Overview of transmission systems

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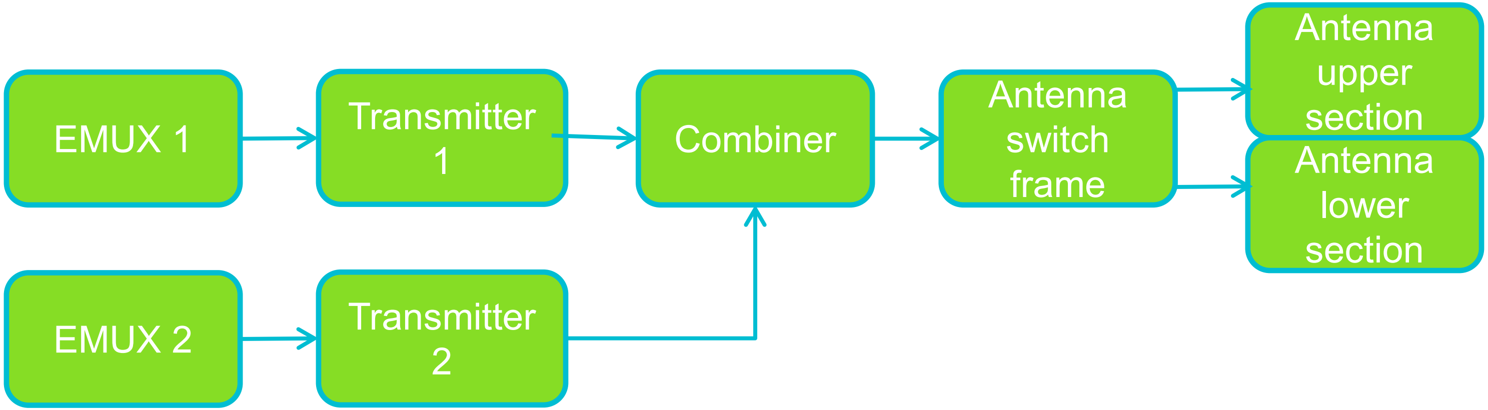
Technical Committee

DAB+ System Structure

1. Transmission system overview
2. Monitoring Systems

Overview

Main system blocks



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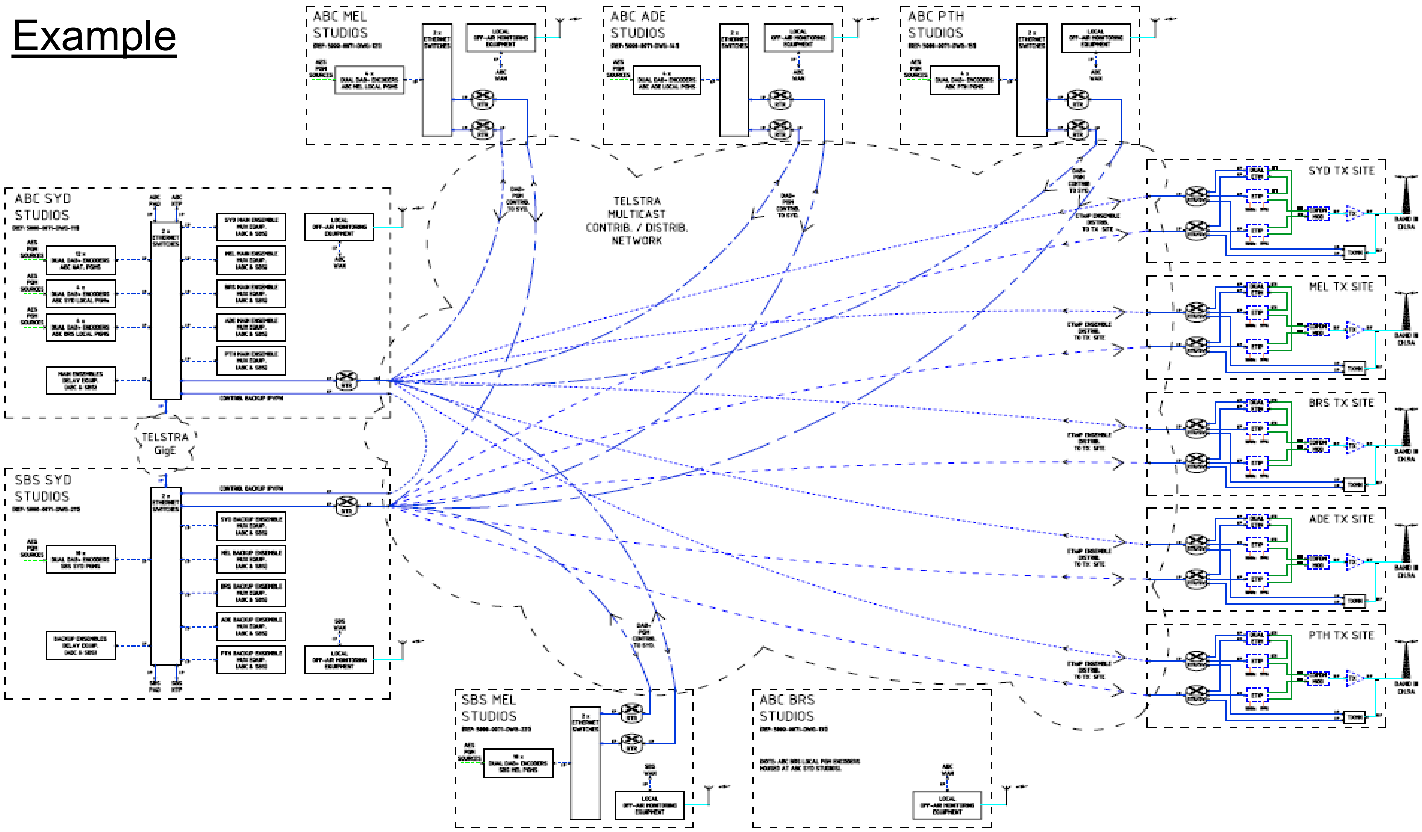
ETI / EDI

