Economic Advantages of DAB+

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About Gates Air

Gates Air is the largest transmitter manufacturer world wide

- **DTV & DAB Transmitter**
  - VHF, UHF

- **FM, DRM+, HD Radio Transmitter**
  - VHF

- **AM, DRM, HD Radio Transmitter**
  - Medium Wave
Economical Advantages of DAB+

Main cost factors of Radio operation

- Equipment
  - Capital Expenses (CAPEX)
- Distribution
- Energy
- Cooling
- Floor space
- Service & maintenance
- License fee, spectrum costs
- Simulcast period, operation of analog and digital Radio in parallel

Operational Expenses (OPEX)
Terrestrial digital Radio technologies

- all using OFDM type of modulation
- Differences in spectrum use and capacity
- For optimized coverage Single Frequency Network (SFN) in DAB+ and DRM+
Transmission System
FM, DAB+, DRM+
The Assumptions used in following comparisons are:

- The comparison is for cost per service
- The coverage area is the same for all radio types, DAB+, FM, DRM+
- The area to be covered has at least 18 services
- All services are good quality audio / music
FM - one complete network per program
- each transmitter needs another frequency

Program 1

Program 2

Program 18
one network / one frequency for up to 18 Radio programs

Notes:
18 programs assumes 64kbps each, DQPSK, FEC=0.5
24 programs could be included but at the lower bit rate of 48kbps
one network / one frequency for up to 3 Radio programs

Notes:
3 programs assumes 62kbps each, 16QAM, FEC=0.62
4 programs could be included but at the lower bit rate of 46kbps
Cost efficiency of FM, DAB+ and DRM+

Example: 18 Radio Programs same coverage

FM
18x FM Transmitter
18x Frequencies
18x Frequency License fee
18x Studio-Transmitter Link (STL)
18x RDS encoder/Data
18x Large antenna

Tx 1, 2, 3  …….  16, 17, 18

DAB+
1x DAB+ Transmitter
1x Frequency
1x Frequency License fee
1x Studio-Transmitter Link (STL)
1x DAB+ Play-out
1x Medium antenna system

Tx 1 carries 18 programs

DRM+
6x DRM+ Transmitter
6x Frequency
6x Frequency License fee
6x Studio-Transmitter Link (STL)
6x DRM+ Head-End
6x Large antenna system

NOTE: DRM+ has a maximum capacity of 186kbps which is equivalent to 62kbps per service using 16QAM and FEC code rate 0.62

NOTE: Antenna system aperture for DAB+ around 200MHz is approximately 1/2 that of FM and DRM+ around 100MHz for the same gain.
Equipment Costs
### Transmitter investment costs FM, DRM+ and DAB+

**Example: 18 Radio Programs same coverage**

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>FM</th>
<th>DRM+</th>
<th>DAB+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>10 kW peak</td>
<td>1 kW rms</td>
<td>2.5 kW rms</td>
</tr>
<tr>
<td>Price per Transmitter</td>
<td>50,000 USD</td>
<td>45,000 USD</td>
<td>80,000 USD</td>
</tr>
<tr>
<td>Transmitter</td>
<td>18</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Price all Transmitter</td>
<td>900,000 USD</td>
<td>270,000 USD</td>
<td>80,000 USD</td>
</tr>
</tbody>
</table>

- **DAB Transmitter investment costs**
  - 11x lower compared to FM
  - 3x lower compared to DRM+
Energy Costs
**Issues Customers Are Facing**

**Rising Cost of Energy**

- Electricity prices increased of 6.3% between 2010 & 2011
- Continued to increase 6.6% between 2011 and 2012
- Projected to continue to rise throughout the world, increasing by as much as 60% by 2030

**Carbon Taxes**

- Some countries have imposed energy taxes based partly on carbon content
- In Australia the carbon tax in 2012 was at $23 per tonne of CO2 emissions
- Broadcast Australia estimated the first year of the new tax cost them almost $3M
# Energy consumption transmitter FM, DRM+ and DAB+

## Example: 18 Radio Programs same coverage

<table>
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<th>DAB+</th>
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</thead>
<tbody>
<tr>
<td>Power</td>
<td>10 kW</td>
<td>1 kW rms</td>
<td>2.5 kW rms</td>
</tr>
<tr>
<td>Efficiency</td>
<td>72%</td>
<td>40 %</td>
<td>40%</td>
</tr>
<tr>
<td>Energy consumption per Transmitter</td>
<td>13.9 kW</td>
<td>2.5 kW</td>
<td>6.25 kW</td>
</tr>
<tr>
<td>Transmitters</td>
<td>18</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Energy all Transmitters</td>
<td>250 kW</td>
<td>15 kW</td>
<td>6.25 kW</td>
</tr>
<tr>
<td>Annual cost of energy</td>
<td>328,500 USD</td>
<td>20,000 USD</td>
<td>8,000 USD</td>
</tr>
</tbody>
</table>

Assumes 0.15 USD per kWh

DAB+ energy savings
- 41x lower compared to FM
- 2.5x lower compared to DRM+

![Graph showing energy savings comparison](image)
Energy costs FM, DRM+ and DAB+

Example: 18 Radio Programs same coverage

- Energy costs over 10 years of operation

DAB+ energy savings over 10 years
3.207.000 USD compared to FM
120.000 USD compared to DRM+

Assumes 0.15 USD / kWh
Cooling Effort
Energy saving for room cooling FM, DRM+ and DAB+

