

Economic Advantages of DAB+

Jens Stockmann,
Product Specialist Transmission
jens.stockmann@gatesair.com



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**



Main cost factors of Radio operation

- Equipment

Capital Expenses (CAPEX)

- Distribution

- Energy

- Cooling

- Floor space

- Service & maintenance

- License fee, spectrum costs

Operational Expenses (OPEX)

- Simulcast period, operation of analog and digital Radio in parallel





- 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:

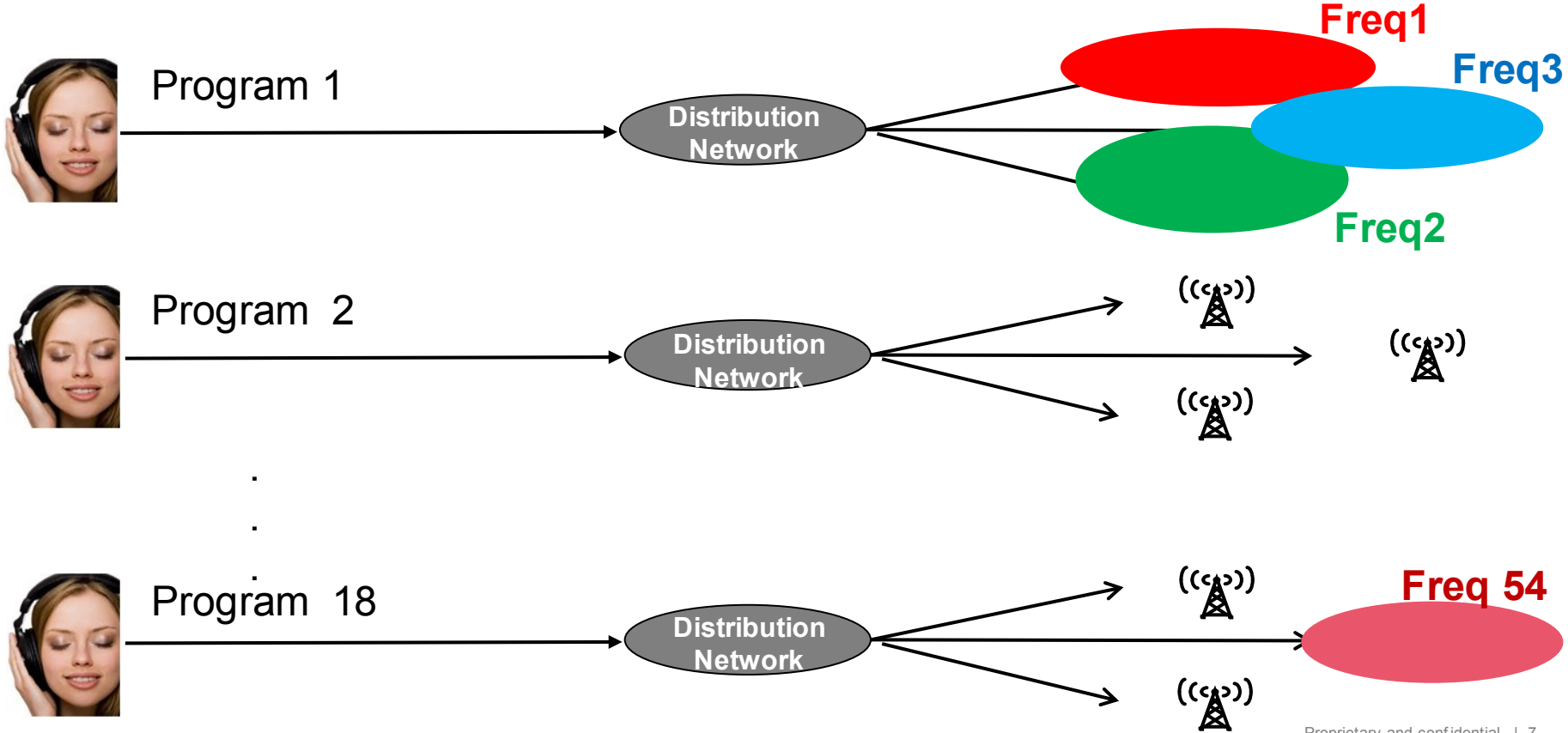


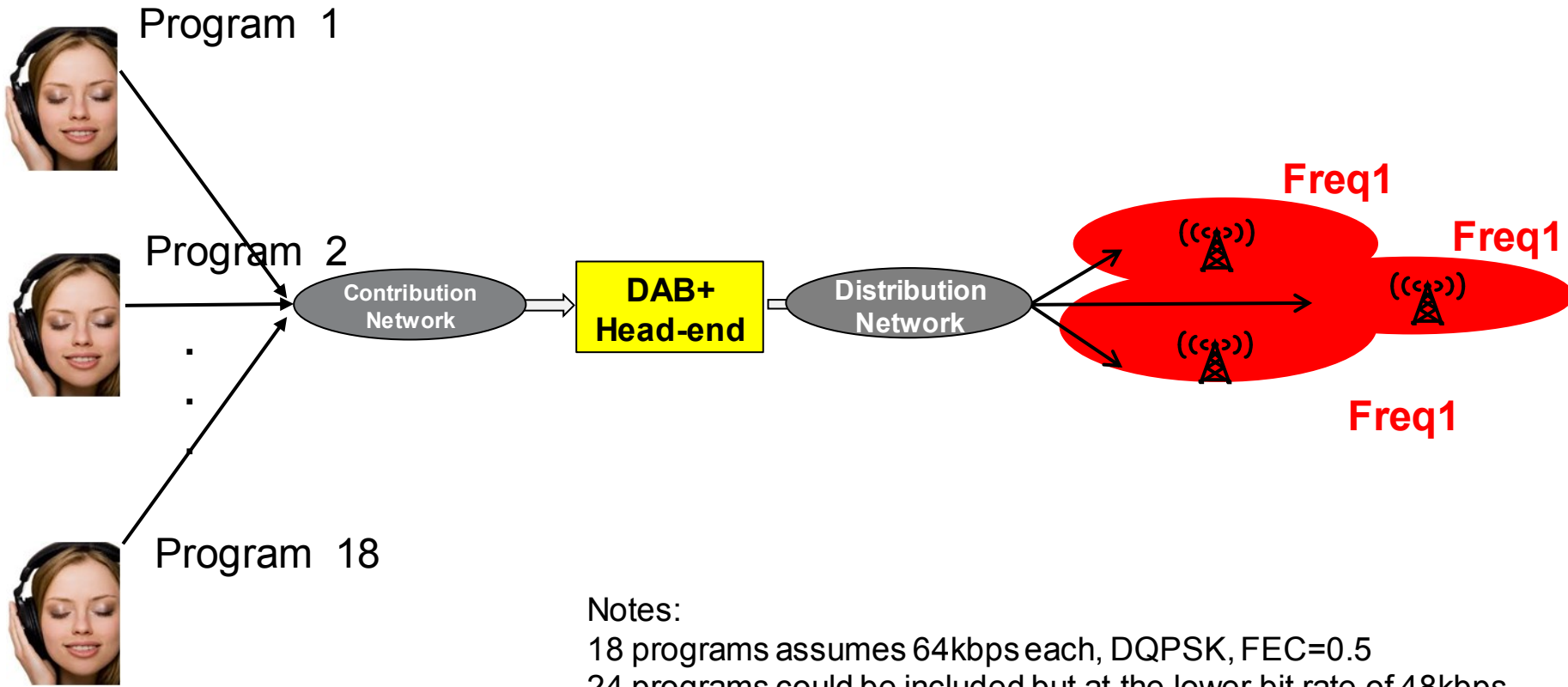
- The comparison is for cost per service
- The coverage area is the same for all radio types, DAB+, FM, DRM+
- The area to be covered has at least 18 services
- All services are good quality audio / music