Example



Modulation and coding

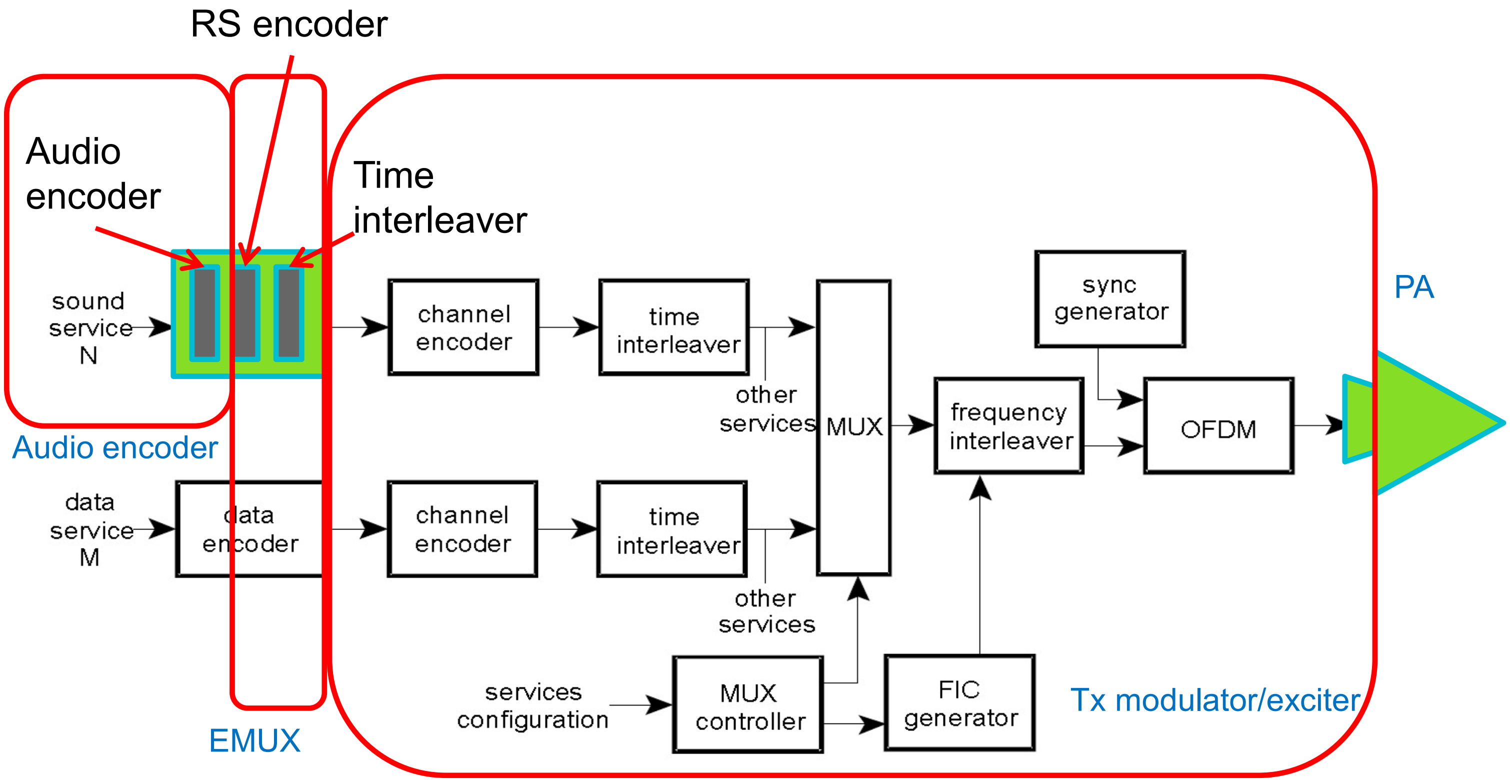


Figure 4.3.1: Conceptual block diagram of the EUREKA DAB system transmitter drive

Forward Error Correction

Forward Error Correction (FEC) codes are applied per sub-channel

Comparative performance

FEC Code	Code Rate	Capacity (kbps)	Number of 64kbps channels	Approximate power required relative to 3A
1A	1/4	576	9	-3 to -6dB
2A	3/8	864	13	-2 to -3dB
3A	1/2	1152	18	0
3B	2/3	1536	24	+3dB
4A	3/4	1728	27	+6dB

