



DAB+

Practical Considerations

World DMB Workshop Budapest, 28th Jan 2014

Harris Broadcast is an independent company not affiliated with Harris Corporation.

- Introduced technical innovations in the DAB + system
- Economical advantages of DAB+ infrastructure
 - Signal distribution over IP using EDI
 - High energy efficient transmitter design
 - Importance of redundancy for DAB+
 - Signal quality and efficiency

CONTENT MANAGEMENT



Media

Maximizes ad revenue by streamlining business processes across multiple channels and platforms.



Playout

Rapid and reliable channel launch with easy upgrade paths as channels grow.

NETWORK INFRASTRUCTURE



Networking

Simplifies today's hybrid operations by efficiently managing any signal type, from SD to 4K to IP.



Transmission

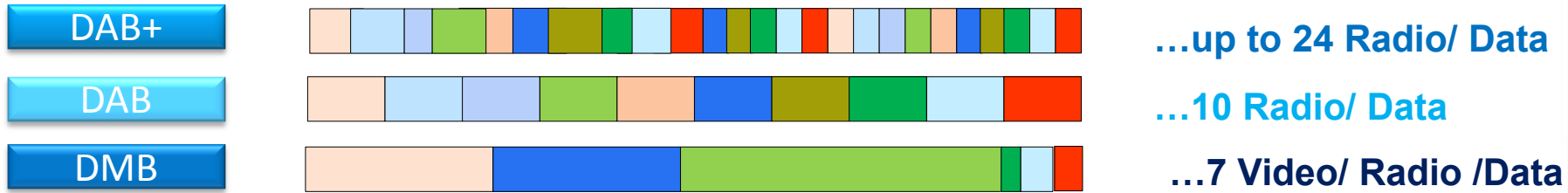
Highly efficient transmission networks that deliver content to vast geographies all around the world.

DAB+ System



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DAB family of standards



- Net data rate of 1.152MBit/s for commonly used rate $\frac{1}{2}$ FEC coding
 - Flexibility for data rate / transmission power trade off from 576kbps to 1.728Mbps
- DAB transmitter can operate DAB, DAB+, DMB without changes in Hardware or Software
- Frequencies VHF Band III (174-240 MHz) or Band L (1452 – 1572 MHz)

- The differences are managed by the Play-Out equipment
 - audio encoding
 - video encoding (DMB)
 - data server
 - error protection

Significant reduced cost & effort compared to FM Radio:

- Equipment

Capital Expenses (CAPEX)

