WORLD DMB

Defining the future of digital radio

Overview of the DAB+ System

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Digital Multimedia Broadcasting

Radio • Mobile TV • Multimedia • Traffic Data

2013

DAB Family of Standards

DAB+ Features

Ensemble Structure

System Structure

Network Options

The Future

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Overview of the DAB+ System

Welcome to the DAB Family of Standards

One family provides the most cost effective delivery of digital radio and mobile TV

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An introduction

The Eureka Family of Standards

- **DAB :** 1995 Original audio with PAD and data services standard
- **T-DMB :** 2006 Added video services for Mobile TV and enhanced data streaming
- **DAB+ :** 2007 Enhanced audio service efficiency

Why DAB+?

One family provides the most cost effective delivery of digital radio and mobile TV

- 2.5 times more audio services than DAB due to the use of HE AAC+ v2
- Slightly better coverage – 1 to 2dB better than DAB – better FEC coding
- More flexibility for Programme Associated Data delivery
- PAD content has much stronger error protection

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The DAB Family of Standards

For detailed description of the DAB+ system refer to the following ETSI standards documents

EN 300 401	Main document
TR 101 496-1, -2, -3	Guidelines of use and operation
TS 102 563	Transport of AAC audio

See http://www.worlddab.org
or
http://www.etsi.org/standards

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DAB Standards

DAB+ Features

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Audio - Room for Lots of Services

Australian example

Simulcast stations (AM / FM)

new DAB+ only stations

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DAB+ Features

Choose the station from a list

No more need to remember the station's frequency!!!

Station list

Easy to choose a station, listener has more information about the services available

Programme Associated Data (PAD)
Dynamic Label Segment – Text Delivery

- Straight forward, effective
- Up to 128 characters per text segment
- All DAB+ receivers have DLS text display
- Good receivers block text display or appropriate scrolling speed

Programme Associated Data Slideshow (SLS) Images

- Further strengthens the audio message
- Standalone advertising during song items
- Promotion of station activities
- Traffic and weather reports
- Sports results and stock market information
- Local news, happenings, community events

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Data Services

Electronic Programme Guide (EPG)

- Very useful tool for promotion of programs, talent, competitions
- Especially useful for multilingual national broadcasters with scheduled programme slots
- Is flexible, can be station, network or ensemble based
- Some receivers can record programs for later listening

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Data Services – Other

Traffic e.g. TMC and TPEG can provide up to the moment information on
- current traffic flow and congestion
- fuel locations and prices
- parking

Journaline
- Hierarchical categorised text service

Custom Applications can be developed

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Ensemble Structure

Ensemble Structure

Multiple different radio stations transmitting on the same frequency

Multiple different radio stations use the same transmitter

Multiple different radio stations share the cost of that single transmission

Very flexible to ensure the broadcaster can deliver the content they provide in the most cost effective manner

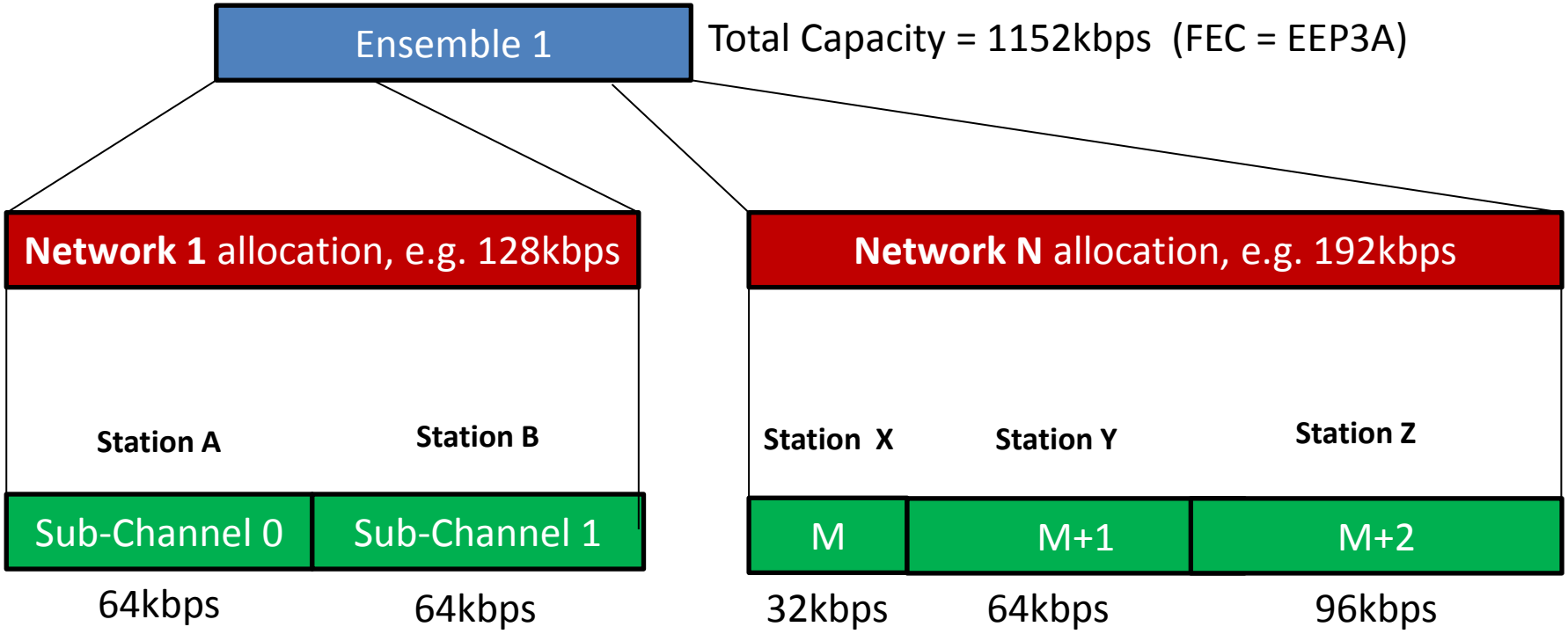
Ensemble Structure

An Ensemble will typically carry multiple services from multiple radio networks, for example:

• Network 1 – 2 stations (services)	128kbps
• Network 2 – 4 stations	256kbps
• Network 3 – 3 stations	192kbps
• Network 4 – 9 stations	576kbps
Total 18 stations	**1152kbps**

- Each network can have their own allocated capacity on the ensemble
  - No other network has access to that capacity
- Each network can **reconfigure** their allocated capacity anytime without impacting the other networks' services
  - **Pop-up services** change their name and sometimes bit rate regularly

