Technical business case for DAB+

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Technical business case

1. Radio distribution costs

2. Use of 5G technologies

Radio distribution costs

- There are several technologies available for the delivery of radio program content
- There have been several studies on the cost efficiency of broadcast vs other technologies to provide content the listeners
- Most of these focus on the ‘technical’ cost of operating distribution systems BUT we must also remember that it is the duty of broadcasters to provide content / coverage to all listeners in the prescribed coverage area.
  - This is particularly the case for Public Service Broadcasters who have a duty of care to provide service to the most compromised listeners whether that is through location or cost issues

Radio distribution costs

Gates Air analysis

- The results from the 2019 presentation at the ASBU / ABU / AIBD / WorldDAB workshop in KL
  - Based on requirements to cover an area with a radius of 25* km with an antenna system with the same tower aperture Gates-Air study

	Transmitter	**FM**	**DAB+**
	Number of transmitters	18	1
,000 USD	**CAPEX**: Cost of transmitters	900	80
,000 USD **PA**	**OPEX**		
	Power	328	6.57
	Cooling	92	3.33
,000 USD **PA**	**Total OPEX**	**420**	**~10**

- These costs exclude floor space, antenna space and maintenance all of which are more expensive for 18 transmissions rather than 1

Source: Gates-Air 2019

* originally 50 km but the author believes this is over estimated

Radio distribution costs

Update to DAB v FM

- Coverage analysis shows that the ERP for the same coverage is approximately the same
- FM antenna system is assumed to be ½ gain of DAB due to having twice the wavelength
- Coverage at 1.5m: DAB at 50 dBuV/m (vehicle) vs FM at 44 dBuV/m (rural stereo)
  - 10 kW ERP => coverage radius of approx. 30 – 40 km

	Transmitter	**FM**	**DAB+**
	Number of transmitters	18	1
,000 USD	**Tx power (kW)**	2	1
,000 USD **PA**	**OPEX**		
	Power	65.5	2.9
	Cooling	17.2	0.9
,000 USD **PA**	**Total OPEX**	**82.7**	**3.8**

FM costs over 20x DAB!

- These costs exclude floor space, antenna space and maintenance all of which are more expensive for 18 transmissions rather than 1

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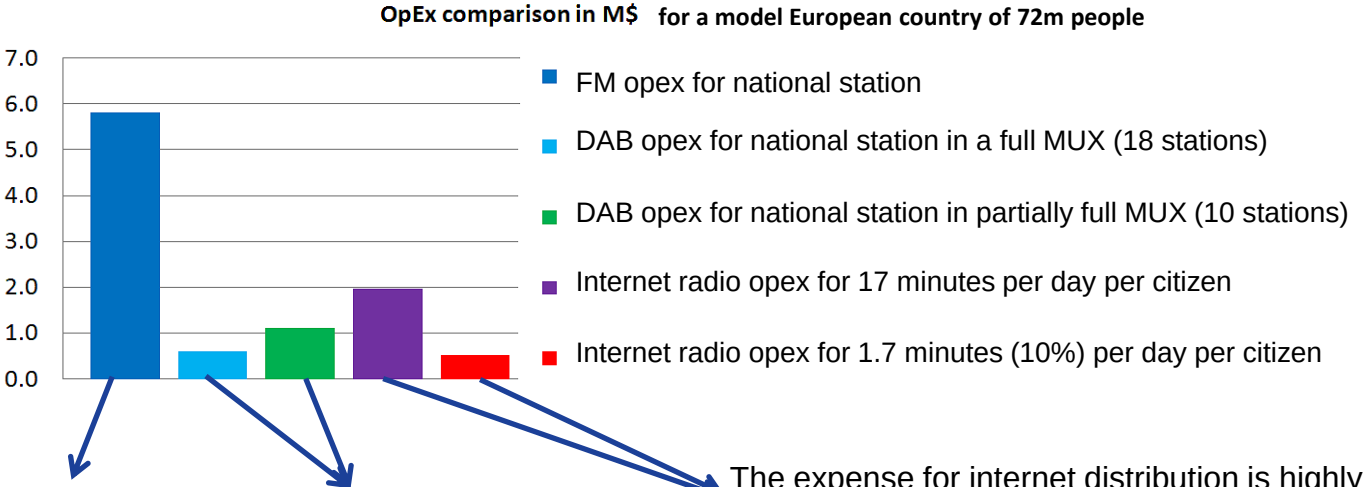
Radio distribution cost analysis