Payload capacity and transmit power can be traded
Stronger FEC protection = lower capacity OR lower power for the same coverage area

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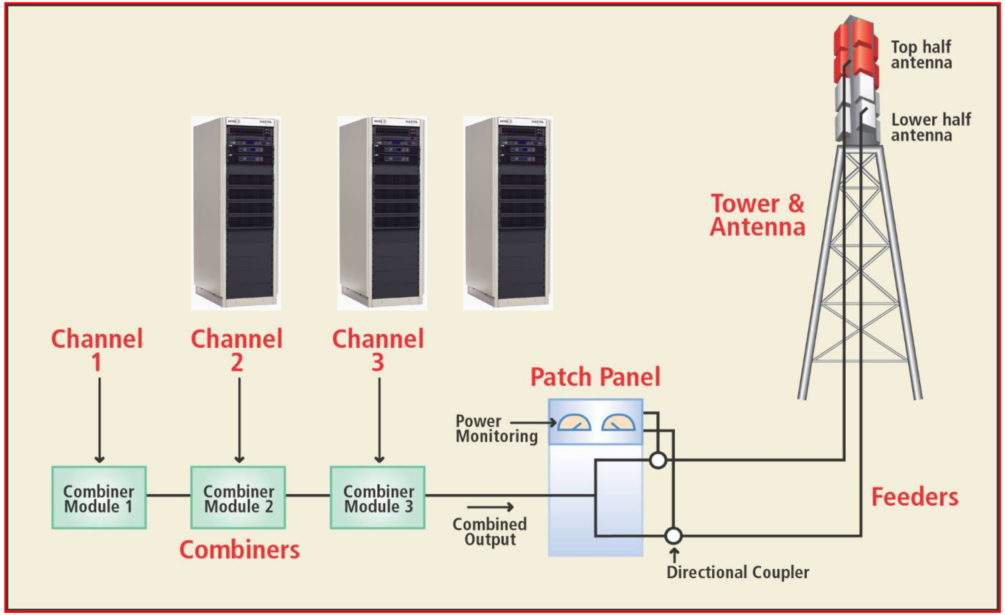
Signal flow

Antenna system



Example antenna switch frame / patch panel and combiner modules

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DAB critical transmission mask

DAB spectrum mask

Signal bandwidth = 1536 carriers at 1kHz each => 1.535MHz
Channel bandwidth = 1.712 MHz