- Signal Distribution

- Energy

- Cooling

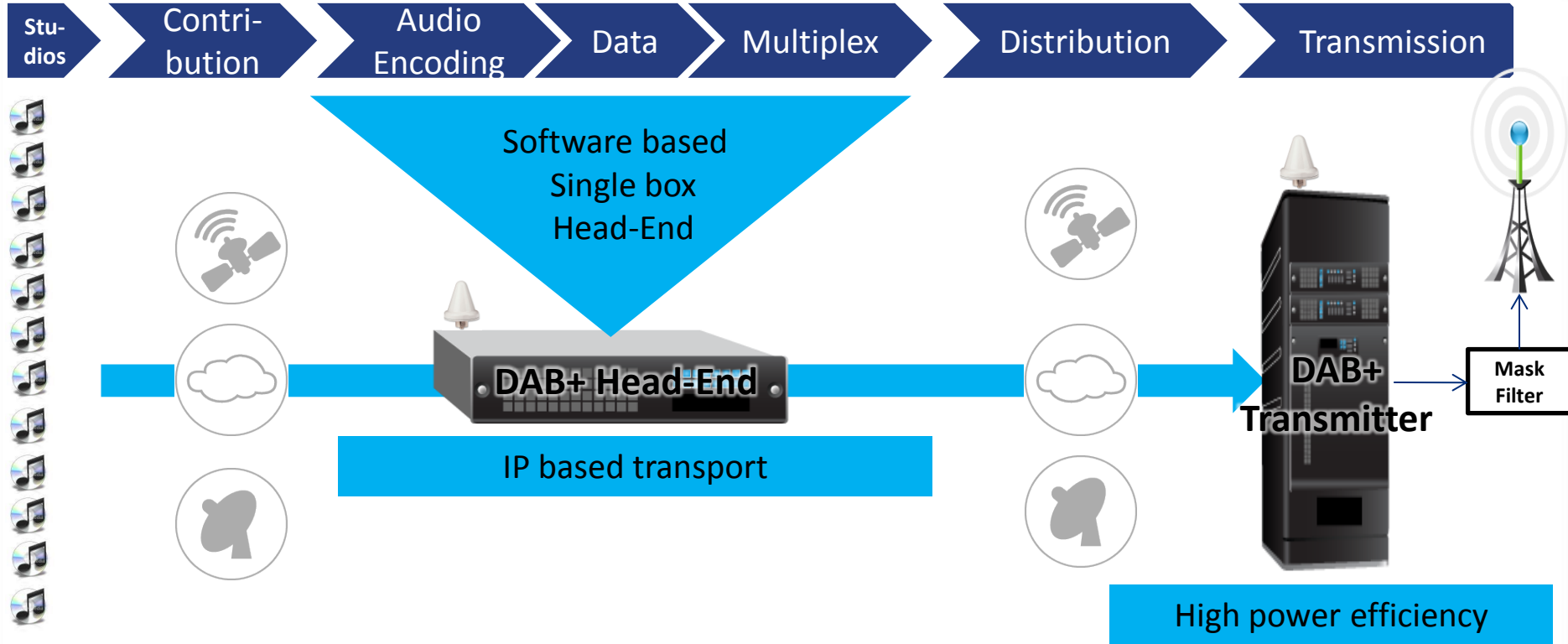
- Floor space

- Service & maintenance

Operational Expenses (OPEX)

(5x CAPEX over the life time !)