EBU analysis

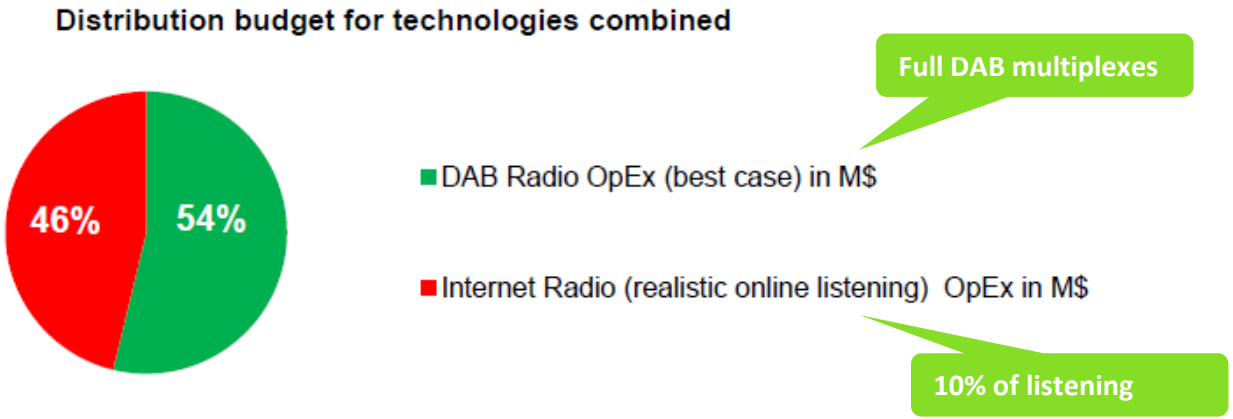
DAB is cheaper to operate than FM or IP



Source: EBU Technical Review, Cost-benefit analysis of FM, DAB+ and broadband for radio broadcasters and listeners, July 2017: https://tech.ebu.ch/publications/tr_2017_radio

DAB+ and IP

Based on the EBU model country of 72m people the analysis shows that 10% of traffic via IP costs similar to 100% traffic by DAB+

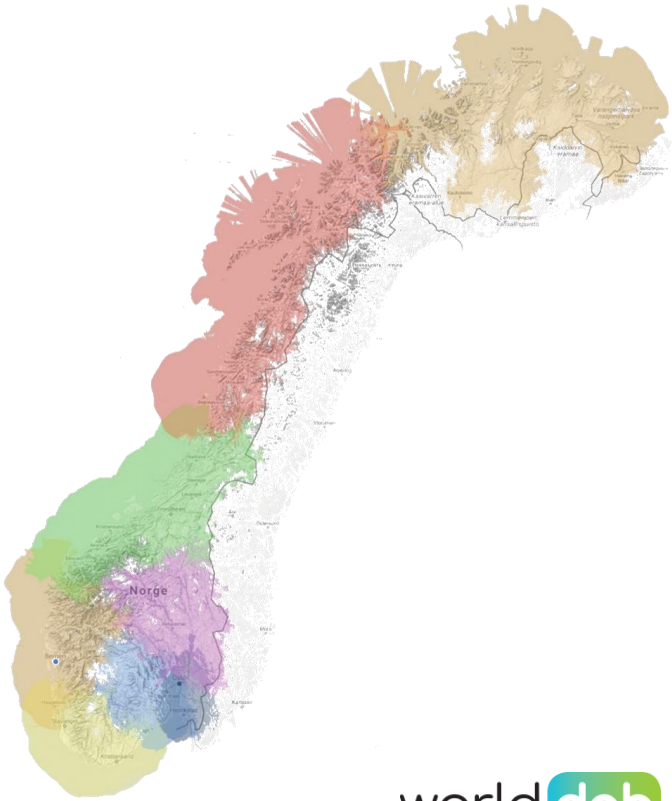


Source: EBU Technical Review, Cost-benefit analysis of FM, DAB+ and broadband for radio broadcasters and listeners, July 2017: https://tech.ebu.ch/publications/tr_2017_radio

Radio distribution in Norway

NRK the national broadcaster in Norway went from 2000 FM transmitters to 1050 DAB transmitters while increasing the number of national stations from 3 to 15+

