

*Broadband Wireless Access*

# **Band Plan and Spectrum Etiquette**

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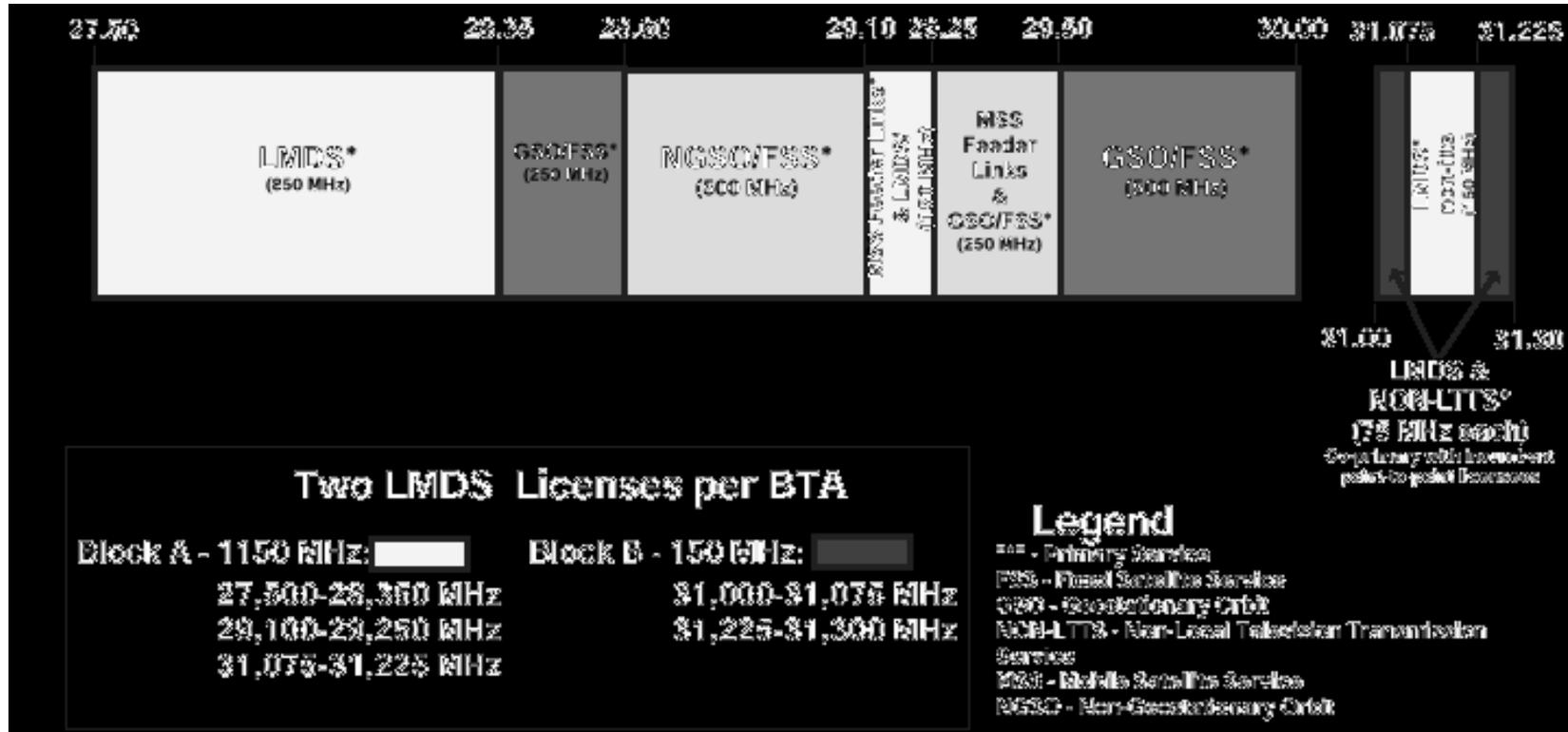


# Objectives

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- ◆ **Maximize utility of A and B-Block spectrum**
- ◆ **Enable co-existence of different vendor's solutions**
  - ⌈ Point-to-point, Point-to-multipoint
  - ⌈ High capacity, Low capacity
- ◆ **Lower equipment costs via common functionality**
  - ⌈ Leverage component and sub system volumes
- ◆ **Avoid limiting innovation by over-standardizing**
  - ⌈ Protect vendor's ability to differentiate their solutions
  - ⌈ Equipment must be profitable during early deployment