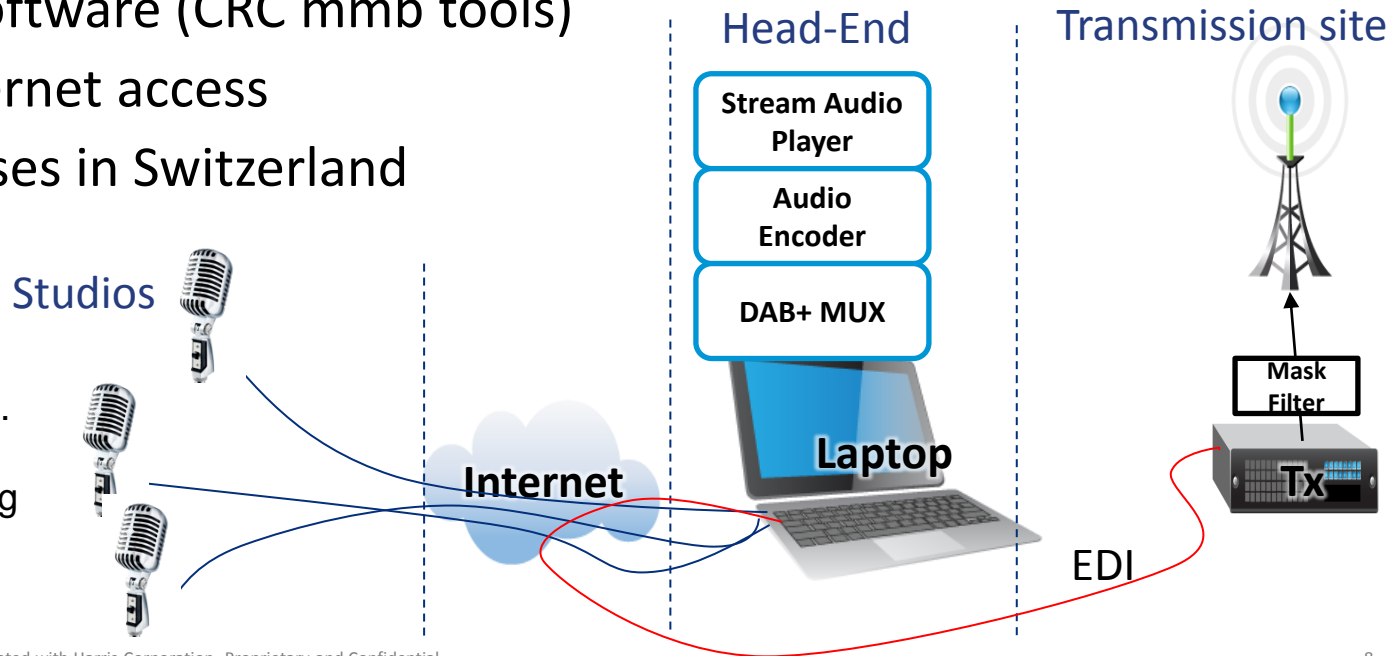
DAB+ System Overview



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

EDI Interface Distribution via IP



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Benefits using IP infrastructure for DAB+

IP distribution for broadcast audio/ video nowadays is:

- Cost effective - standardized equipment in IP Core and Edge
- Reliable - Closed User Groups, committed Quality of Service
- Universal - xDSL, Fiber Optic, Microwave, Managed Service,
- Future-proof - IPv6, LAN up 100Gb/s, WAN DWDM 1Tb/s per Fiber

- EDI = Encapsulation of DAB Interface
- Mechanism for transport STI-D and ETI over data over IP infrastructure
- Ensure robust delivery over varying conditions of IP networks
- Based on Distribution & Communications Protocol (DCP),
- Packet oriented
- Supports Unicast & Multicast (UDP-IP) and connections based on TCP/IP

Operation

- The multiplexer sends EDI data to the IP address of the EDI board in the Transmitter.
- The processor on the EDI board receives the EDI data, converts it to an ETI stream, and outputs the ETI stream to the DAB modulator.

EDI interface for transmitter

Benefits of Harris Broadcast Transmitters with integrated EDI

- Cost effective, built-in solution compared to external adapter
- Preserves investment, EDI card can be factory ordered or retrofitted later
- Simplifies management, EDI interface management fully integrated in transmitter user interface and management
- Tested with all of the DAB head-end vendors on the market
- Use cases: Netherlands, Norway, CZ



Transmitter design for high efficient operation



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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**

Transmitter Efficiency: what does it include?



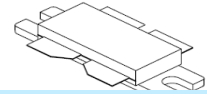
Main reductions in energy consumption

Key for significant power savings in the transmitter are

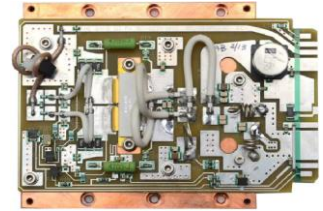
- New, more power full Transistors
- High Efficient Power Amplifier Technology and
- High efficient switched power supplies (96% AC-DC)

This causes secondary energy savings by:

- higher integration and compactness
- reduced cooling effort (fan speed, smaller fans)
- > 40% over all transmitter efficiency



