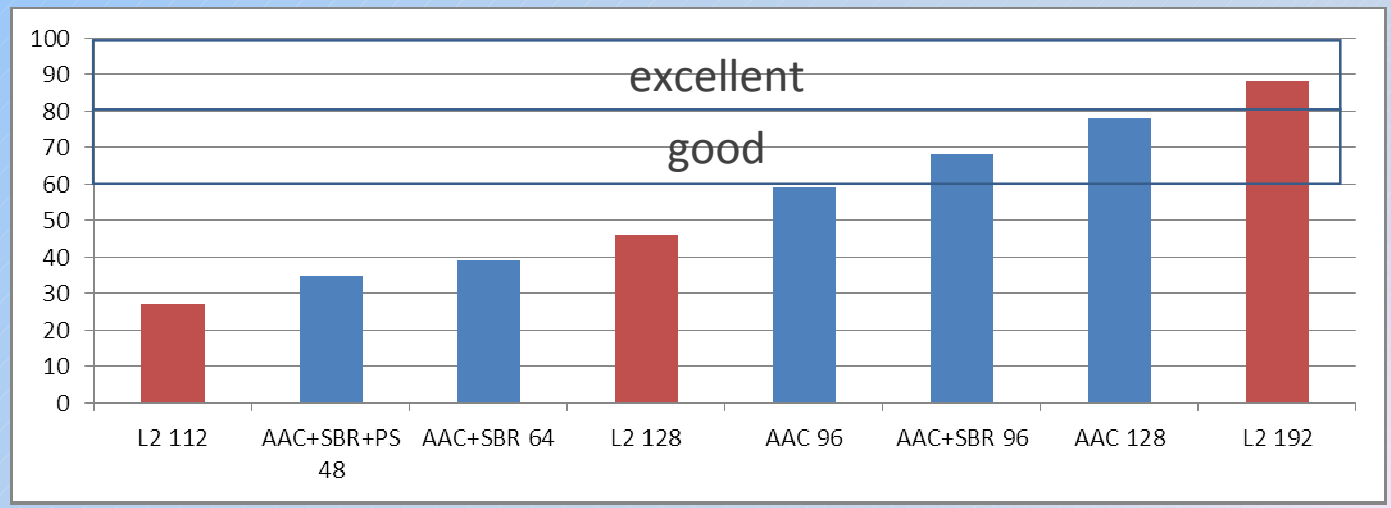
Sub-channel data rate cannot be halved.

Listening tests

- EBU, Swedish Radio, …
- Double blind tests
- Expert and non-expert participants
- Several genres: pop, jazz, classical music, female speech, applause, big band, etc.
- Perceived degradations:
  - changes in the frequency response,
  - comb filter effects,
  - low bit rate artefacts,
  - changes in the stereo image,
  - longer attack time of transients,
  - more noise,
  - degradation of the “feeling” of the sound.

EBU test

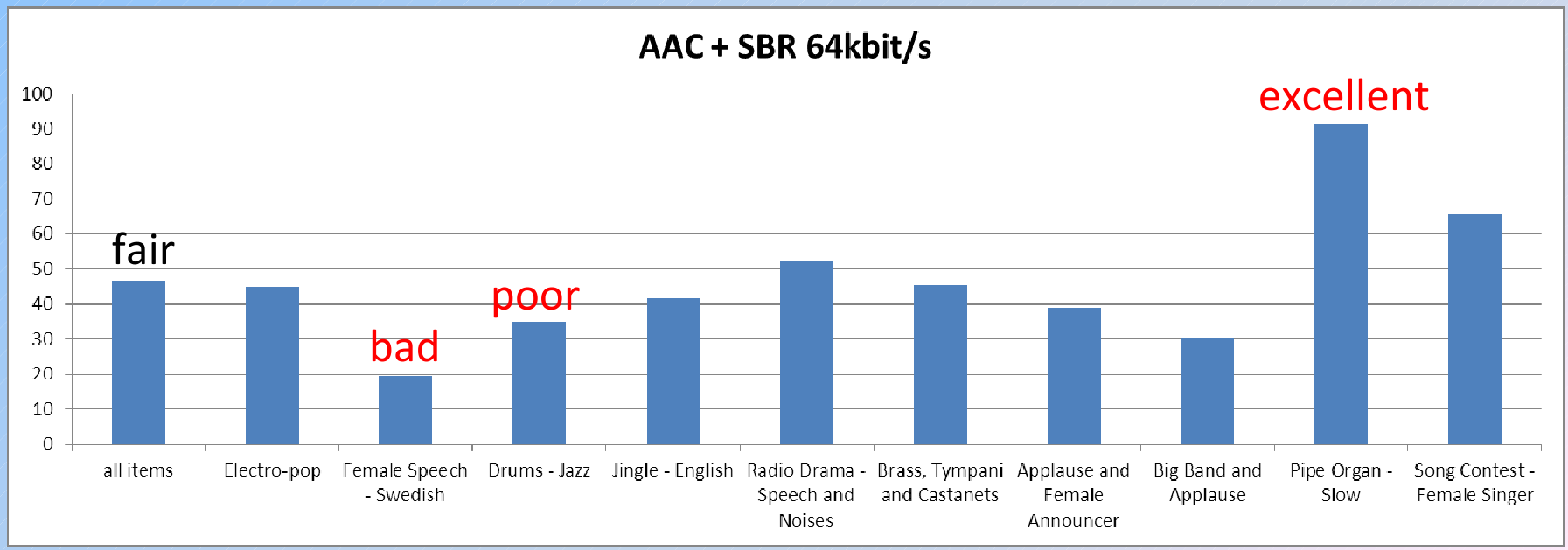
- DAB vs. DAB+
- Highest bitrates: 192 kbit/s (MPEG L2) & 128 kbit/s (HE AAC)
- 5 categories
- 80-100 points excellent
- Only 192 kbit/s L2 is above 80 points
- 128 kbit/s AAC and 96 kbit/s AAC+SBR are good