Ensemble Structure



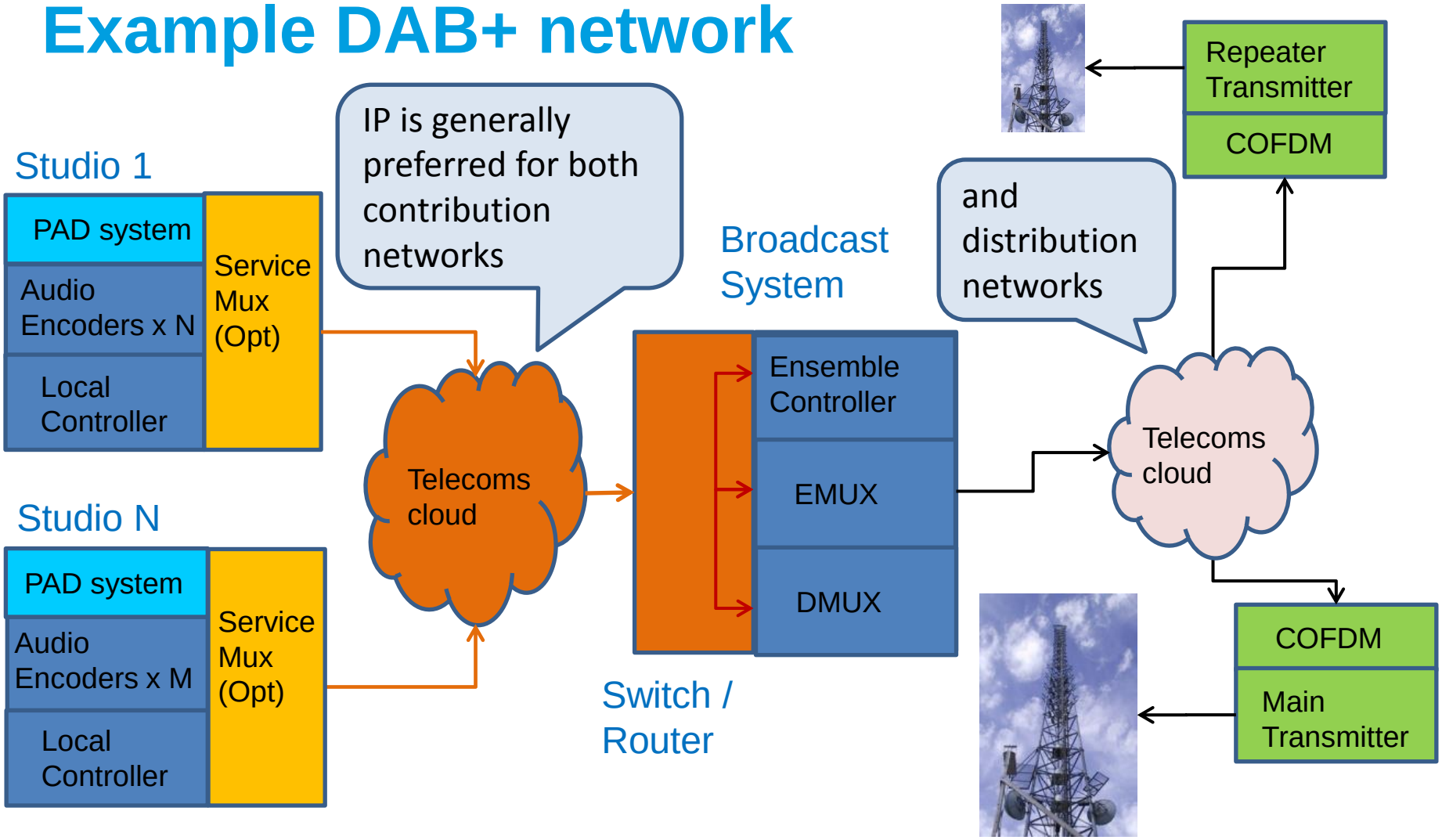
Ensemble Structure

Each ensemble has

- its own Ensemble Label
- its own unique Ensemble ID code
- can carry a unique identifying code of the transmitter (TII)
- a Signalling Channel – the Fast Information Channel (FIC)
  - Provides details about all services (stations) carried
    - Service labels
    - Bit rates
    - Data location in the stream
  - Provides details of all data services and PAD
  - Provides announcements and warnings

System Structure

Example DAB+ network



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System Structure

DAB+ Audio

Many combinations to allow the most cost effective delivery of different audio content types

HE AAC+ V2 audio encoding table combinations

Sampling rate (kHz)	SBR on	Sub-channel data rates (kbps)					
		Stereo		Parametric Stereo		Mono	
		Min	Max	Min	Max	Min	Max
48	no	24	192	-	-	16	176
24	yes	24	136	24	48	16	64
32	no	24	192	-	-	16	168
16	yes	24	136	24	48	16	64

Coding Technologies / Dolby AAC+ implementation

DAB+ Audio Encoding

Spectral Band Replication

From Computer Desktop Encyclopedia
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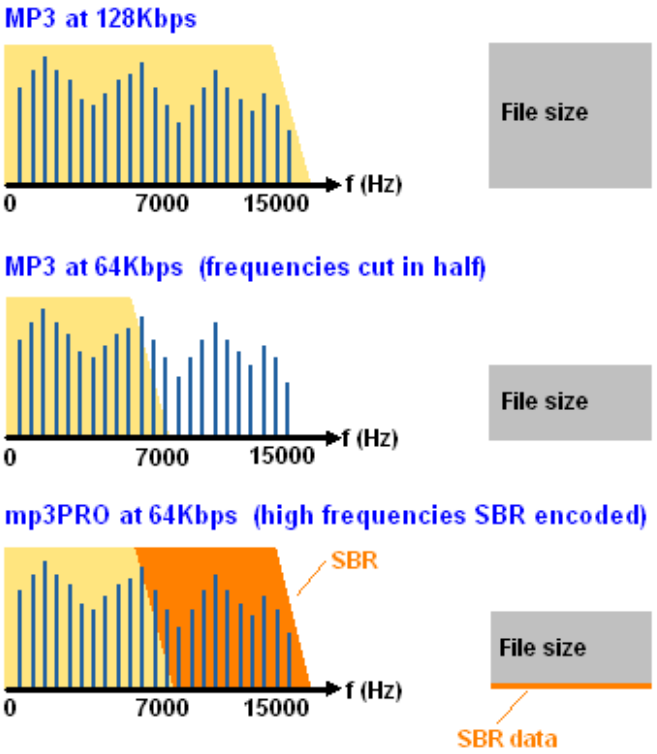
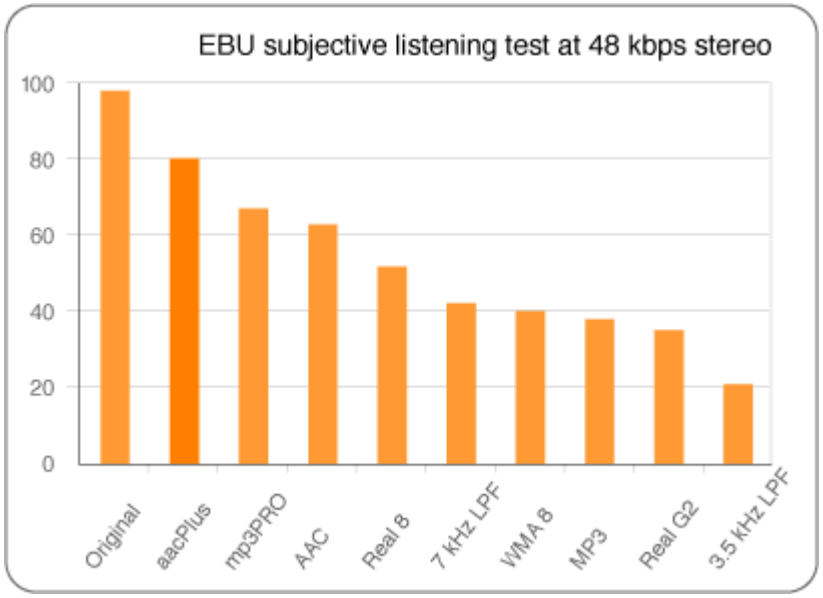