New powerful *Transistors*



New High Efficiency
Power Amplifier



New High Efficiency DC
Power Supply

Power Smart 3D Harris Broadcast Patent

- Simple
- Cost effective
- Broadband & frequency agile
- No power back-off

**Efficiency with
no compromise !!!**

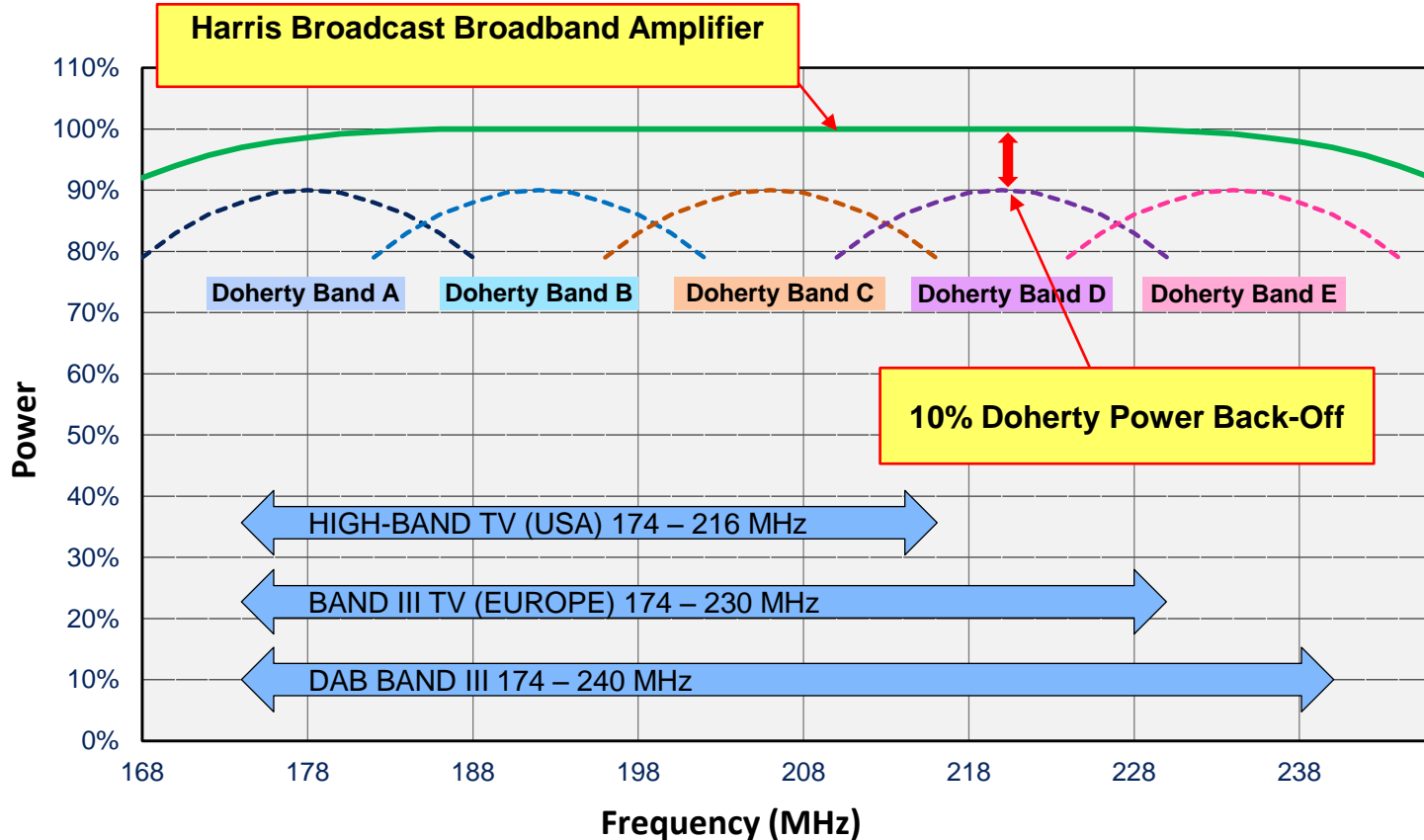
Doherty

- Simple
- Cost effective
- RF bandwidth limited
- No broadband operation
- Power back-off, 10% power loss
- Re-tuning of amplifier modules
- Separate modules for each band

Drain modulation

- broadband & frequency agile
- Costly
- Complex,
- Potentially less reliable

Maximum Power & Efficiency



DAB+ energy savings

Example: 18 Radio Programs same coverage DAB+ and FM

Transmitter	FM	DAB+
Power	10 kW	2,5 kW
Efficiency	72 %	40 %
Energy per Transmitter	13,9 kW	6.5 kW

Transmitters	18	1
Energy all Transmitters	250,2 kW	6.5 kW
Cost of energy 10y operation	3.287 Mio EUR	0,085 Mio EUR