Averaged scores

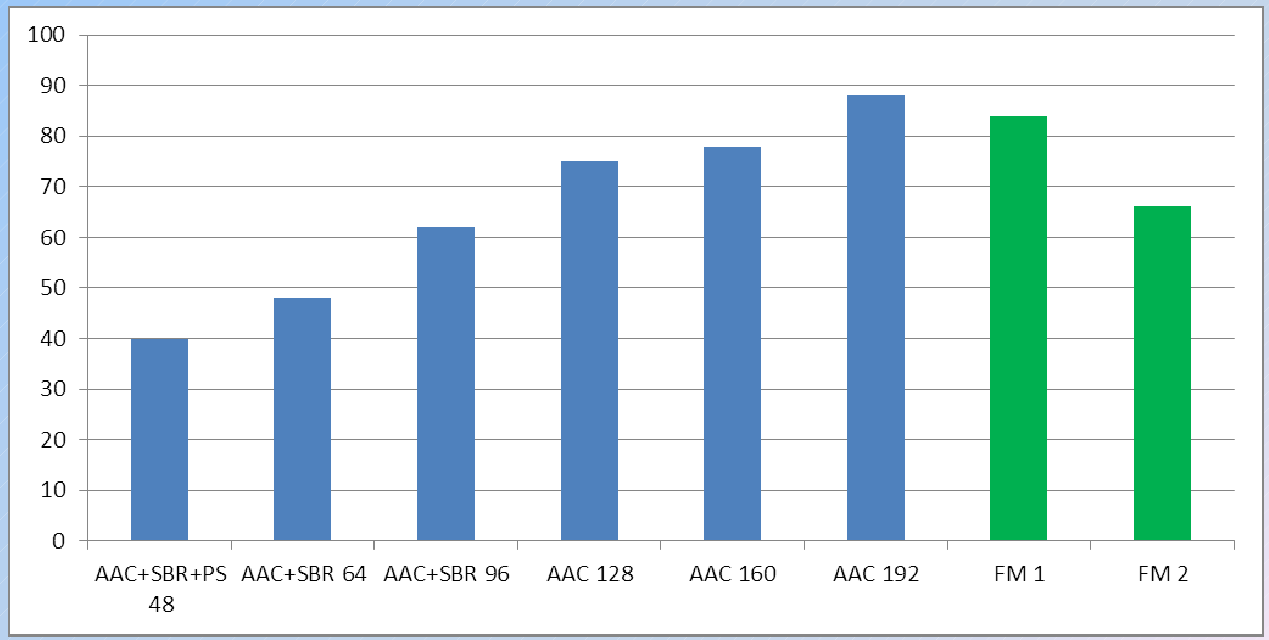
Averaging hides details

- AAC + SBR 64kbit/s
  - fair on average
  - bad on female speech
  - poor on drums



Swedish Radio test

- DAB+ vs. FM
- Highest bitrate: 192 kbit/s (HE AAC)
- 192 kbit/s or higher is good enough
- 192 kbit/s AAC sounds better then quality FM (public, classical)
- 128-160 kbit/s AAC is better then commercial FM (pop, rock)



Recommended DAB+ sub-channel bitrates

- Stereo: ≥ 128 kbit/s
- Mono: ≥ 64 kbit/s

- Suggested bitrates based on expert data
- Why to use high bitrates if a good part of listeners are not critical?