# 28 & 31 GHz Band Plans



# Band Plan Issues

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## ◆ Channel widths

### { Example:

- 8 50 MHz basic channels
- 8 2.5, 5, 10, 12.5, 25 MHz sub-channels

### { Issues:

- 8 Accomodate different levels of modulation and payload
- 8 Facilitate intra and inter-BTA frequency coordination

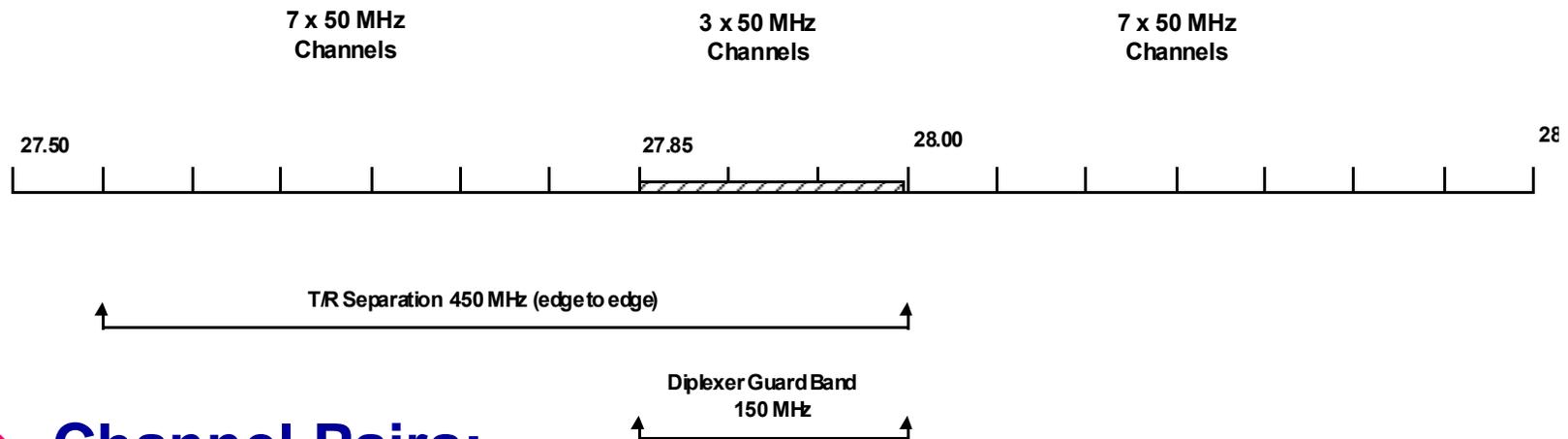
## ◆ Transmit/Receive spacing for FDD systems

### { Guard bands for FDD systems

### { Related to system costs and performance



# A-Block: 850 MHz Segment



## ◆ Channel Pairs:

- { 7 x 50 MHz
- { 14 x 25 MHz
- { 28 x 12.5 MHz
- { 35 x 10 MHz
- { 70 x 5 MHz
- { 140 x 2.5 MHz

## ◆ Good for FDD systems: PP, PMP

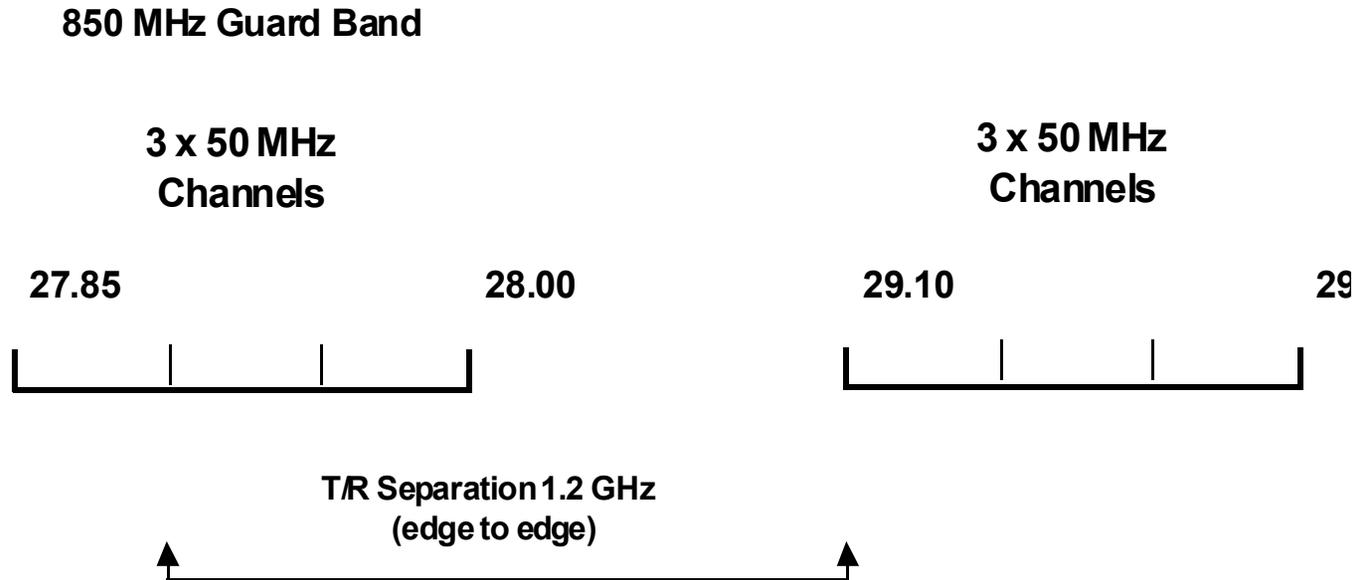
- { High-capacity PP access links and backhaul
- { PMP: 50 MHz downstream, 10 x 5 MHz upstream