Efficient sample rate and bit rate reduction method

Only slight audio degradation



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DAB+ Audio Encoding

Outer layer of FEC coding and interleaving provides protection for PAD – especially important to ensure robust SLS image delivery

Signal Flow with outer layer FEC

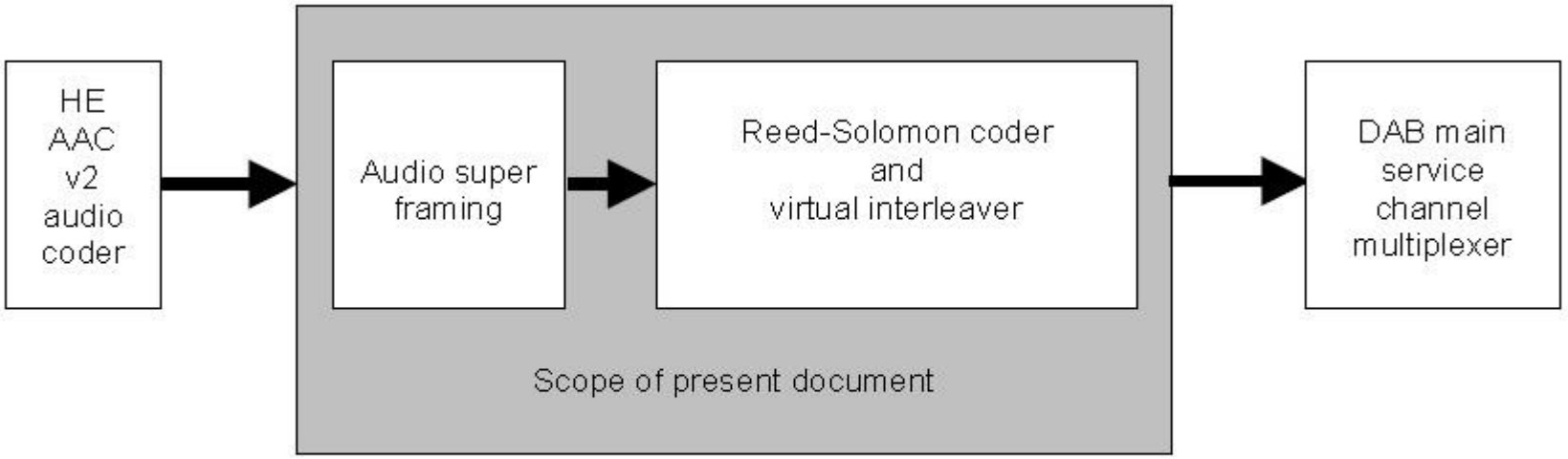
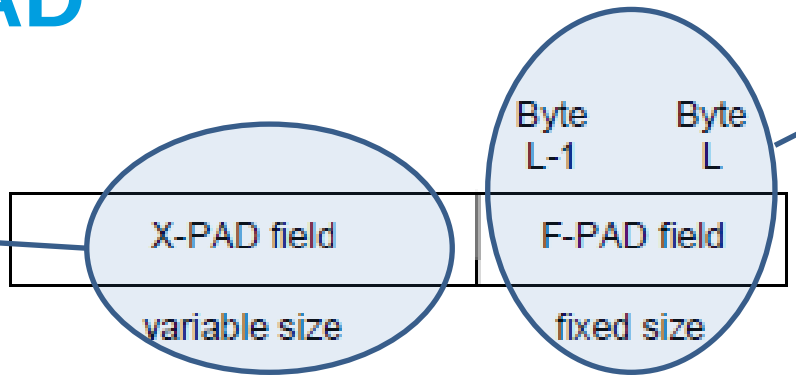


Figure 1: Conceptual diagram of the outer coder and interleaver

Audio - PAD

PAD for DLS and SLS delivery



XPAD size, music/speech flag, command channel

Figure 2: Coding of the PAD field

Table 10: Maximum bit rate of F-PAD and X-PAD data

AAC core sampling rate	Maximum bit rate for F-PAD data (2 bytes)	Maximum bit rate for X-PAD data (196 bytes)
16 kHz	267 bps	26 133 bps
24 kHz	400 bps	39 200 bps
32 kHz	533 bps	52 267 bps
48 kHz	800 bps	78 400 bps

Typical use: SBR on @ 24kHz core sampling rate, 3 frames per super-frame, 1 super-frame per 120mS

Audio Bit Rates v PAD Bit Rate

Need to ensure the correct balance between audio bit rate, audio settings and PAD

Audio bit rate ≈ Sub-Channel bit rate *0.9 – PAD bit rate

SLS images are best synchronised with audio using pre-delivered images and header update display triggers, either

TriggerTime = time/date or

TriggerTime = now

Sub-Channel bit rate (kbps)	FEC Overhead 10%	Payload capacity (kbps)	PAD (kbps)	Audio bit rate (kbps)
32	3.2	28.8	1	27.8
32	3.2	28.8	2	26.8
32	3.2	28.8	4	24.8
32	3.2	28.8	8	20.8
48	4.8	43.2	1	42.2
48	4.8	43.2	2	41.2
48	4.8	43.2	4	39.2
48	4.8	43.2	8	35.2
64	6.4	57.6	1	56.6
64	6.4	57.6	2	55.6
64	6.4	57.6	4	53.6
64	6.4	57.6	8	49.6
64	6.4	57.6	16	41.6
80	8	72	1	71
80	8	72	2	70
80	8	72	4	68
80	8	72	8	64
80	8	72	16	56