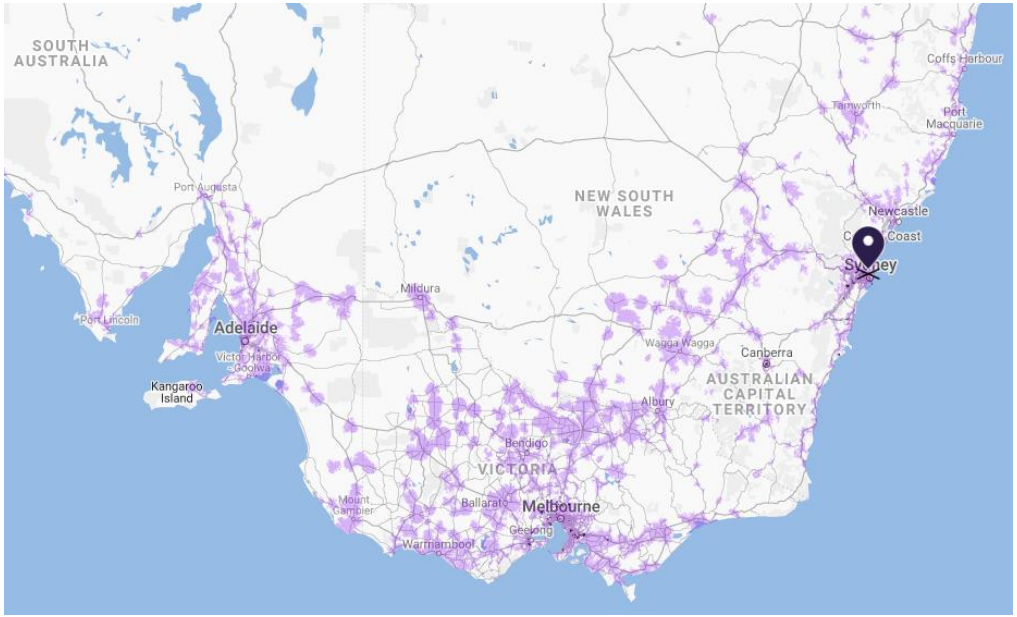
- The operating cost of the DAB+ and old FM system is approximately the same, hence the cost of the DAB+ service is approximately 1/5 of FM
- The cost of establishing the DAB+ system including DAB+ transmitters, new VHF Band III antenna systems and support equipment is amortised into the DAB+ Opex cost further showing a significant cost reduction



Source: NRK 2020

Radio distribution via IP

- NBN rollout in SE Australia is limited to cities and towns
- Using wired IP is not currently feasible to deliver IP streaming to homes outside towns

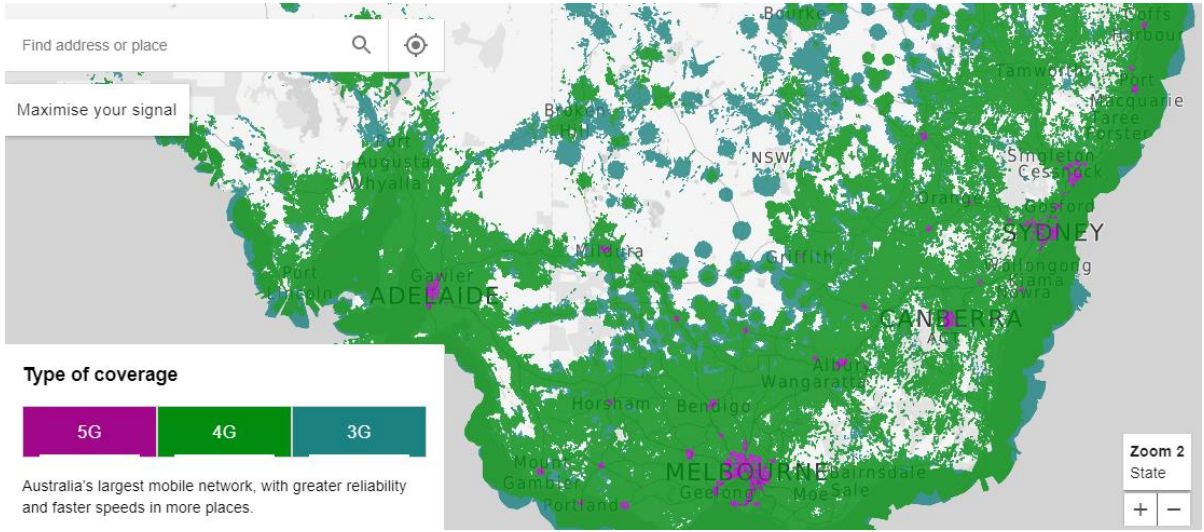


Source: NBN - https://www.nbnco.com.au/learn/rollout-map

Radio distribution via mobile

Telstra mobile coverage

- Good city and town coverage but still lack of coverage in many regional areas
- Broadcasting is required to provide services to regional and remote listeners



Source: https://www.telstra.com.au/coverage-networks/our-coverage

5G – where does radio fit?