10 log(1536 kHz / 4 kHz) = -25.84 dB

The mask filter is designed to allow multiplexers to operate in immediately adjacent frequency blocks, e.g. 9A and 9B

Areas with adjacent channel usage require the critical mask

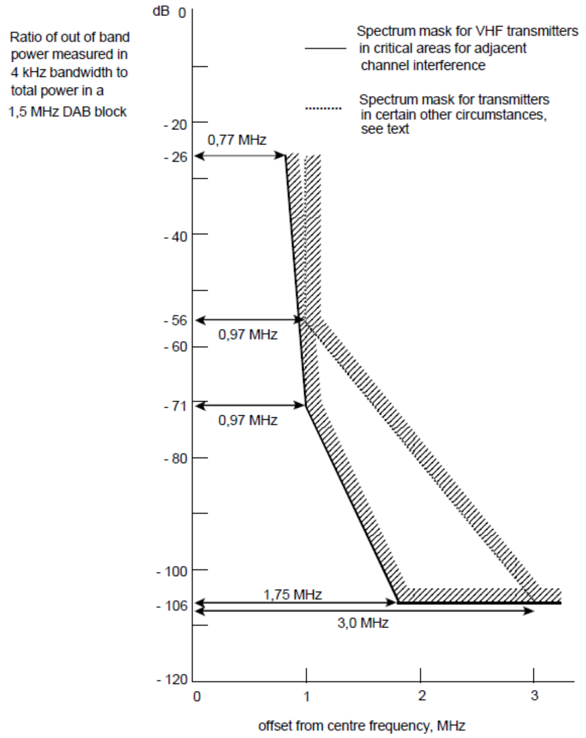

Figure 66: Out-of-band spectrum mask for DAB transmission signal (all transmission modes)

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Simple single filter

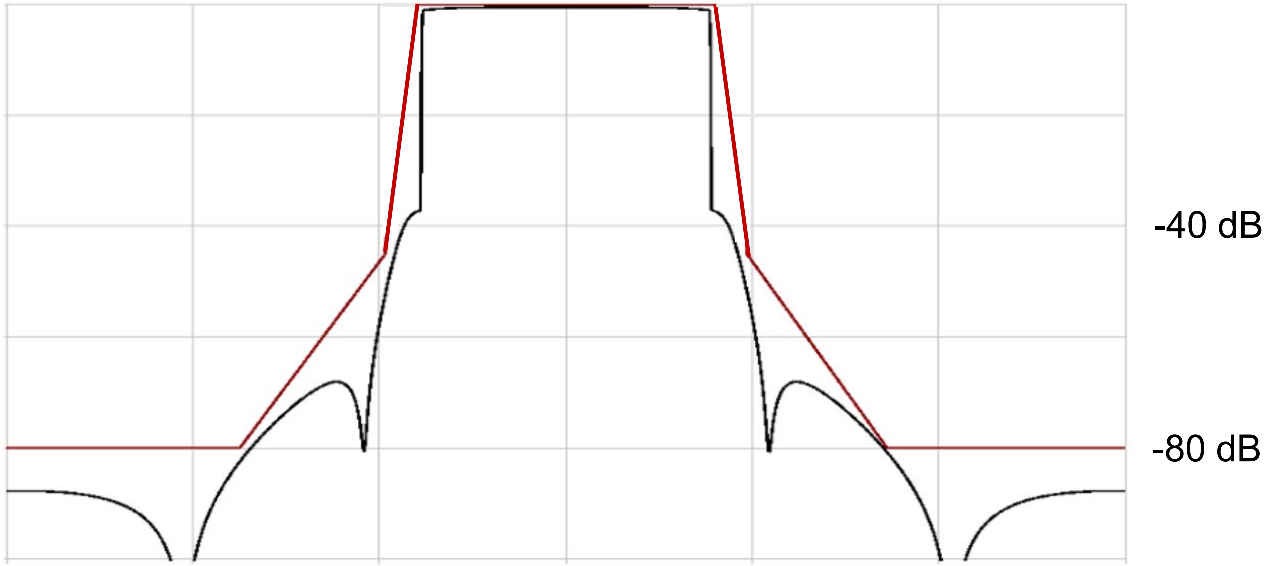
Tx spectrum before and after the mask filter