Signal Flow - Transmitter

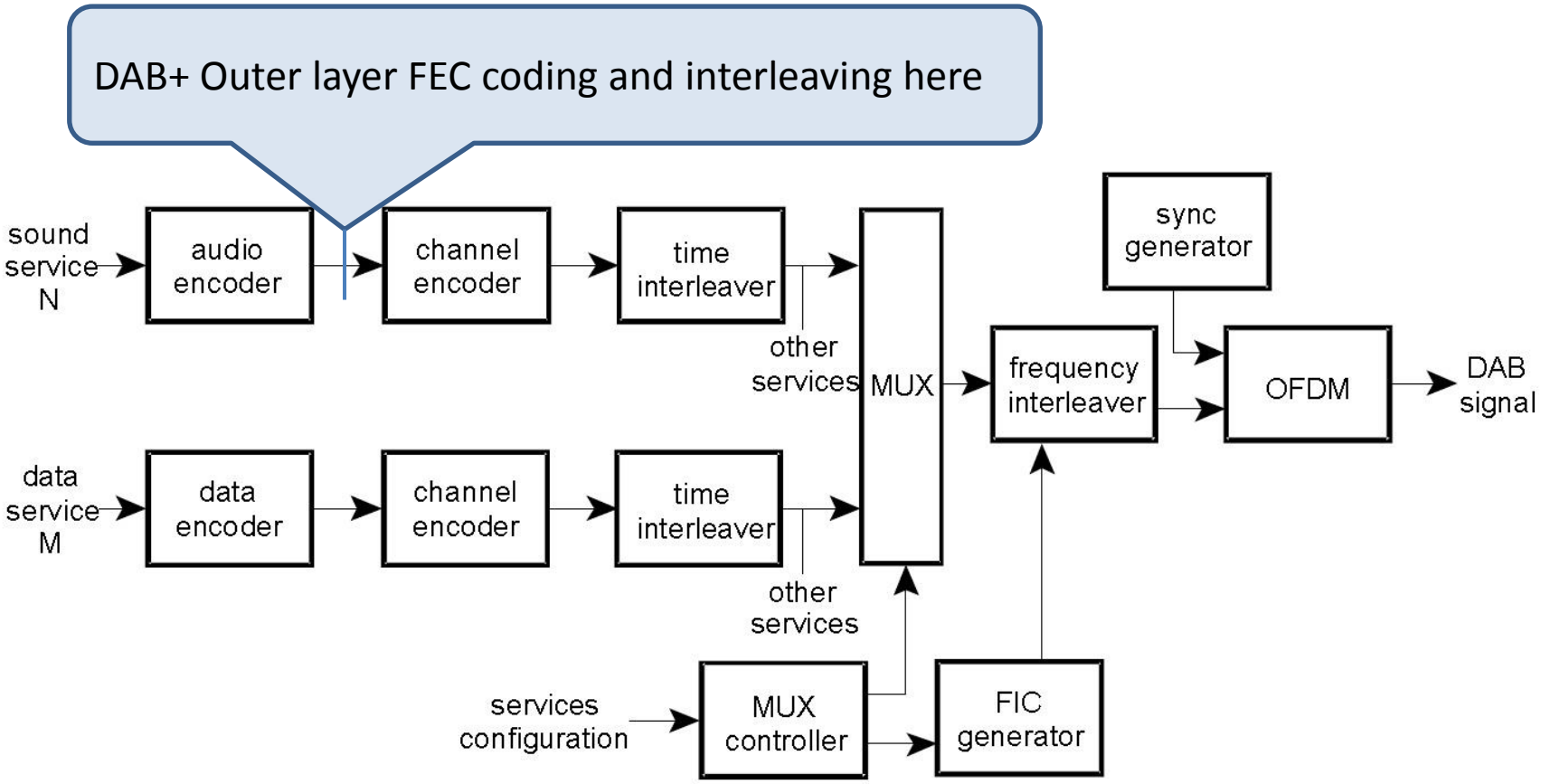


Figure 4.3.1: Conceptual block diagram of the EUREKA DAB system transmitter drive

FEC Code Rate Comparison

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 BUT lower power for the same coverage area

Transmission Structure

Signalling and service information is sent in the Fast Information Channel

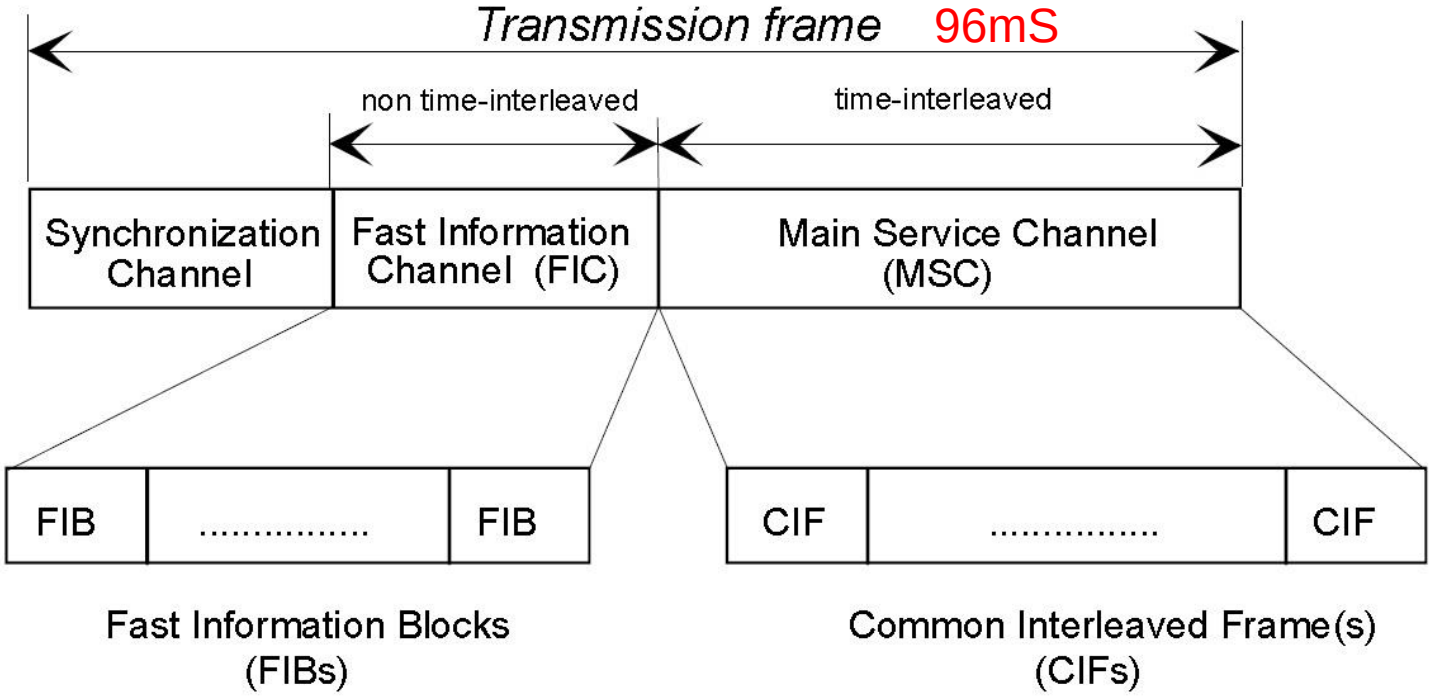
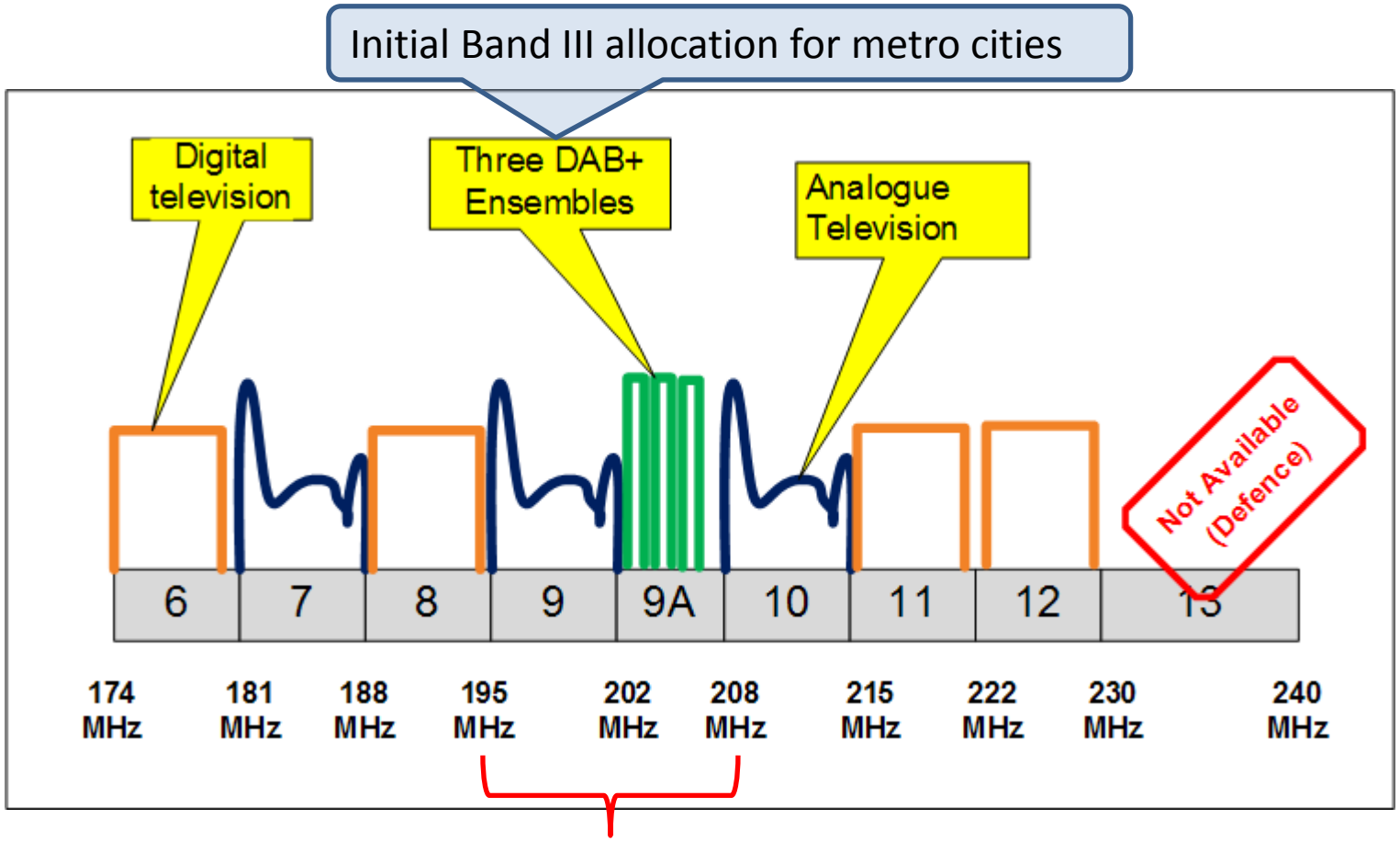