FM - one complete network per program

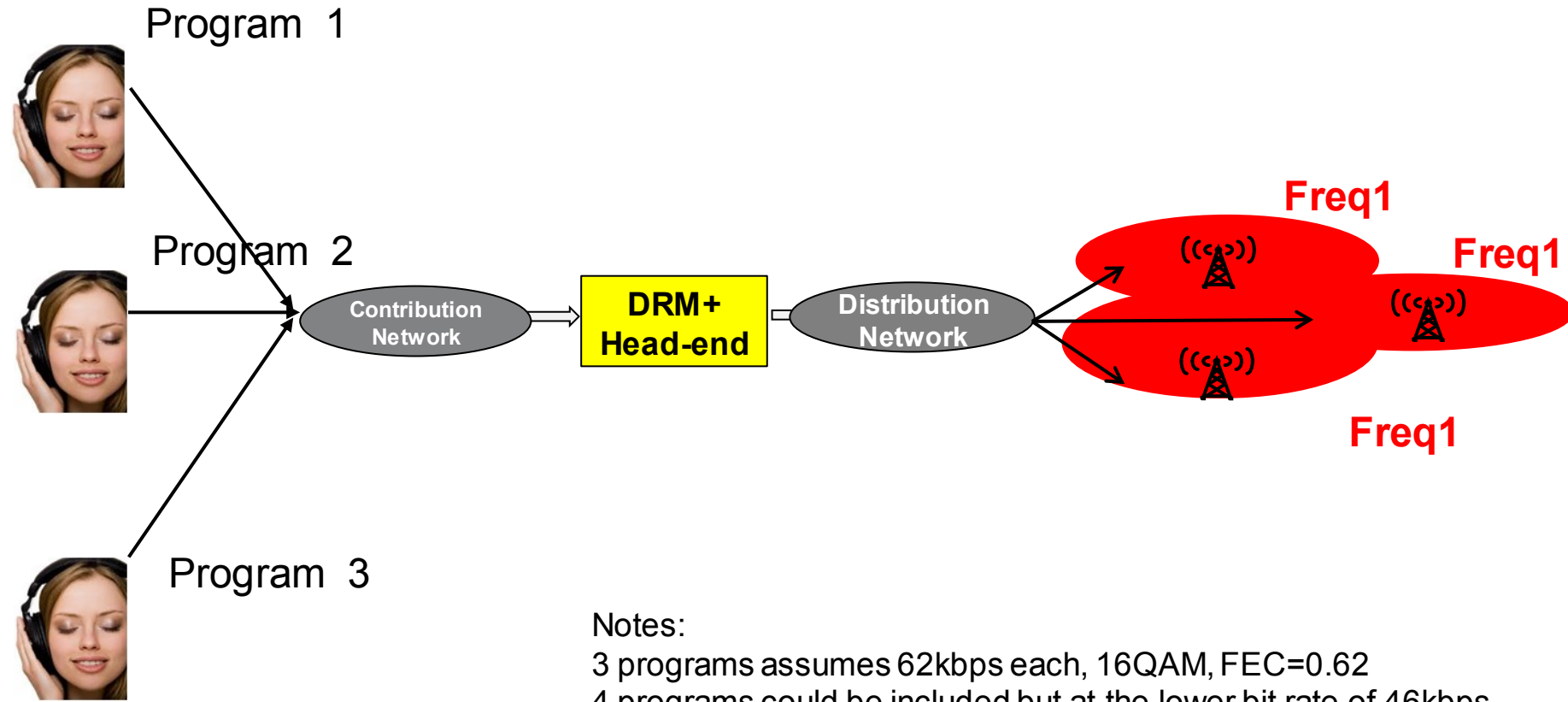
- each transmitter needs another frequency





Notes:
18 programs assumes 64kbps each, DQPSK, FEC=0.5
24 programs could be included but at the lower bit rate of 48kbps





Notes:

3 programs assumes 62kbps each, 16QAM, FEC=0.62

4 programs could be included but at the lower bit rate of 46kbps

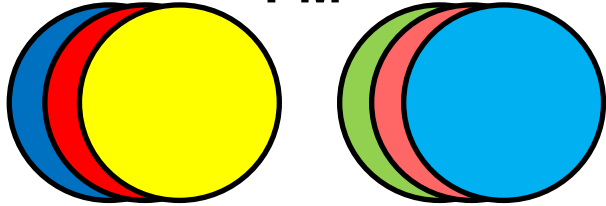
Proprietary and confidential. | 9



Cost efficiency of FM, DAB+ and DRM+

Example: 18 Radio Programs same coverage

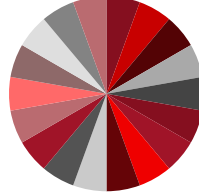
FM



Tx 1, 2, 3 16, 17, 18

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

DAB+

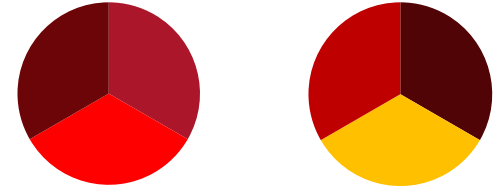


Tx 1 carries 18 programs

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

NOTE: Antenna system aperture for DAB+ around 200MHz is approximately 1/2 that of FM and DRM+ around 100MHz for the same gain.

DRM+



Tx 1, 6 carries 18 programs

- 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



Equipment Costs

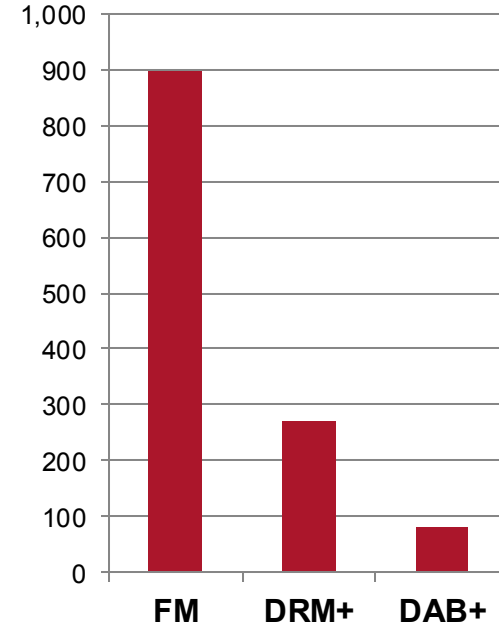


Transmitter investment costs FM, DRM+ and DAB+

Example: 18 Radio Programs same coverage

Transmitter	FM	DRM+	DAB+
Power	10 kW peak	1 kW rms	2,5 kW rms
Price per Transmitter	50.000 USD	45.000 USD	80.000 USD
Transmitter	18	6	1
Price all Transmitter	900.000 USD	270.000 USD	80.000 USD

DAB Transmitter investment costs
11x lower compared to FM
3x lower compared to DRM+



Energy Costs



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**



Example: 18 Radio Programs same coverage

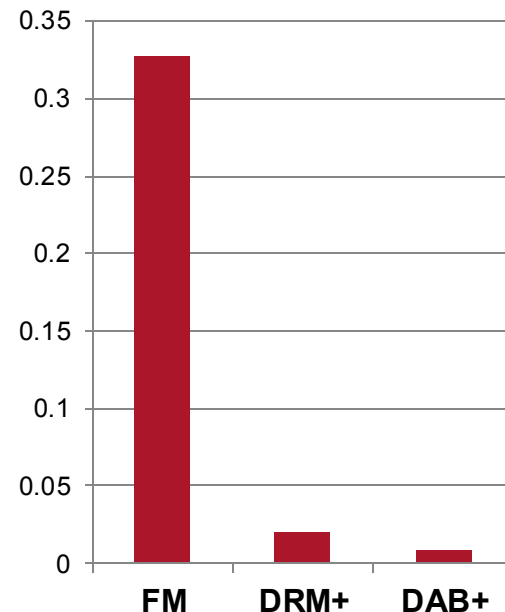
Transmitter	FM	DRM+	DAB+
Power	10 kW	1 kW rms	2,5 kW rms
Efficiency	72%	40 %	40%
Energy consumption per Transmitter	13,9 kW	2,5 kW	6,25 kW
Transmitters	18	6	1
Energy all Transmitters	250 kW	15 kW	6,25 kW
Annual cost of energy	328.500 USD	20.000 USD	8.000 USD