3.287.628 EUR



FM



85.510 EUR

DAB

**Savings:
3.202.281 EUR
(38 times)**

Assumes 0.15 EUR / kWh

Energy saving for room cooling DAB+ versus FM

Example: 18 Radio Programs same coverage



1x DAB+ Transmitter

Heat dissipation of DAB+

- 1/9 of FM
- Energy cooling efficiency ration 5

18 x FM Transmitter

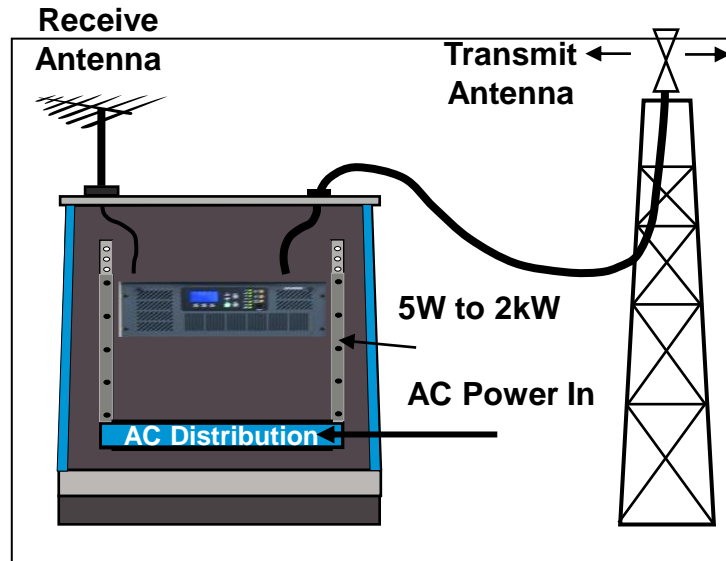


Power Saving cooling installations – air cooled

- Ducted Air racks
- Evacuate the heat from the building
- Reduces Cooling costs

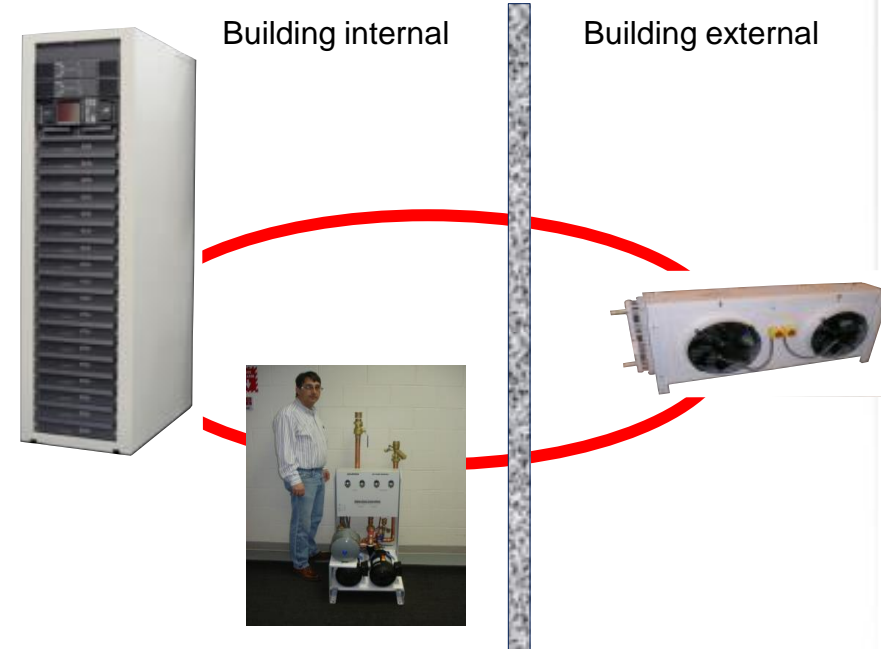
- Outdoor shelter
- Reduces site costs
- Fast deployment

- Both solutions reduce operating costs



Further savings using transmitter with liquid cooling system

- Drastic reduced building cooling costs
- Directly evacuate heat out side of the building
- Reduced space & installation effort
- Variable speed fans and pumps
- to reduce power consumption
- Flexible hose for easy installation
- Redundant system can support multiple transmitters
- Silent, low acoustic noise
- Low maintenance effort



Service & Maintenance

Reduced Service & Maintenance with DAB+

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1x DAB+ Transmitter

Drastic Service cost reductions using DAB+

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

18 x FM Transmitter



Service & repair of DAB+ transmitter

Light & universal parts for cost effective repair & logistic

RF Pallet

identical for
Air cooled and
Liquid cooled



500 g

Power Amplifier

Air cooled



2 kg

Power Supply

Air cooled
Liquid cooled



1 kg



250 g

- Low spare part costs
- Low shipment costs
- Low import fee
- Easy to carry and replace