Figure 2: Transmission mode independent description of the FIC and MSC

DAB+ Transmission – Australian VHF channels



2 DTV channels allocated = 14MHz = 8 DAB channels = 8A, B, C, D, 9A, B, C, D

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RF Spectrum

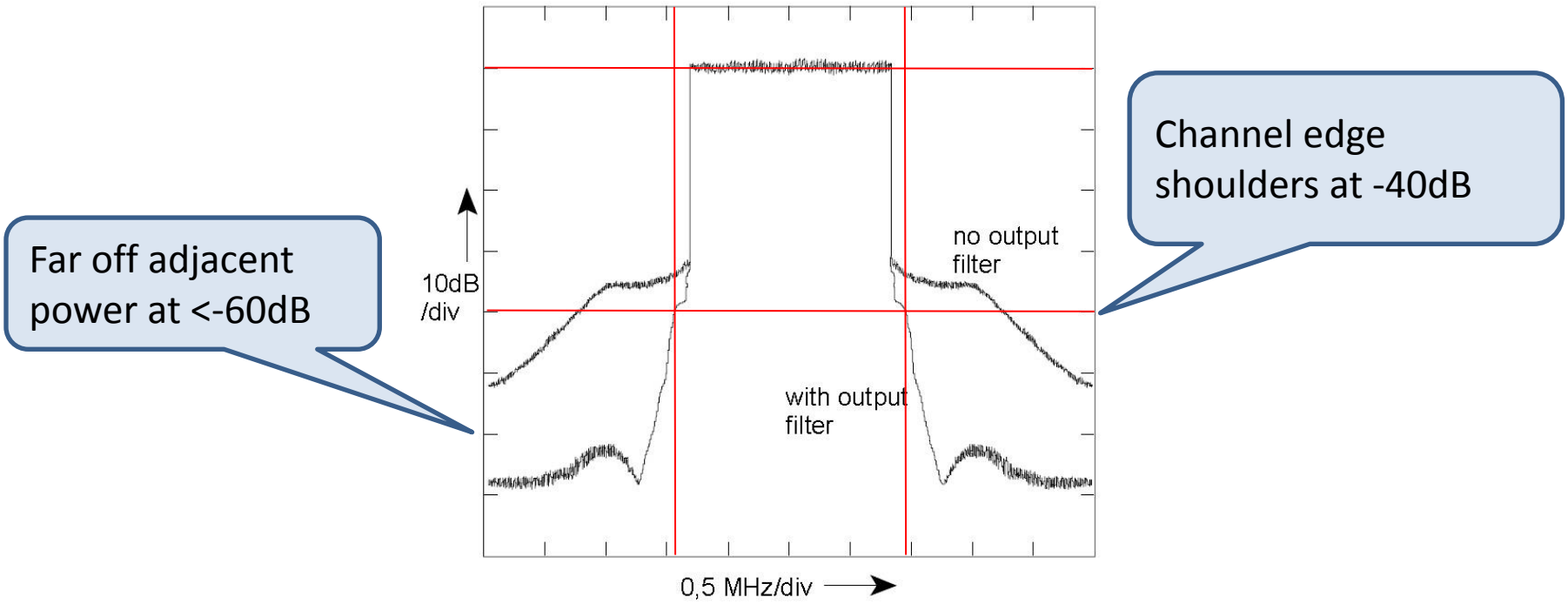


Figure 4.3.4: Example of DAB transmitted signal spectrum (VHF band III)

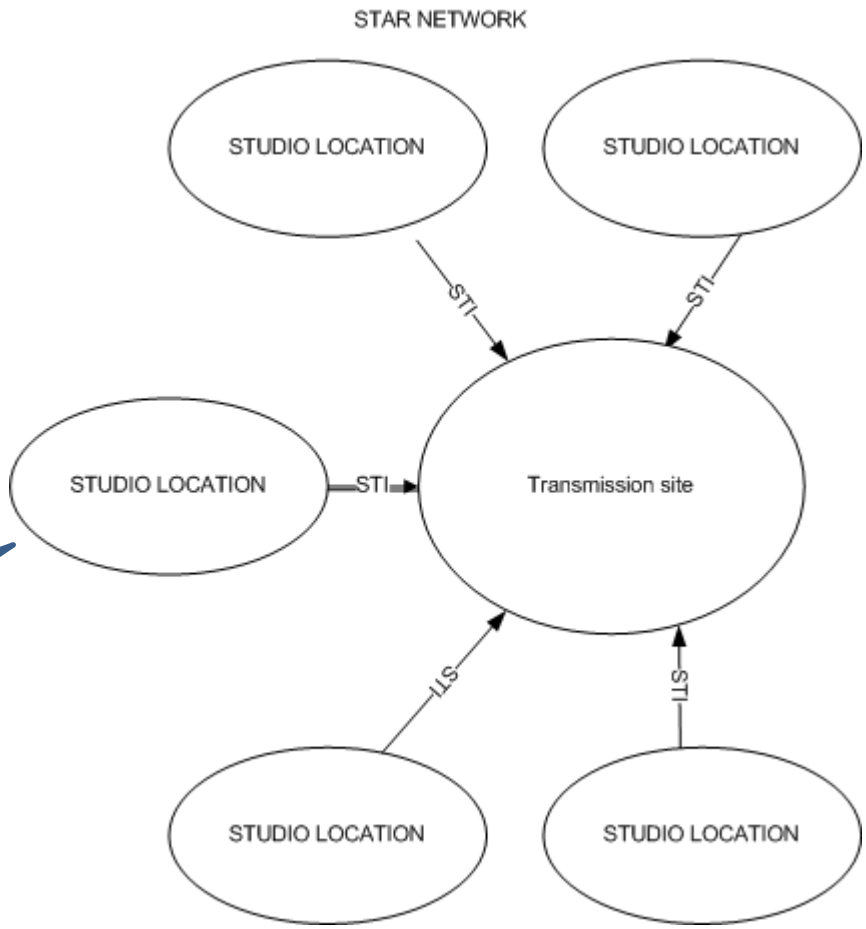
Signal bandwidth = 1536 carriers at 1kHz each => 1.535MHz
Channel bandwidth = 1.712 MHz