Assumes 0,15 USD per kWh

DAB+ energy savings

41x lower compared to FM

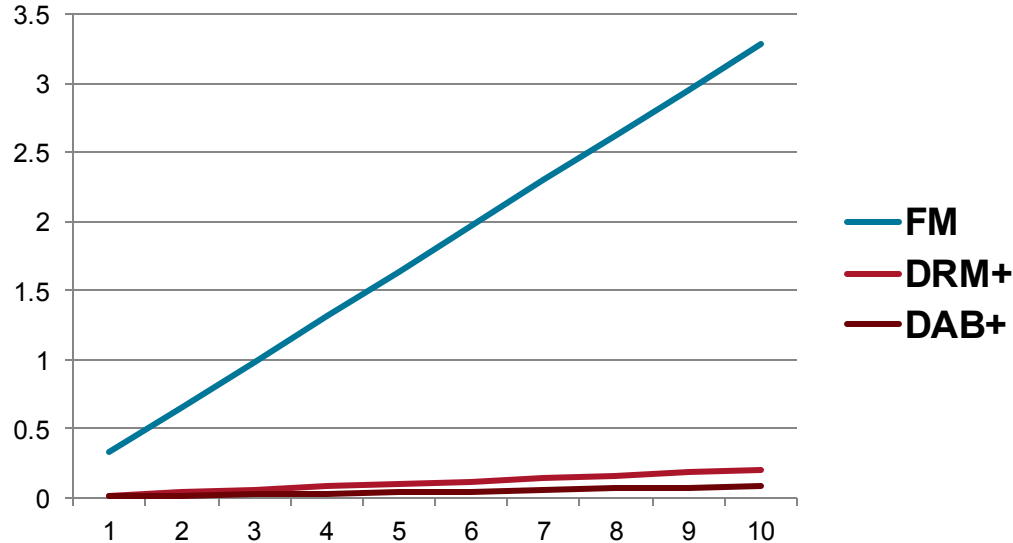
2,5x lower compared to DRM+



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

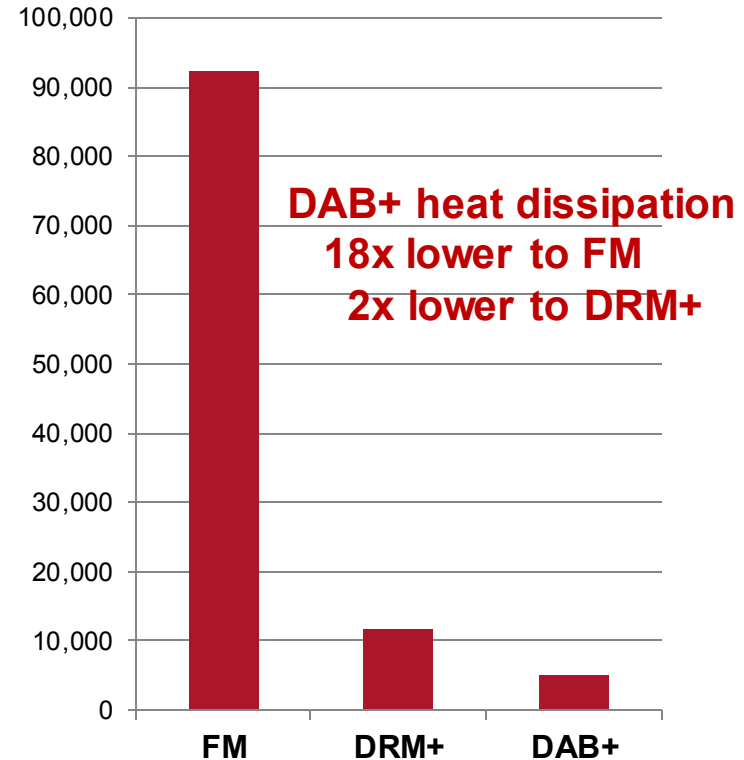


Energy saving for room cooling FM, DRM+ and DAB+



Example: 18 Radio Programs same coverage

Transmitter	FM	DRM+	DAB+
Power	10 kW	1 kW rms	2,5 kW rms
Power consumption (rms)	13,9 kW	2,5 kW	6,25 kW
Dissipated Power	3,9 kW	1,5 kW	3,75 kW
Transmitter for 18 Radio programs	18	6	1
Dissipated power for 18 programs	70,2 kW	9 kW	3,75 kW
Cost per annum	92.250 USD	11.800 USD	5.000 USD