5G applications

“5G” is an evolution from 4G

New technologies are gradually being rolled into the existing LTE/4G mobile ecosystem to provide improvements in:

- Increased speed
- Improved reliability and QoS
- Lower latency

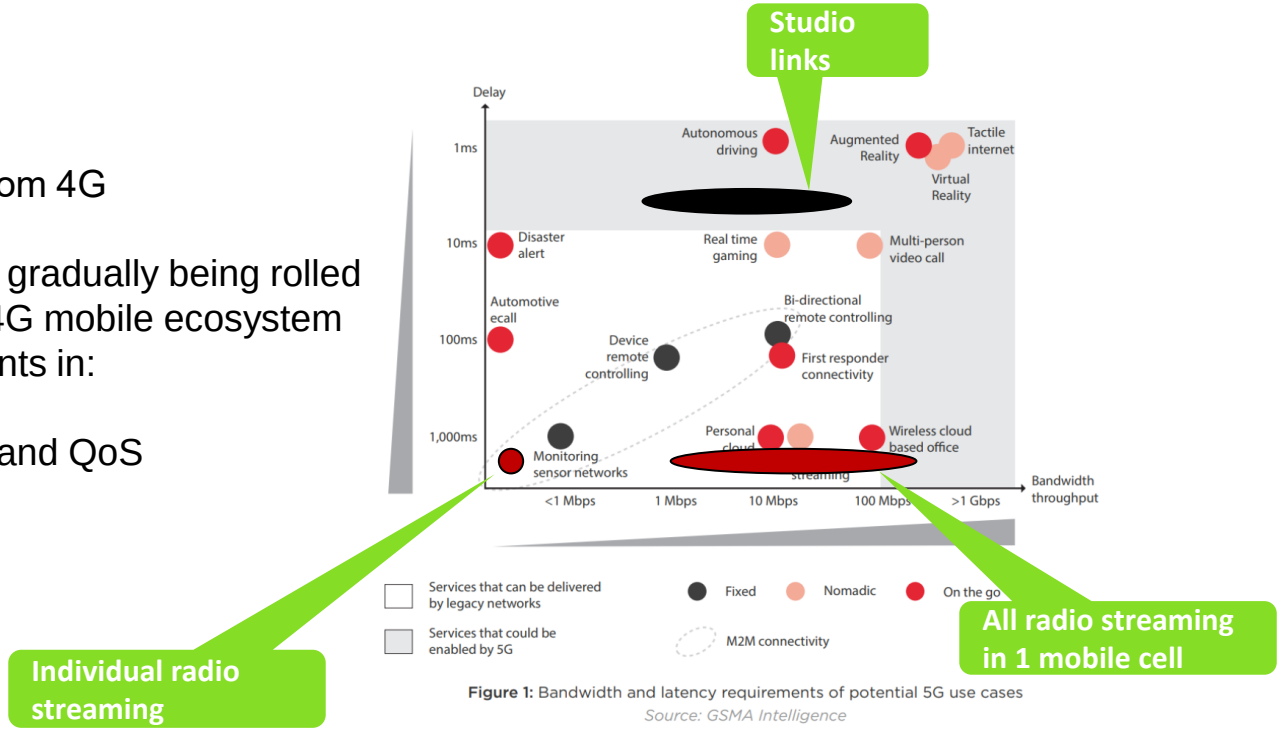
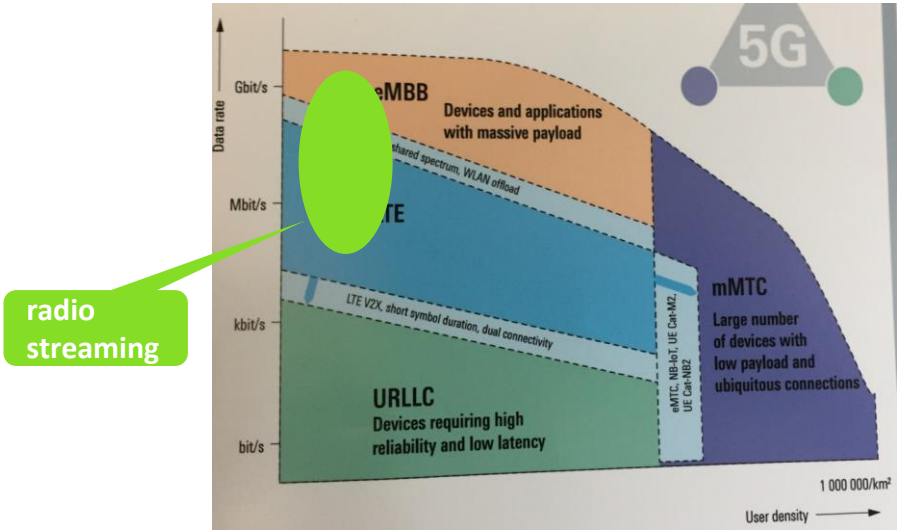


