# Coverage Enhancement for PMR/LMR Networks

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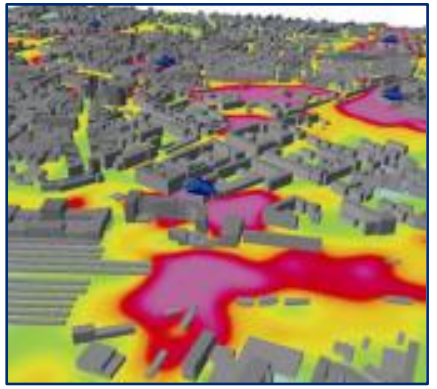
# Agenda

- PMR/LMR Coverage Challenges
- What is Radio Rebroadcast?
- PMR/LMR Radio Rebroadcast Solutions
- Design Considerations

# Radio Coverage Challenges

- PMR/LMR plays a vital role in maintaining and improving the personnel safety and operational efficiency in public safety, transport, resources and utilities sectors
- Large scale public safety and enterprise networks have often outstanding outdoor coverage which continues to expand
- Indoor Coverage has been limited to date
- Primary investments have been in outdoor coverage
- Strained Capex budgets have been able to serve only absolute priority sites
- New radio site deployments can be very expensive  and complex



# What is Radio Rebroadcast?

- Radio Rebroadcast (RRB) is the generic term for coverage enhancement solutions that boost and extend the existing radio coverage (from a donor ) into a desired area where the coverage is poor or non-existent

- Cost effective and easy to deploy where coverage is needed with no extra capacity

- Advantages over a new radio site deployment
  - Lower equipment cost
  - No need for expensive multicoupling and backhaul
  - No additional core or spectrum licenses
  - Easier maintenance and lower operational costs

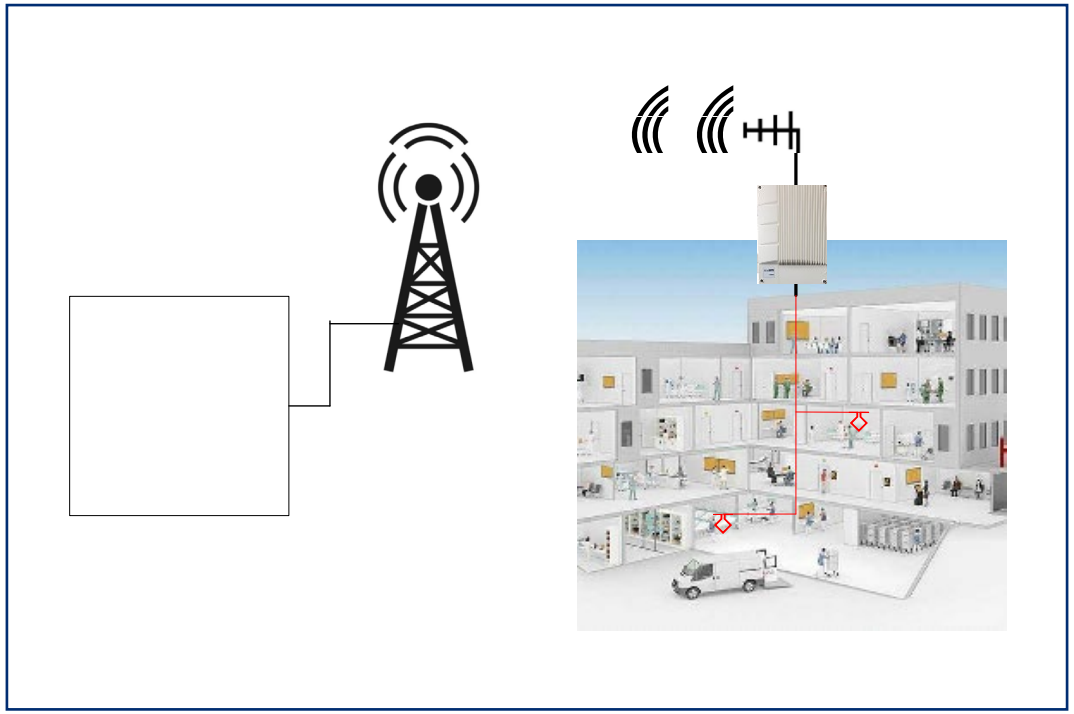
# RRB Applications

- Underground tunnels
- In-building coverage
  - Hospitals
  - Shopping Centers
  - Police and Fire Stations
  - Public Performance Venues
- Outdoor blackspots
- Remote locations and sites
- Rapid coverage deployment