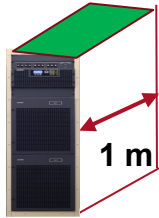
Space in Equipment Room and on Towers



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

18 x FM Transmitter



10,8 m²

1 m



Save tower & antenna space with DAB+

Analog 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

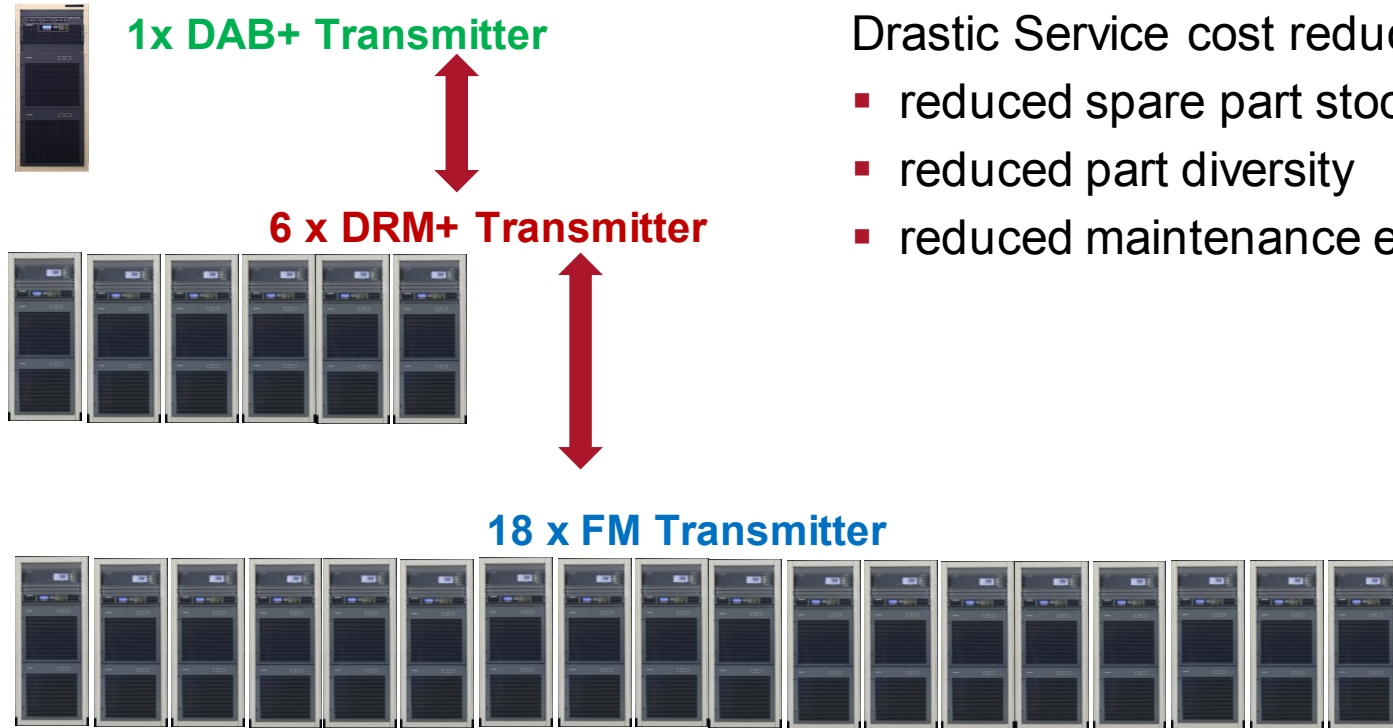
Transmitter	FM			DRM+			DAB+		
	Owned	Region site	Metro site	Owned	Region site	Metro site	Owned	Region site	Metro site
Cost per annum ,000s USD	5	35	75	5	35	75	5	35	75
Number of transmitters	18	18	18	6	6	6	1	1	1
Cost per annum ,000 USD	90	630	1,350	30	210	450	5	35	75