Figure 1: Bandwidth and latency requirements of potential 5G use cases

Source: GSMA Intelligence

5G Application space - radio

5G provides improved solutions for
- Massive machine comms for IoT - mMTC
- Ultra reliable and low latency for IoT - URLLC
- Ultra high bit rate mobile broadband - eMBB



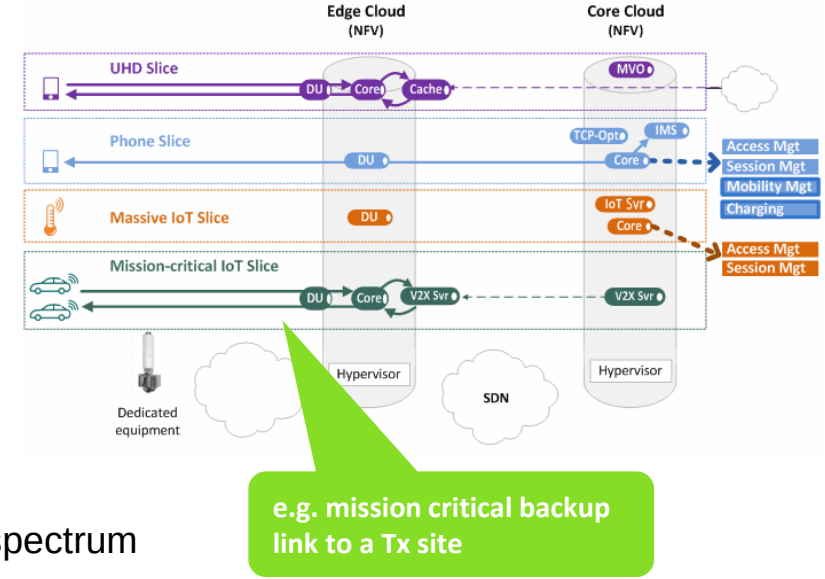
All extensions and capabilities are NOT available at the same time

Source: Rhode & Schwarz

5G for contribution

Contribution

- 5G capacity increases and network slicing technologies will provide new opportunities for broadcaster contribution networks
- More capacity in cities and towns
- Controlled QoS for mission critical links, e.g. Outside Broadcast links or Studio to Transmitter links



BUT

- Very high capacity links will rely on 3.6 or 26 GHz spectrum which have shorter range than 900 MHz band
- Still waiting for the Network Slicing / QoS functionality to be standardised for the Physical Layer (i.e. the Radio link)
- Still waiting for the business model to be defined

5G for distribution

Distribution

- eMBB in cities and towns will reduce the overall % load for streaming
- 5G capacity increases are primarily due to the use of very high frequencies:
  - High bandwidth channels such as 50/100 MHz are only available in the 3.6GHz and 26/39 GHz bands
  - High frequencies have much greater path loss and hence much smaller coverage areas
  - Capacity increases rely on the use of High Order modulation such as 256 QAM which is not robust for mobile reception
- To deliver radio in wide coverage areas low frequencies (700 - 900 MHz band) will be required
  - This band will already be stretched to deliver eMBB services over wide areas
  - To achieve similar coverage and robustness to DAB+ similar MCS will required
    - NB-IoT has a range of approx. 10 km
    - Most receivers will not have Line of Site to the transmitter
  - The use of current individual links will consume significant capacity
  - The use of multicast and broadcast is still being defined by 3GPP / 5GPP / 5G-Xcast
  - Few receivers
  - No cost models available (yet)