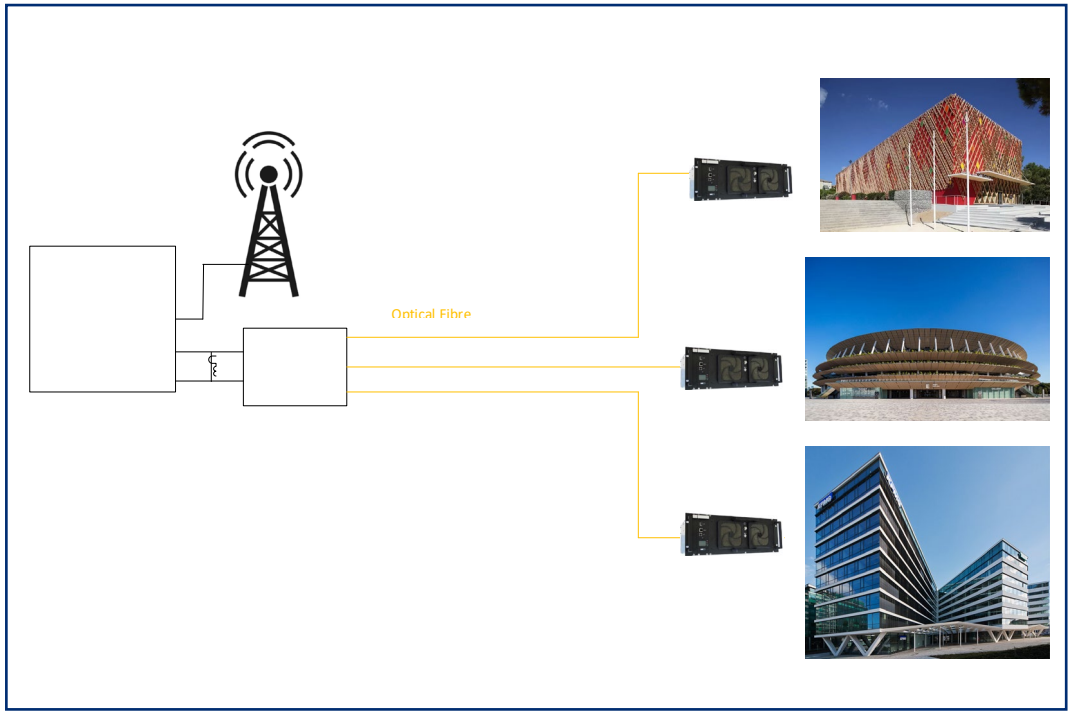
# What Radio Signals Can Be Rebroadcast?

- PMR / LMR Radio Coverage (2Way Radio)
- AM/FM/DAB/DAB+ radio signals
- Paging System
- GPS
- Cellular
- WiFi