Network Options

Star Network

- Central multiplexing equipment
- Individual links per studio site
- Simple networking
- Stations are in control of their content
- Privacy

This architecture is often used for stand-alone / isolated installations such as single city or area transmissions



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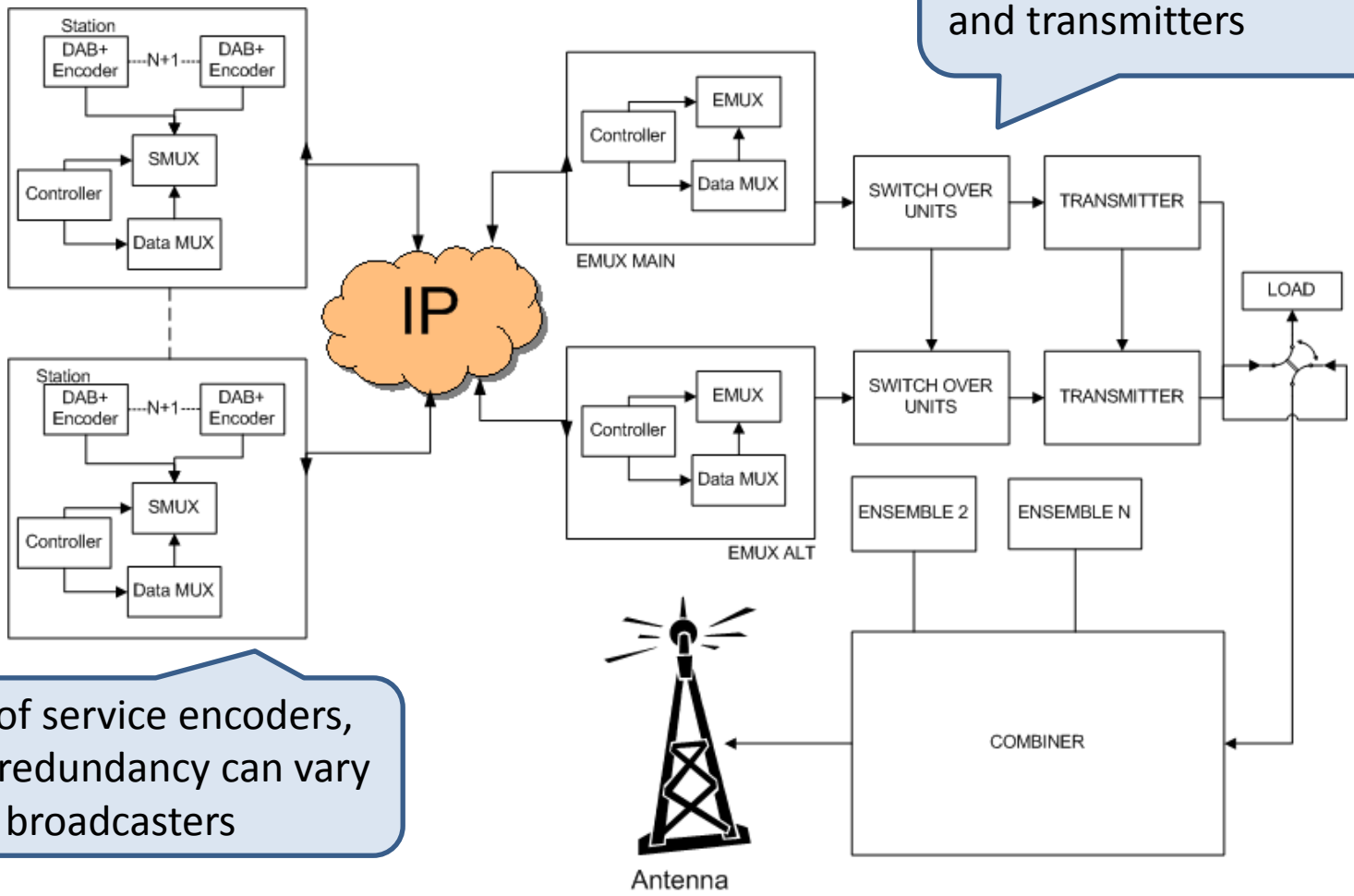
Star Network

Redundant common ensemble multiplexing and transmitters



Number of service encoders, PAD and redundancy can vary between broadcasters

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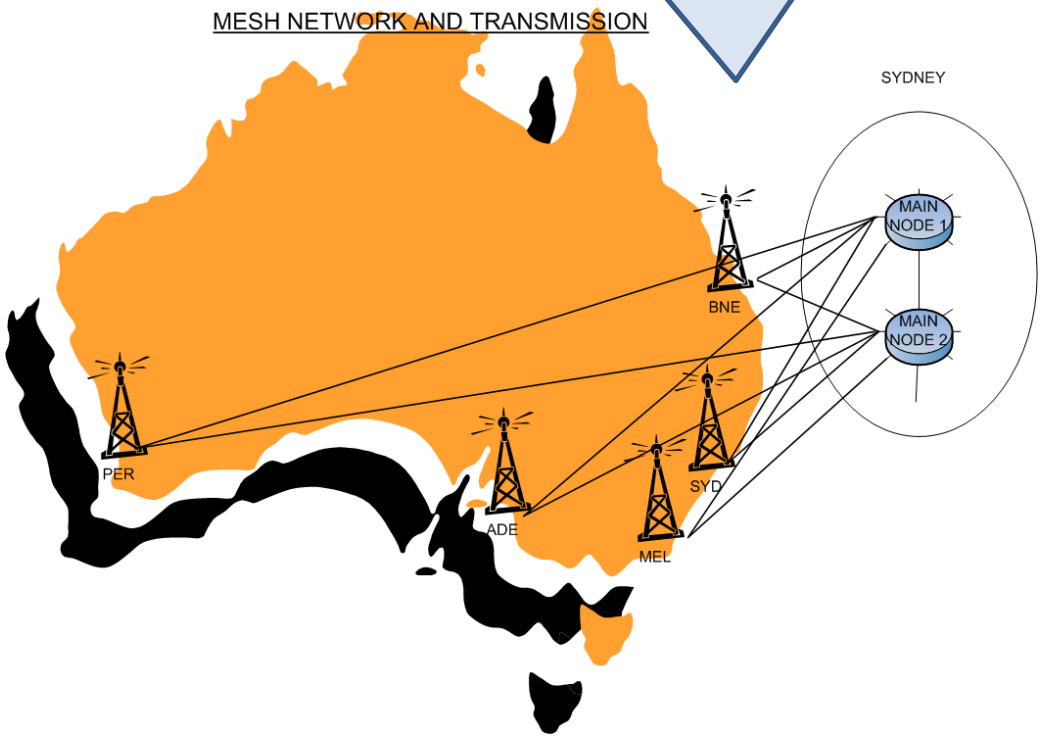
Network Options

Mesh Network

Suitable for distributed broadcast networks such as national multi-studio networks

- Transparent interconnect between sites
- High Redundancy and Reliability
- Typically uses a multicast enabled VPN
- Content produced at any site can be transmitted at any site



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Monitoring Equipment - Overview

Service Monitor

Ensemble Recorder

ETI Monitor

Tx Monitor

Repeaters

In-Field Monitors

Listeners

Multiple monitoring points throughout the system allow rapid fault finding and rectification

Listeners provide the ultimate feedback!!