**The cost of DAB+ transmitter tower and hall space is
18x lower compared to FM
6x lower compared to DRM+**



Service & Maintenance





Drastic Service cost reductions using DAB+

- reduced spare part stock
- reduced part diversity
- reduced maintenance effort



Example: 18 Radio Programs same coverage

There are a number of options for operations and maintenance including

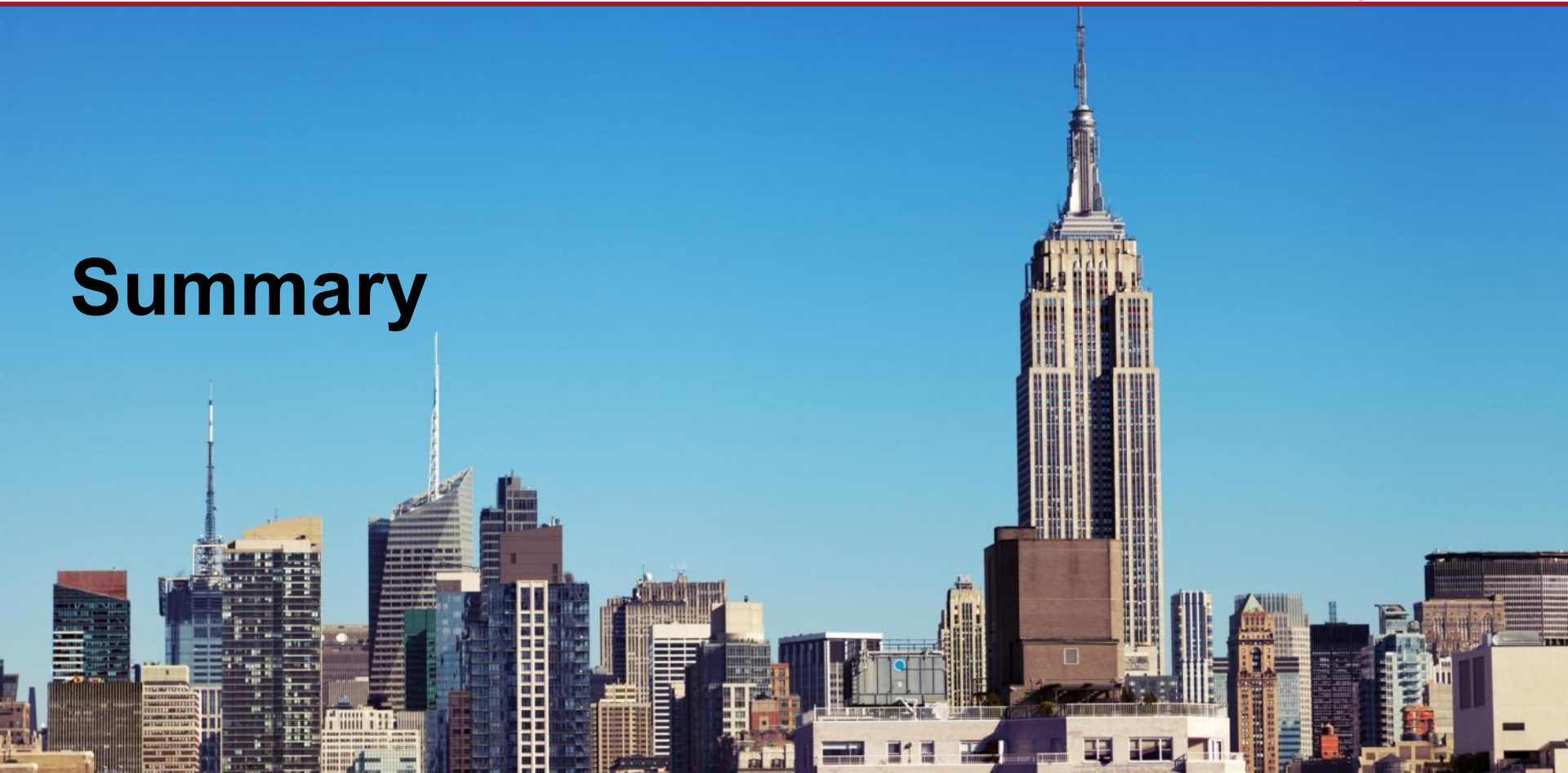
- Broadcaster provides internal staff to conduct the work, often the case for commercial broadcasters
- A managed service is used, often the case for multiplexes which have multiple broadcasters, e.g. DAB+
- A mixture where the operations aspects are conducted by the broadcaster but maintenance is done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