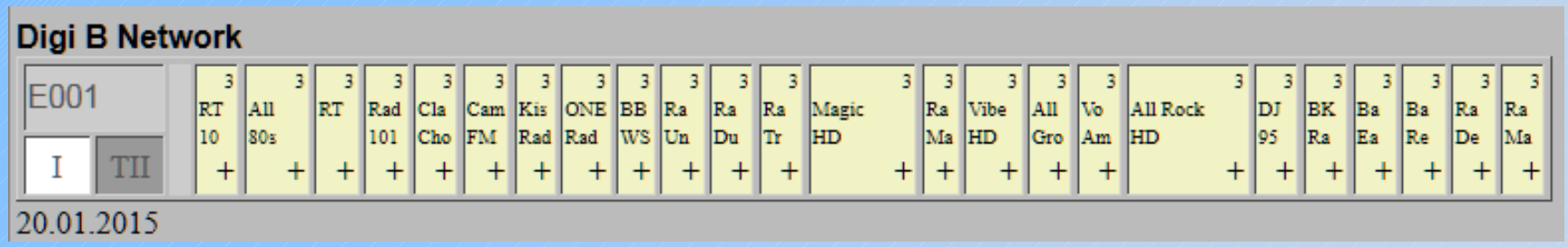
1. Need of reserves
   - LPCM source in the tests
   - Re-encoding cannot be avoided in production
   - Higher bitrates less artefacts
2. PAD

Current DAB+ sub-ch. bitrates

Country	lowest	highest	average	median	modus
Australia	24	128	59.9	64	64
Bayern	64	144	87	80	80
Nordrhein-Westfalen	48	128	90.1	96	96
Suisse Romande	56	104	76	72	72
Malta	32	128	56.5	40	40
Hungary *	48	128	77.7	64	64
Hungary MTVA *	80	128	106.7	112	n.a.

* test

Malta mux 1



Programme Service Label	Sub-ch. data rate	Programme Type	Programme Service Label	Sub-ch. data rate	Programme Type
All 80s	56 kbit/s	Other Music	ONE Radio	40 kbit/s	Information
All Groove	56 kbit/s	Oldies Music	Radio 101	40 kbit/s	Current Affairs
All Rock HD	128 kbit/s	Rock Music	Radju Deejay	40 kbit/s	Pop Music
Bay Easy	40 kbit/s	Easy Listening	Radio Malta	40 kbit/s	Culture
Bay Retro	40 kbit/s	Easy Listening	Radju Marija	32 kbit/s	Religion
BKR Radio	40 kbit/s	Pop Music	RAI RadioUno	40 kbit/s	Current Affairs
BBC WS	32 kbit/s	News	RAI RadioDue	40 kbit/s	No PTy
Campus FM	40 kbit/s	Culture	RAI RadioTre	40 kbit/s	No PTy
Classic Choice	40 kbit/s	Serious Classical	RTK	40 kbit/s	Religion
DJ 95.6	40 kbit/s	Pop Music	RTL 102.5	40 kbit/s	Information
Kiss Radio	40 kbit/s	Other Music	Vibe HD	56 kbit/s	Pop Music
Magic Malta HD	112 kbit/s	Pop Music	Voice of America	40 kbit/s	Other Music

Further data: **DAB Ensembles Worldwide** http://www.wohnort.org/dab/

Planned Hungarian mux

Programme Service Label	Sub-ch. data rate	Programme Type
Kossuth Rádió	128 kbit/s	Current Affairs
Petőfi Rádió	192 kbit/s	Other Music
Bartók Rádió	192 kbit/s	Serious Classical
Dankó Rádió	192 kbit/s	Culture
?		
?		
?		

MTVA

Dynamics processing

- Less processing needed.
- Separate processing for analogue & digital platforms.

Summary

- For public broadcasters DAB+ is the future terrestrial radio.
- Programme choice widening is not enough
- At least FM quality
- Recommendation: at least
  - 128 kbit/s (stereo) and
  - 64 kbit/s (mono) channel bitrates.
- Higher dynamics for digital broadcast (Separate dynamics proc. for A. & D. platforms)

Thank you for your attention