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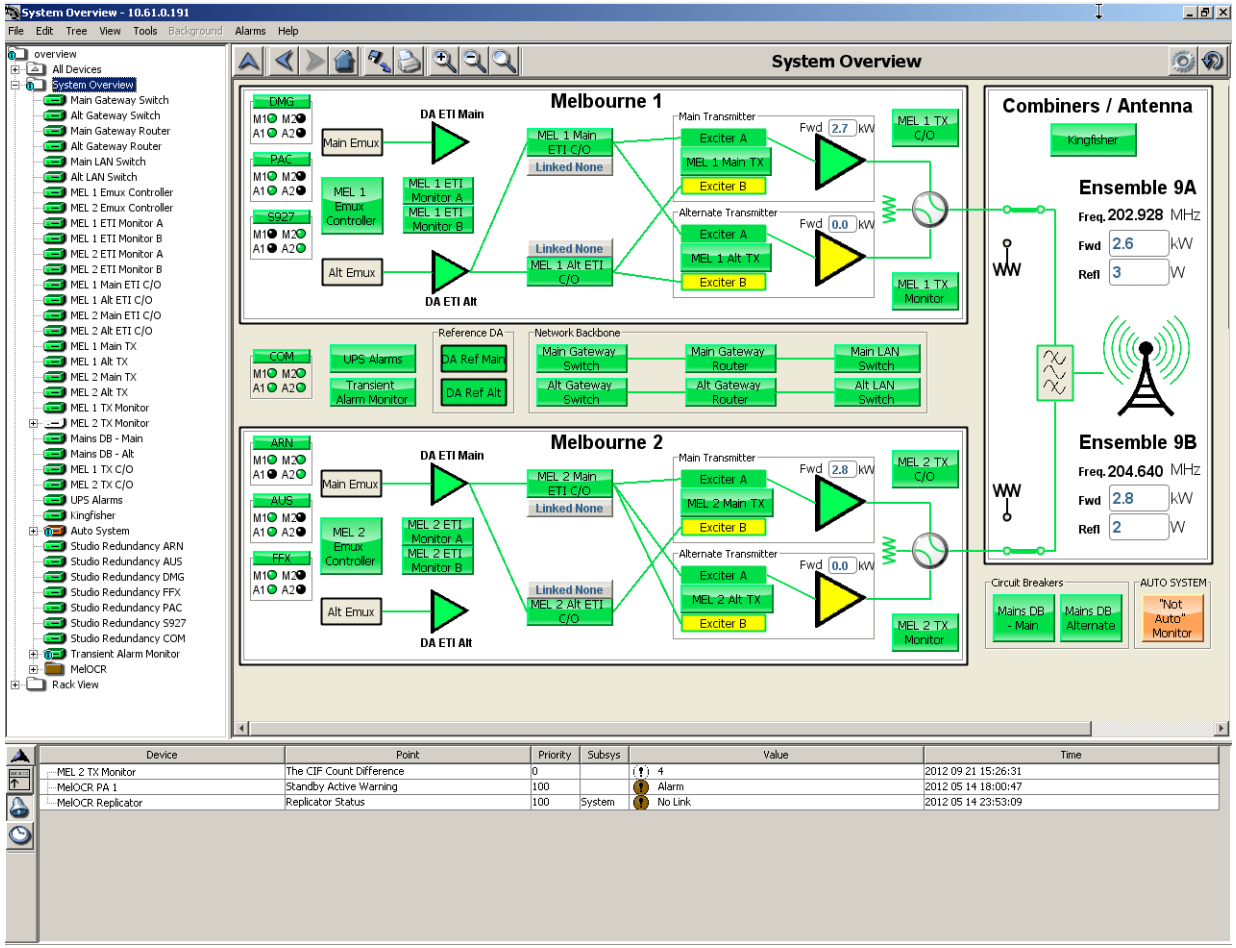
Network Options

Network Management System

Network Management is essential for rapid fault detection and correction

Virtually all equipment now has SNMP fault reporting

Remote access via web interface allows best grade of service



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Network Options

Examples of DAB+ multiplexer and transmitter equipment

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The Future

The Future – Hybrid Radio

Hybrid Radio combines digital radio broadcast to deliver audio and common PAD to many AND the internet to provide individual actions and services

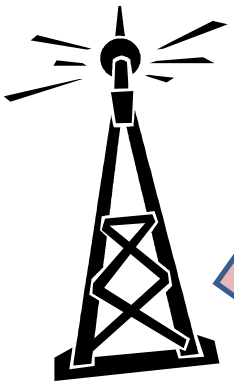
DL+ and CAT-SLS are examples of Hybrid Radio

Providing More Information to listeners on demand

Tagging and reminders for later content use

The standards are being written now!

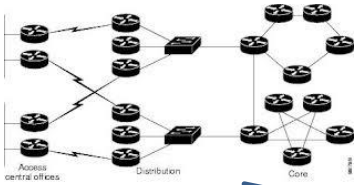
What is Hybrid Radio



Transmission Information from Broadcaster

Broadcaster

Telco network



Free to Air DAB+
broadcast with PAD

Broadcaster
interaction

WiFi
connection

Bluetooth connection
for browser actions

Hybrid Radio
Touchscreen for
basic actions

3rd Party services

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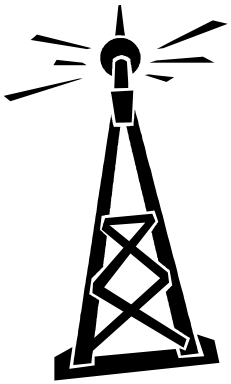
Home Operation