Improved shoulder distance after filter

Source: Gates Air

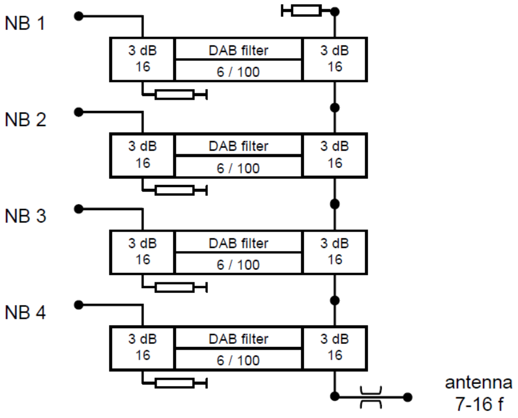
DAB critical transmission mask

Example output spectrum after the mask filter



Combiners

Combiners allow multiple transmission signals to be 'combined' with low loss and suitable DAB mask filtering



insertion loss in dB (tolerance ± 0,05 dB)			return loss
$f_{0\,-\,0,77\ \mathrm{MHz}}$	f_0	$f_{0\,+\,0,77\ \mathrm{MHz}}$	
2,6	1,3	2,6	≥ 26 dB
2,3	1,0	2,3	≥ 26 dB
≥ 0			
> 40 ± 5 dB			
	$f_{0\,\pm\,0,97\ \mathrm{MHz}}$	$f_{0\,\pm\,1,75\ \mathrm{MHz}}$	$f_{0\,\pm\,3\ \mathrm{MHz}}$
	≥ 15	≥ 45	≥ 53

Typical design

Source: Spinner

High Power High Tower - Antenna systems

Examples

Band III antenna at Artarmon site in Sydney

Transmission tower at Mt Wellington, Hobart has a full raydome due to extreme weather conditions

Antenna systems

- DAB+ Signals are vertically polarised
- TV Signals are usually horizontally polarised
- Beam Tilt techniques can be employed in Vertical Radiation Pattern to allow higher ERP and more efficient Co-Channel reuse
- Photo of combined Band III TV & DAB+ antenna at Mount Lofty in Adelaide

RFS 662 dual polarisation VHF Band III antenna panel

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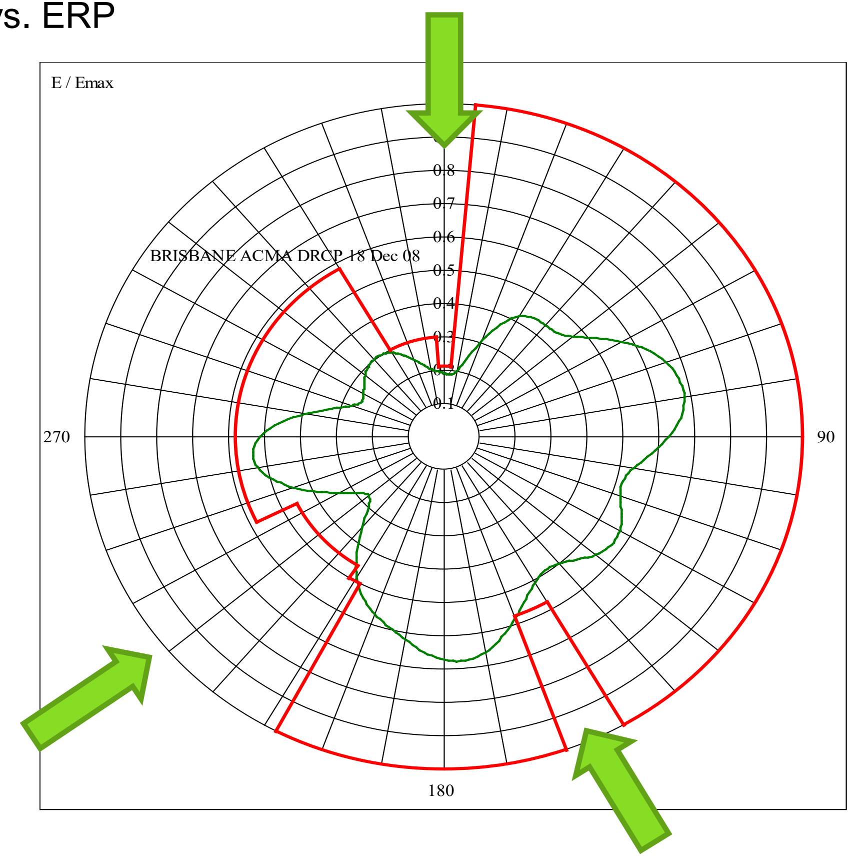
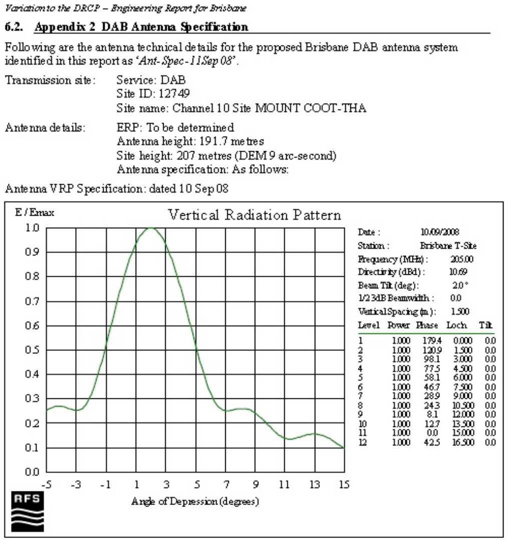
Antenna patterns – high complexity