Importance of Redundancy

For Multi Program Infrastructure



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High reliability is key for DAB+ transmission

Up to 24 Radio Programs
in one DAB+ Multiplex

1 Head-End

1 Transmission
System



- No redundancy - single components
- Multiple components - single drive, multiple PS, PA, cooling fans
- Partly redundancy - redundant Modulator / Exciter (dual drive)
multiple PS, PA, cooling fans
- Full redundancy - complete 2nd transmitter in stand-by

- Reliability of the transmitter system can be scaled to the needs depending on the cost & coverage situation
- Non redundant transmitter are already very reliable by using elements, parts & modules with high MTBF in the design
- i.e. power supply with 900.000h MTBF

Solutions for scaled redundancy for single transmitter infrastructure

No Redundancy

- For low power & GF filler sites with non-critical coverage
- Complete of air in case of a component failure
- SFN network gain from main power site could compensate partly the coverage losses
- 1+1 transmitter system if redundancy is needed



1. Single Drive
2. Single power supply
3. Single power amplifier
4. Single cooling system

Redundancy in the Transmission system

Solutions for scaled redundancy for single transmitter infrastructure

Multiple Components

- For coverage of less populated areas with medium power sites
- On air under reduced power in case of one faulty PA, PS or cooling fan
- Off air in case of modulator failures

1. Single drive
2. 1:1 power supply to power amplifier
3. Dual power amplifier, power supply
4. Dual cooling reserve

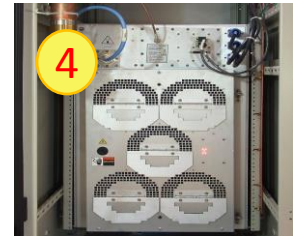
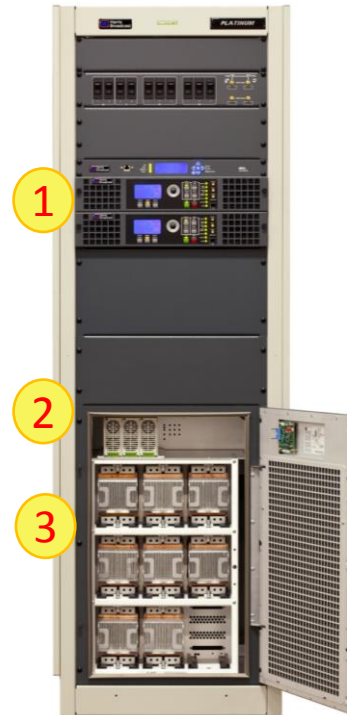


Redundancy in the Transmission system

Solutions for scaled redundancy for single transmitter infrastructure

Partly Redundancy

- For coverage of large and high populated areas
 - medium & high power transmitter
 - On air full power in case of one faulty modulator or cooling fan
 - Small power drop in case of one faulty Transistor, PS or PA
1. Exciter redundancy (Dual Drive)
 2. 1:1 power supply to power amplifier
 3. Many power amplifier, power supply modules
 4. Many cooling fans

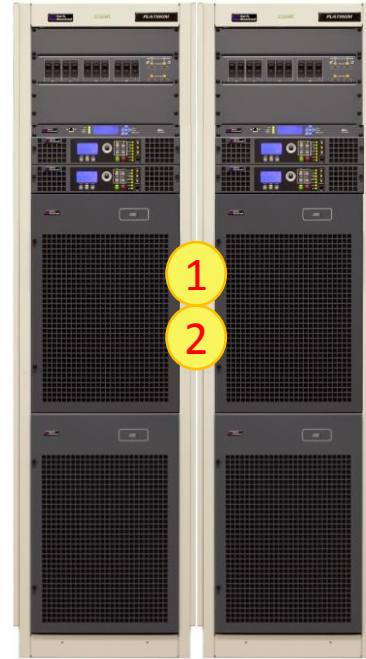


Redundancy in the Transmission system

Solutions for scaled redundancy for single transmitter infrastructure

Full Redundancy

- For coverage of large and high populated areas
 - medium & high power
 - important low power sites
-
- On air full power in case of any faulty component or module
-
1. 1+1 transmitter system
 2. Transmitter complete redundant