Spectrum implications

26/39 GHz is limited to micro / pico cells with max range of approx. 0.5 km

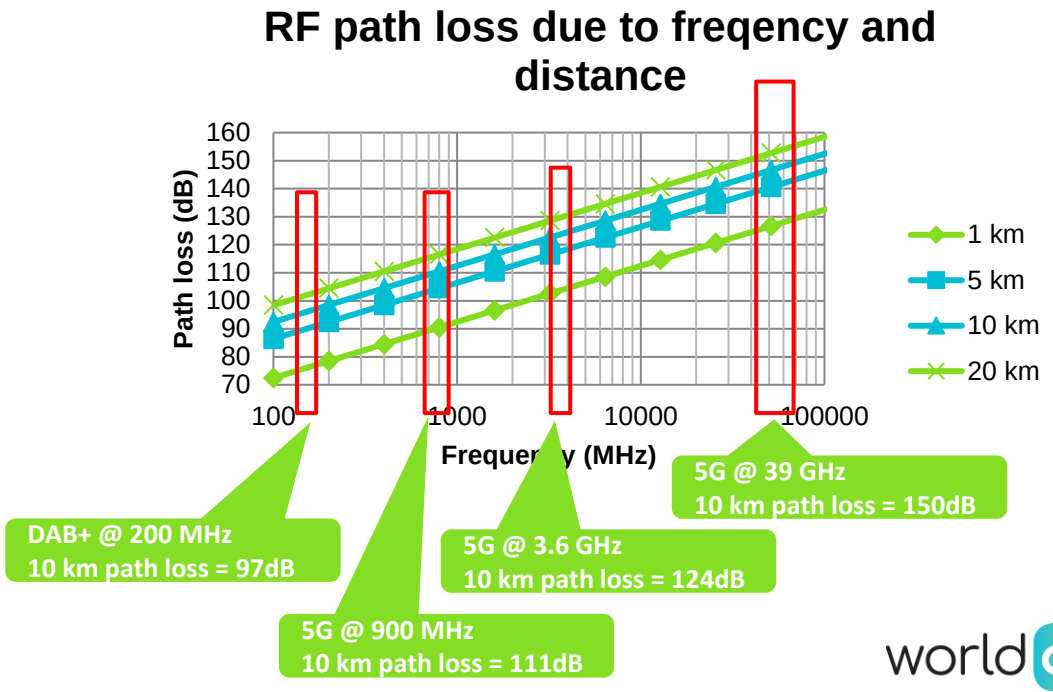
3.6 GHz micro cells with range up to a few km max

Significant distance loss impact at high frequencies and long distances

Sub 1 GHz band still needed for macro cells and wide area coverage

Increased demand due to push for higher bit rates

$$P_R = \frac{P_T G_T G_R \lambda^2}{(4\pi d)^2} \qquad FSPL = \left(\frac{4\pi d f}{c}\right)^2$$



Spectrum implications

- The acquisition of sub-700 MHz spectrum was not discussed in the World Radio Conference 2019 – WRC19
  - Current mobile frequency bands of operation are listed from 450 MHz and higher
  - The implication is further compression of terrestrial DTV in UHF
    - Spectrum sharing
    - Pushing DTV into VHF bands

- VHF Band III spectrum is very valuable.

- Compression in UHF bands threatens the ability of DTV to both increase content offerings and video resolution – strong competition from UHD IP services.

- The loss of spectrum for terrestrial DTV has potential to threaten the capacity available for DAB+ in VHF Band III

Conclusions

DAB is the most cost effective transmission system for radio with significant cost savings over FM

5G will provide new **contribution** capabilities for broadcasters enabling feature rich multimedia radio services

5G will not provide a cost effective **distribution** mechanism for critical audio delivery, especially in wide area and rural situations

5G / 4G / IP will provide effective mechanisms for non-critical hybrid radio multimedia content

Broadcasters need to protect VHF Band III for DAB+ radio

Hybrid DAB+ with 5G : the most cost effective delivery of multimedia radio offers exciting new functionality and interactivity for listeners and advertisers

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Thank You

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