Brisbane EMAX vs. ERP





Variation to the DRCP – Engineering Report for Brisbane

6.2. Appendix 2 DAB Antenna Specification

Following are the antenna technical details for the proposed Brisbane DAB antenna system identified in this report as '*Ant-Spec-11Sep 08*'.

Transmission site: Service: DAB
Site ID: 12749
Site name: Channel 10 Site MOUNT COOT-THA

Antenna details: ERP: To be determined
Antenna height: 191.7 metres
Site height: 207 metres (DEM 9 arc-second)
Antenna specification: As follows:

Antenna VRP Specification: dated 10 Sep 08

Date : 10/09/2008
Station : Brisbane T-Site
Frequency (MHz) : 205.00
Directivity (dBd) : 10.69
Beam Tilt (deg): 2.0 °
1/2 3dB Beamwidth : 0.0
Vertical Spacing (m): 1.500

Level	Power	Phase	Loch	Tilt
1	1.000	179.4	0.000	0.0
2	1.000	120.9	1.500	0.0
3	1.000	98.1	3.000	0.0
4	1.000	77.5	4.500	0.0
5	1.000	58.1	6.000	0.0
6	1.000	46.7	7.500	0.0
7	1.000	28.9	9.000	0.0
8	1.000	24.3	10.500	0.0
9	1.000	8.1	12.000	0.0
10	1.000	12.7	13.500	0.0
11	1.000	0.0	15.000	0.0
12	1.000	42.5	16.500	0.0

RF network and antenna design must consider interference and well as coverage

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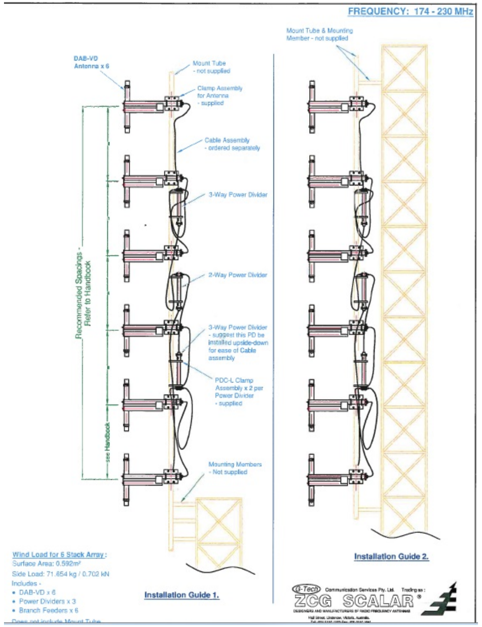
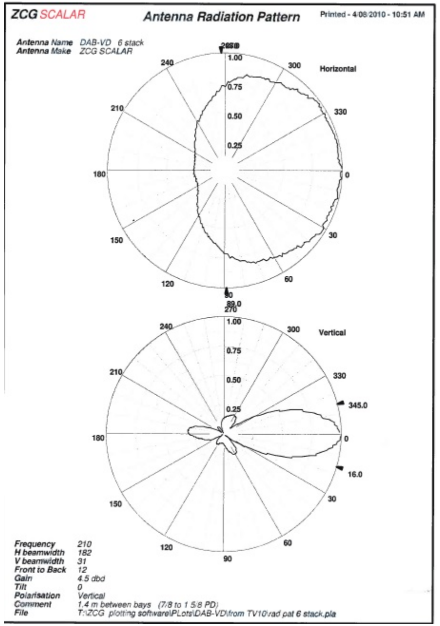
Lower Power transmissions

Medium power transmissions are used extensively in Europe and UK where most main sites are 5 – 10 kW.