Transmitter	FM			DRM+			DAB+		
	Owned	Regional site	Metro site	Owned	Regional site	Metro site	Owned	Regional site	Metro site
Situation									
Weeks of effort per annum	2			4			12		
Cost per annum ,000s USD	5	5	5	10	10	10	50	50	50
Number of transmitters	18			6			1		
Cost per annum ,000 USD	90	90	90	60	60	60	50	50	50

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



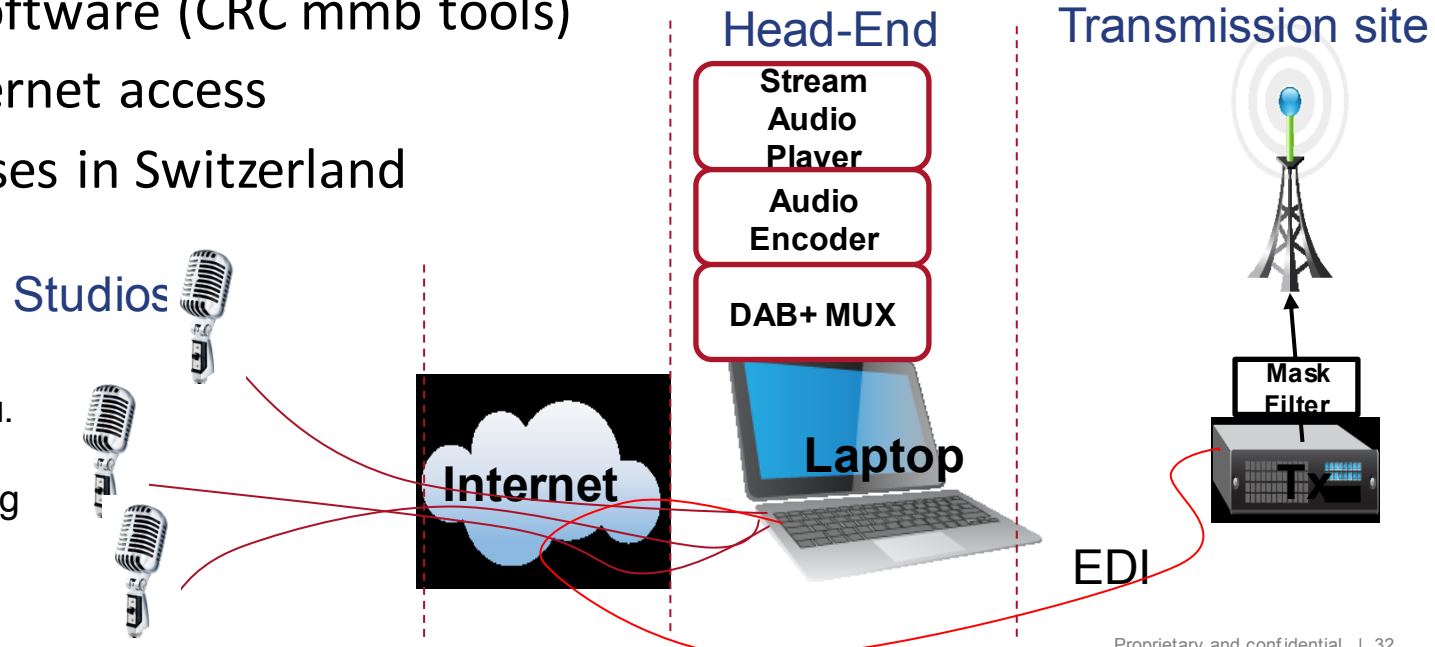
Simulcast period most costly for program provider

- 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



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.ch
More information on
www.opendigitalradio.org
wiki.digris.ch
mmbtools.crc.ca



Thank you for your attention!



It's time for DAB+ !