# How Does a PMR/LMR RRB System Work?

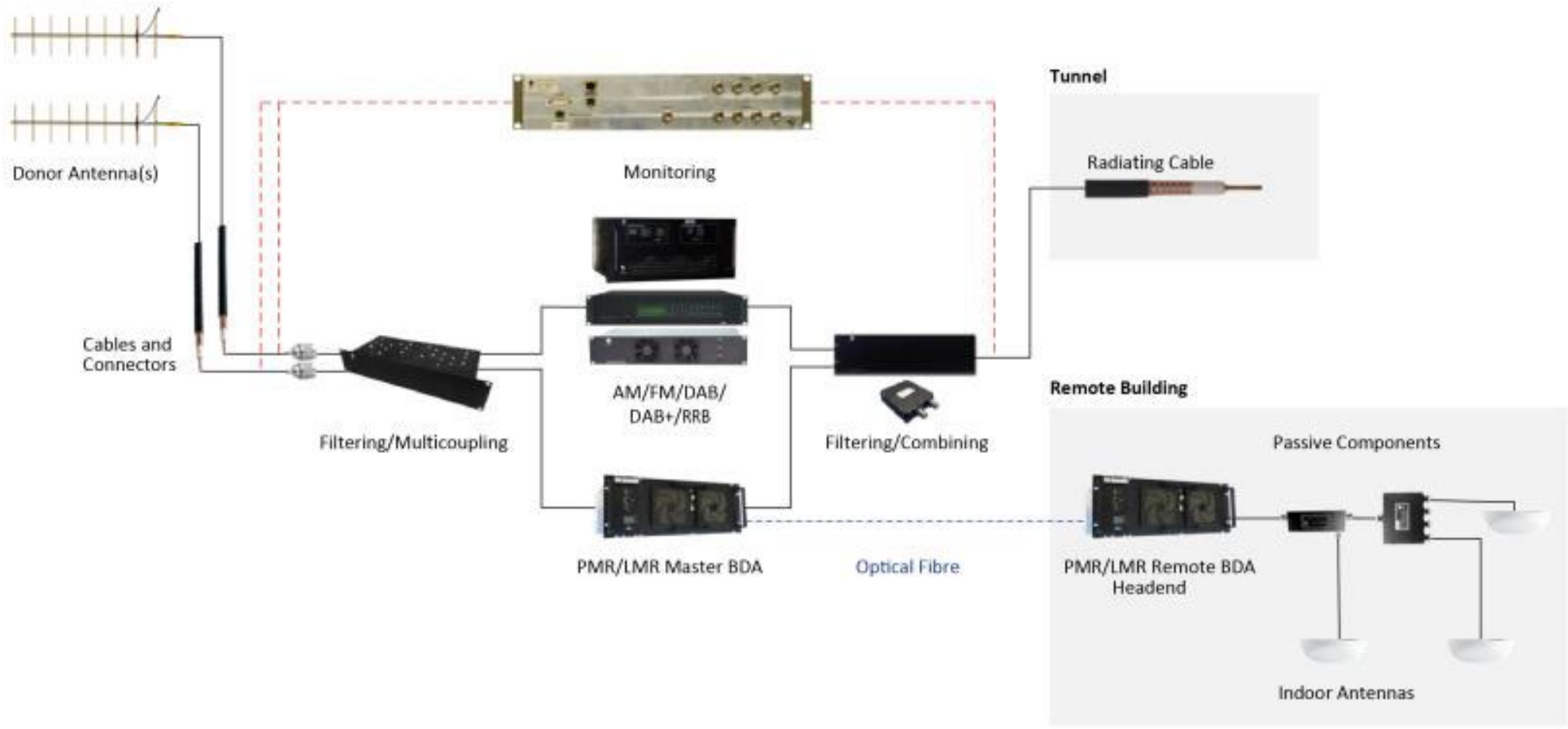


**Off-Air RRB System**




**Fibre -Fed RRB System**

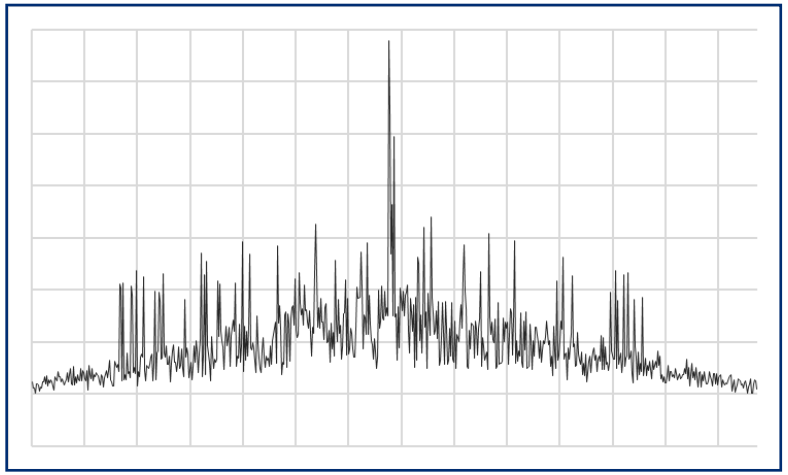
# RRB System Components



# Channel Selective VS Band Selective BDAs

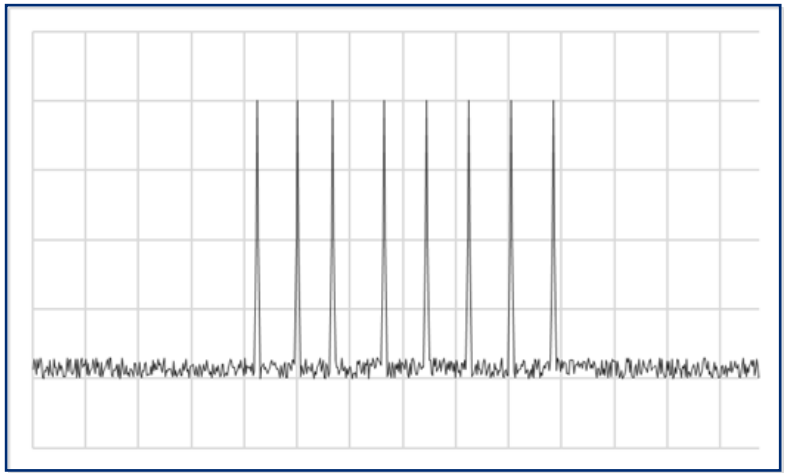
**Band Selective BDA:**

- Broad frequency passband
- Potential spectrum pollution
- Part of the available power is wasted on unwanted signals and noise
- Suitable for underground and remote applications or where the spectrum regulatory requirements are note very strict



**Channel Selective BDA:**

- Passes and boosts only the desired frequencies
- No spectrum pollution
- Power budget is spent only on desired signals
- Usually more expensive than band selective BDAs
- Introduces group delay due to the narrow filter width
- Additional features such as gating and equalization