Repeater / infill sites can be from 100W to 5 kW depending on the coverage requirements and SFN compatibility.

These sites generally use dipole antennas as the are much cheaper and lighter.





Yagi antenna example approx. 4.5 dBd gain

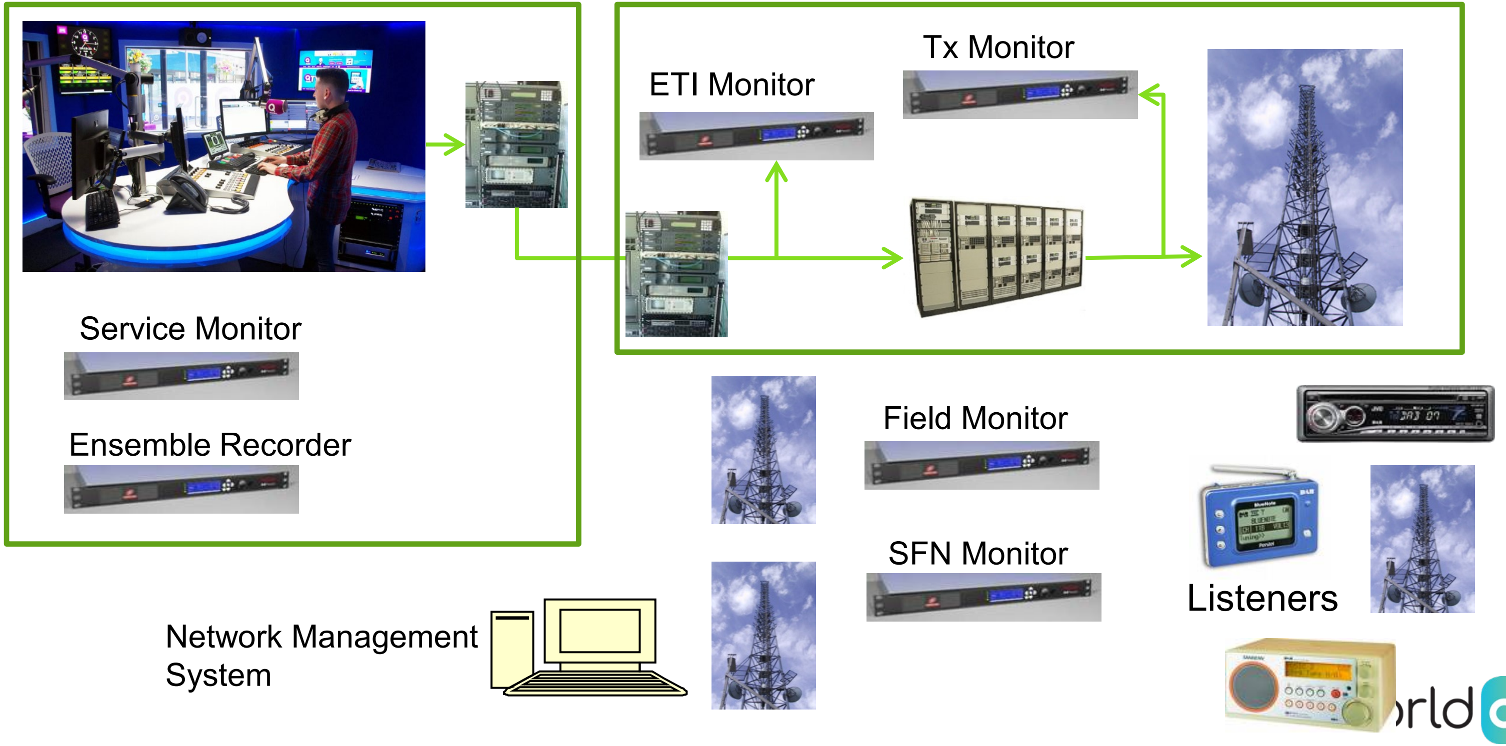
Monitoring systems

Overview

- Content delivery
- Control and monitoring

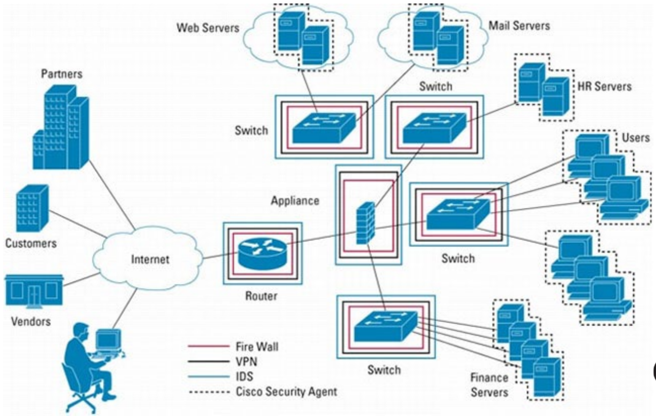
Control and monitoring

Monitoring equipment



Control and monitoring

- Network Management Systems
  - Lots of options
  - SNMP basis
  - Physical relay systems reducing
- Equipment control and configuration
- Remote observation
- Remote maintenance
- Operational history and recording
  - Fault analysis
- MSTS for system access and control

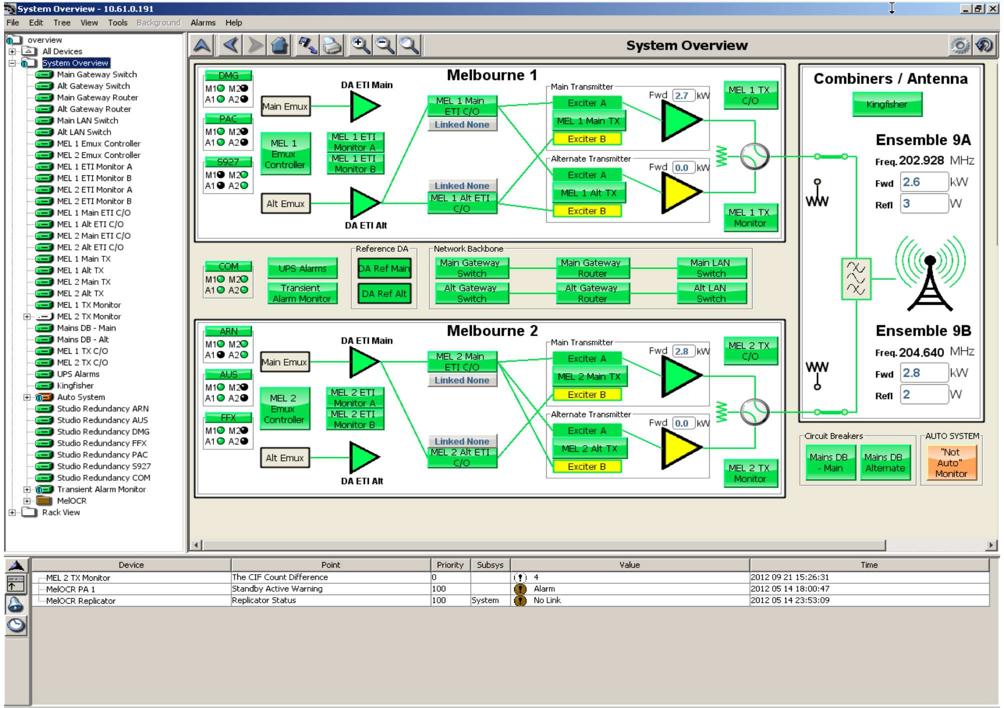


Control and monitoring

Network Management Systems

Icon based mimic diagrams can help NMC staff quickly identify issues

Systems should be designed to allow remote access via web interfaces to ensure rapid response times



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Summary

- Transmissions systems need to be engineered to meet the business demands for
  - Coverage and interference
  - Reliability
  - Performance and cost effectiveness

- Monitoring systems are essential to ensure appropriate system operation
  - Reliability
  - Fault detection and recovery
  - Ongoing operations and feature updates
  - Future proofing the business

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Thank you

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