VAX16-3D with 1+1

Signal Quality & Efficiency



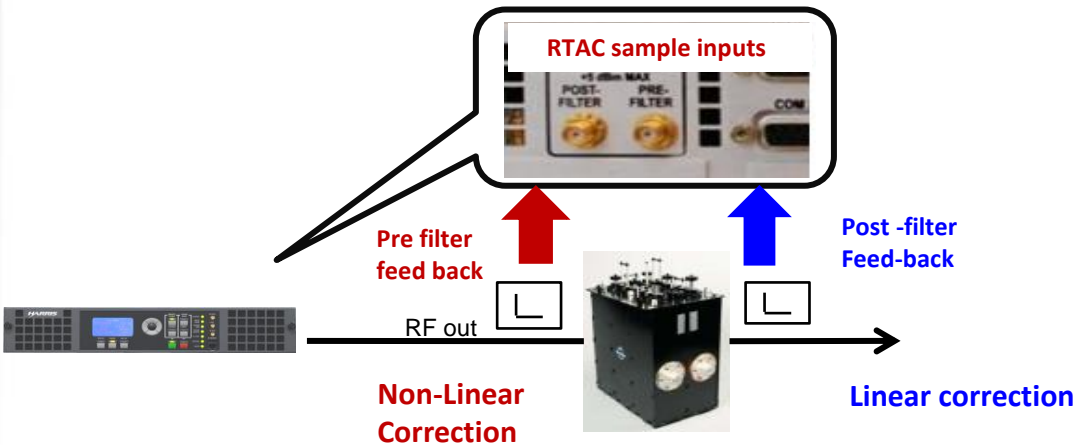
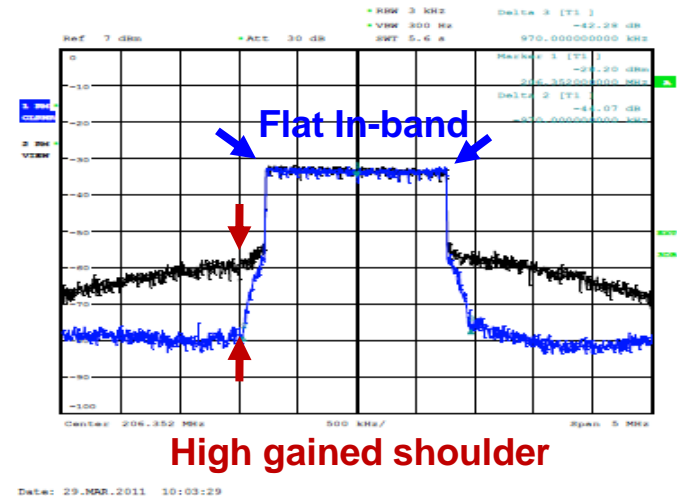
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Quality parameter of DAB+ signal

- Spectrum Mask (shoulder) and MER (Modulation error ration) are the main quality parameter in DAB+
- Trade –off between high power / high efficiency  spectrum mask (high shoulder) / high MER
- Real Time Adaptive Correction is key instruments for Optimization of DAB+ signal quality
- MER of 26dB allows best TX power efficiency and great shoulder
- Actual in new deployed DAB+ networks MER of 26dB is used

Clean spectrum - Real Time Adaptive Correction

- Secures high signal quality and clean spectrum
- Non-linear + linear correction for best results
- Up to 20dB gained shoulder distance (!)
- Compensate seasonal caused influences if permanently running



Conclusions



Harris Broadcast is an independent company not affiliated with Harris Corporation.

- DAB+ is the Radio technology with lowest Total Cost of Ownership (TCO)
- Significant cost reductions using IP and high power efficient + broadband Technologies
- Redundancy is important for multi program distribution systems as DAB+, (Impact of interruptions as higher as more programs are distributed over one single infrastructure)
- Moderate MER secures cost effective coverage with no impact on signal quality