What is Hybrid Radio



Transmission Information from Broadcaster

Broadcaster

Mobile network

Broadcaster interaction

Mobile internet

Free to Air DAB+ broadcast with PAD

DAB+ capable mobile phone can use full range of hybrid functions

3rd party services

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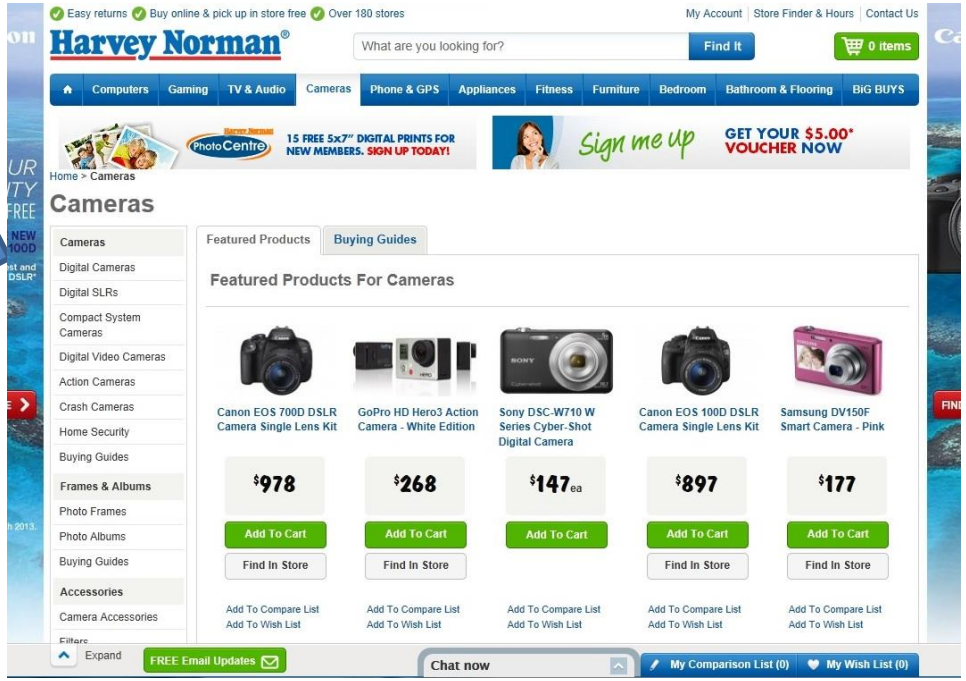
Mobile Operation

More Information: Use Case Example 1 – connection to an advertiser

Screen tap



Accessing a website from a URL delivered associated with a product / service being advertised

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Hybrid Radio Use Cases

More Information: Use Case Example 2 – Artist Information

Screen tap

Listeners can access more information about the current artist, tour dates, biographical info, purchase

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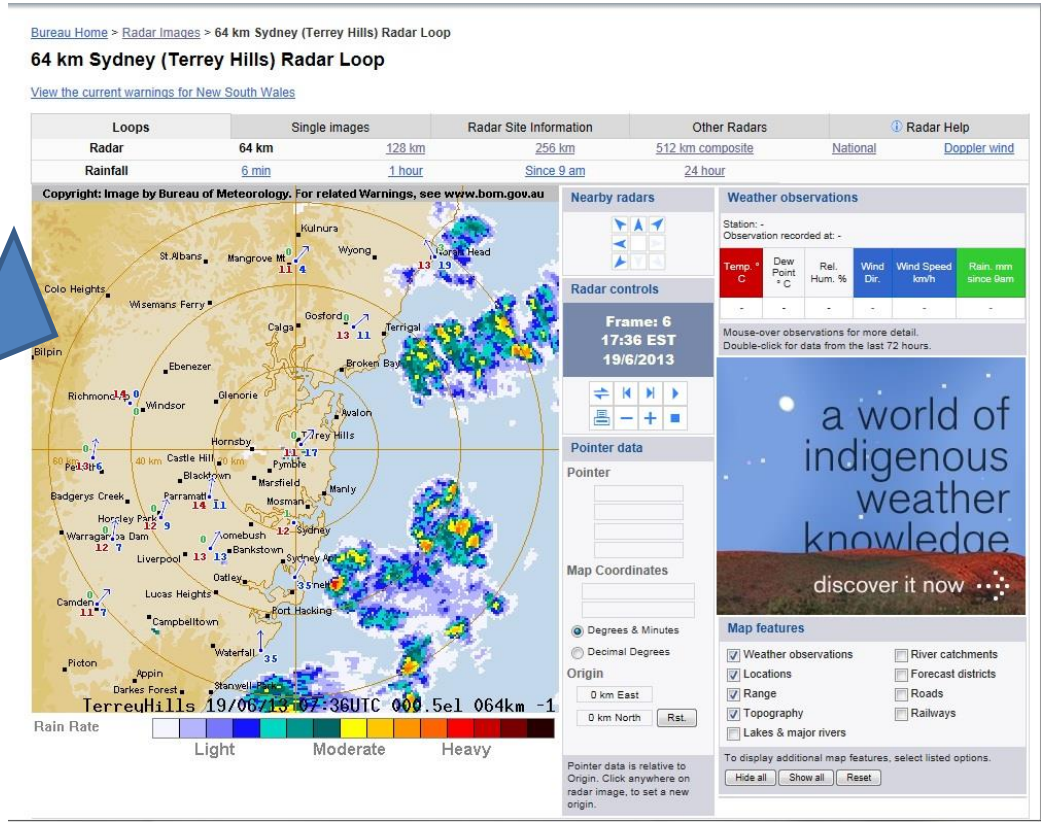
More Information: Use Case Example 3 – Public Information

Button press



Accessing a website from a URL delivered associated with the information provided

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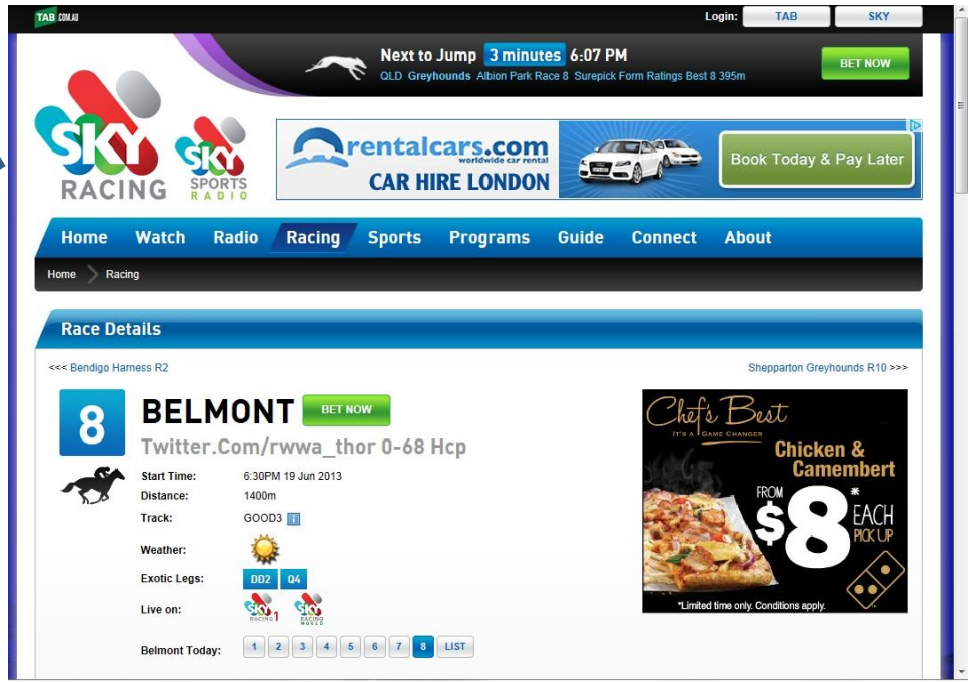
Hybrid Radio Use Cases

More Information: Use Case Example 4 – Sports Results

Screen tap



Drives listeners to use additional broadcaster facilities, value add advertising and cross promotion

What sport is on tonight, current and previous results, betting

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Summary – Top Tips

1. DAB+ is the best Digital Radio delivery system available
2. Proven technology
3. Cost effective infrastructure
4. Deployed worldwide and expanding rapidly
5. Very flexible operation for broadcasters
6. Huge range of receiver products
7. Great features including scrolling text, images, EPG and data services
8. Many new developments including Interactivity

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