Example: 18 Radio Programs same coverage

1x DAB+ Transmitter

6 x DRM+ Transmitter

18 x FM Transmitter
# Energy saving for room cooling  FM, DRM+ and DAB+

**Example: 18 Radio Programs same coverage**

<table>
<thead>
<tr>
<th>Transmitter for 18 Radio programs</th>
<th>FM</th>
<th>DRM+</th>
<th>DAB+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power</td>
<td>10 kW</td>
<td>1 kW rms</td>
<td>2,5 kW rms</td>
</tr>
<tr>
<td>Power consumption (rms)</td>
<td>13,9 kW</td>
<td>2,5 kW</td>
<td>6,25 kW</td>
</tr>
<tr>
<td>Dissipated Power</td>
<td>3,9 kW</td>
<td>1,5 kW</td>
<td>3,75 kW</td>
</tr>
<tr>
<td>Dissipated power for 18 programs</td>
<td>70,2 kW</td>
<td>9 kW</td>
<td>3,75 kW</td>
</tr>
<tr>
<td>Cost per annum</td>
<td>92,250 USD</td>
<td>11,800 USD</td>
<td>5,000 USD</td>
</tr>
</tbody>
</table>

DAB+ heat dissipation  
18x lower to FM  
2x lower to DRM+

![Graph showing energy consumption and cost comparison between FM, DRM+, and DAB+ transmitters.](image)
Space in Equipment Room and on Towers
Space savings on transmission site FM, DRM+ and DAB+

Example: 18 Radio Programs same coverage

- 0.6 m²
  - 1x DAB+ Transmitter

- 3.6 m²
  - 6 x DRM+ Transmitter

- 10.8 m²
  - 18 x FM Transmitter
Save tower & antenna space with DAB+

Analoge FM, DRM+
- Many towers
- Interferences

DAB+
- Single Antenna
- No interferences
# The Cost of Space

Cost comparison for combined antenna aperture on the transmission tower and transmitter room space

<table>
<thead>
<tr>
<th>Transmitter</th>
<th>FM</th>
<th>DRM+</th>
<th>DAB+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owned</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Region site</td>
<td>35</td>
<td>35</td>
<td>35</td>
</tr>
<tr>
<td>Metro site</td>
<td>75</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td>Cost per annum,000s USD</td>
<td>90</td>
<td>30</td>
<td>5</td>
</tr>
<tr>
<td>Number of transmitters</td>
<td>18</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Cost per annum,000 USD</td>
<td>630</td>
<td>210</td>
<td>35</td>
</tr>
</tbody>
</table>

The cost of DAB+ transmitter tower and hall space is
- 18x lower compared to FM
- 6x lower compared to DRM+
Service & Maintenance
Reduced Service & Maintenance Cost FM, DRM+ and DAB+

Drastic Service cost reductions using DAB+
- reduced spare part stock
- reduced part diversity
- reduced maintenance effort

1x DAB+ Transmitter

6 x DRM+ Transmitter

18 x FM Transmitter
Reduced Service & Maintenance Cost FM, DRM+ and DAB+

Example: 18 Radio Programs same coverage

There are a number of options for operations and maintenance including:

- Broadcaster provides internal staff to conduct the work, often the case for commercial broadcasters
- A managed service is used, often the case for multiplexes which have multiple broadcasters, e.g. DAB+
- A mixture where the operations aspects are conducted by the broadcaster but maintenance is done by a contract organization, this occurs in large metro transmission sites as well as remote sites

<table>
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<tr>
<th>Transmitter</th>
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<th>DRM+</th>
<th>DAB+</th>
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</thead>
<tbody>
<tr>
<td>Situation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Owned</td>
<td>2</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>Regional site</td>
<td>5</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Metro site</td>
<td>5</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Weeks of effort per annum</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost per annum ,000s USD</td>
<td>5</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Number of transmitters</td>
<td>18</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>Cost per annum ,000 USD</td>
<td>90</td>
<td>60</td>
<td>50</td>
</tr>
</tbody>
</table>

The cost of DAB+ maintenance is approximately the same as DRM+ and 1/2 of FM
Summary
Summary economical advantages of DAB+

Drastic cost reductions (CAPEX & OPEX) using DAB+ compared to FM for:

1. Equipment
2. Distribution
3. Energy
4. Cooling
5. Space
6. Service & Maintenance
7. RF transmission License Fees
Simulcast period

Simulcast period most costly for program provider

- Transition period from analog to digital for Radio is longer than for TV
- Additional costs of transmission during the simulcast period will be approximately 10% -15% more relative to FM operation for each program provider.
- Broadcaster may not be able to compensate all additional costs of simulcast operation by more revenue

1. Simulcast costs are critical for acceptance & motivation of broadcaster
2. Clear road map of analog to digital transition helps to secure planning
3. Cost compensations for broadcaster during simulcast period
DAB+ for local Broadcaster

Cost effective Soft Defined DAB+ solution based on Open Code Software

- Standard PC for DAB Head-End (Audio live encoding, Multiplexing)
- Open source software (CRC mmb tools)
- Broadband internet access
- First local licenses in Switzerland

Contact: coinchon@ebu.
More information on
www.opendigitalradio.org
wiki.digris.ch
mmbtools.crc.ca

<Diagram of DAB+ system>
Thank you for your attention!

*It’s time for DAB+!*