# BDA Selection Criteria

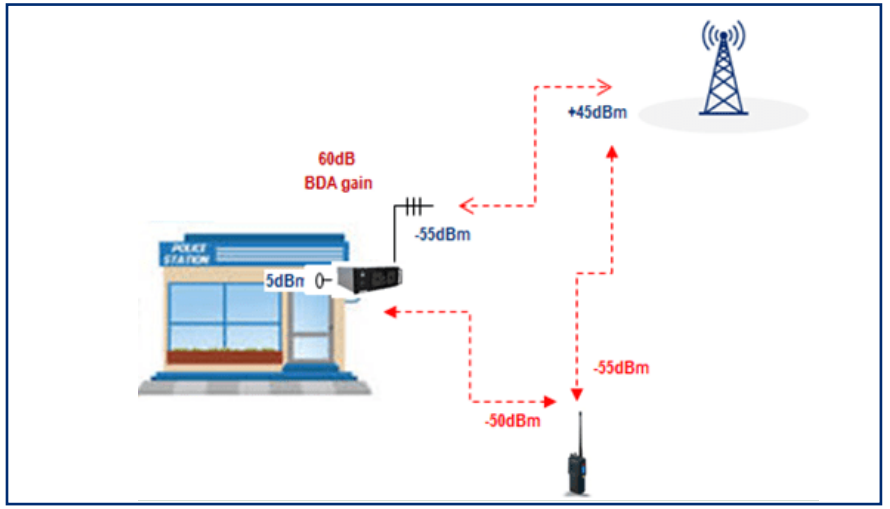
- Band Selective vs. Channel Selective BDA
  - Spectrum regulatory requirements
    - Regulatory requirements are different in every country
  - BDA and desired coverage area location
    - Spectrum pollution is a less serious issue if the desired coverage area is underground or in a remote location
    - Uplink spectrum pollution: Less serious issue if the BDA is coupled with the donor site directly
  - Cost
    - Channel Selective BDAs are generally more expensive
  - Radio Technology and Group Delay
    - With channel selective BDAs, each radio technology requires a specific filter with a specific group delay
    - Some technologies are more sensitive to time delays
    - With channel selective BDAs, signal dominance should be carefully considered in the design. Frequency translation simplifies the design.

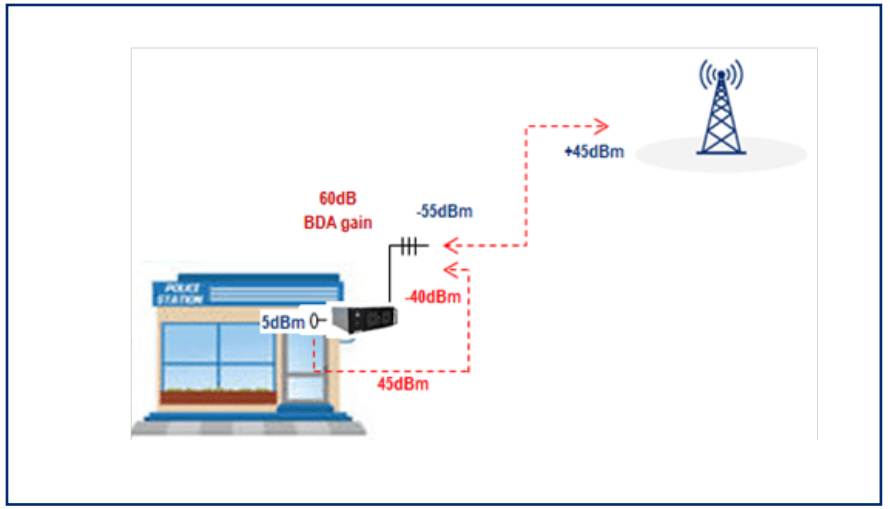
**Band Selective BDAs**

**Channel Selective BDAs (DSPbR)**

# Design Considerations

- Signal dominance in non-translating systems
  - UL signal dominance
  - DL signal dominance
- Isolation between donor and service antennas
  - 10dB higher than the gain in Non-translating BDAs
- Frequency translation relaxes isolation requirements and rectifies the signal dominance issues
  - TRex for P25 Trunking Networks
- Uplink signal levels in DAS
  - RSSI should be <-30dBm



# Deployments

- Scalable Solutions from small buildings to large and complex tunnel networks
  - From single BDA and single antenna to multiple nodes and full DAS systems for complex buildings and tunnels
- Simple deployment for small to medium installations
  - Desktop Design
  - Site Survey
  - Installation
  - Test and Commissioning

**Sydney NorthConnex**

**Waterview Tunnel**

**Maitland Hospital**

**Sydney Harbour Tunnel**

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