## Broadband Wireless Access

# A-Block: Guard Band & Lower 150 MHz

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## ◆ Excellent for PMP systems

- ⌈ Low duplexer cost due to 1.1 GHz guard band
- ⌈ CPE always in one sub-band keeps RF cost lower (narrower occupied BW = lower cost for Tx and Rx)
- ⌈ Narrow tuning range (150 MHz) = lower cost frequency agility

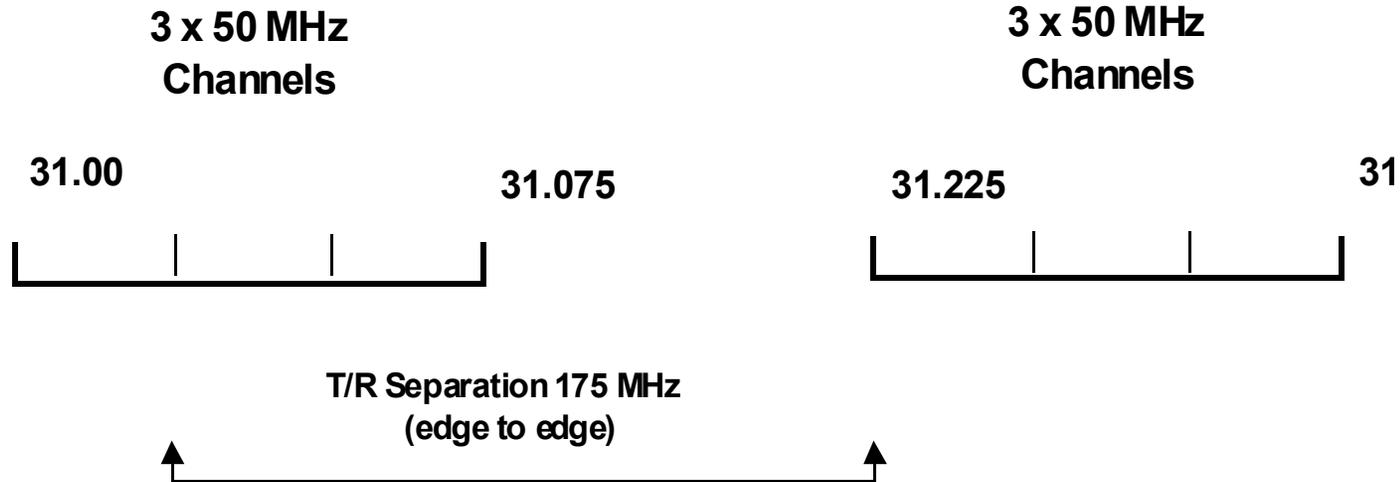
# A-Block: Upper 150 MHz

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- ◆ **31.075 - 31.225 GHz (centered between B-Blocks)**
- ◆ **Could pair with other A-Block 150 MHz segments**
  - { 2 GHz separation from other A-Block sub-bands
    - 8 Antenna bandwidth is an issue: might need separate Tx/Rx ants.
    - 8 Diplexers would be low cost
- ◆ **Excellent for TDD systems**
  - { Occupy same channel for downstream and upstream
  - { PP and PMP

# B-Block: 75 MHz Segments

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- ◆ **FDD is feasible:**
  - ( 150 MHz guard band = costly diplexer, or multiple versions (high spares costs)
- ◆ **TDD is an excellent fit in this sub-band**
  - ( Lower capacity service

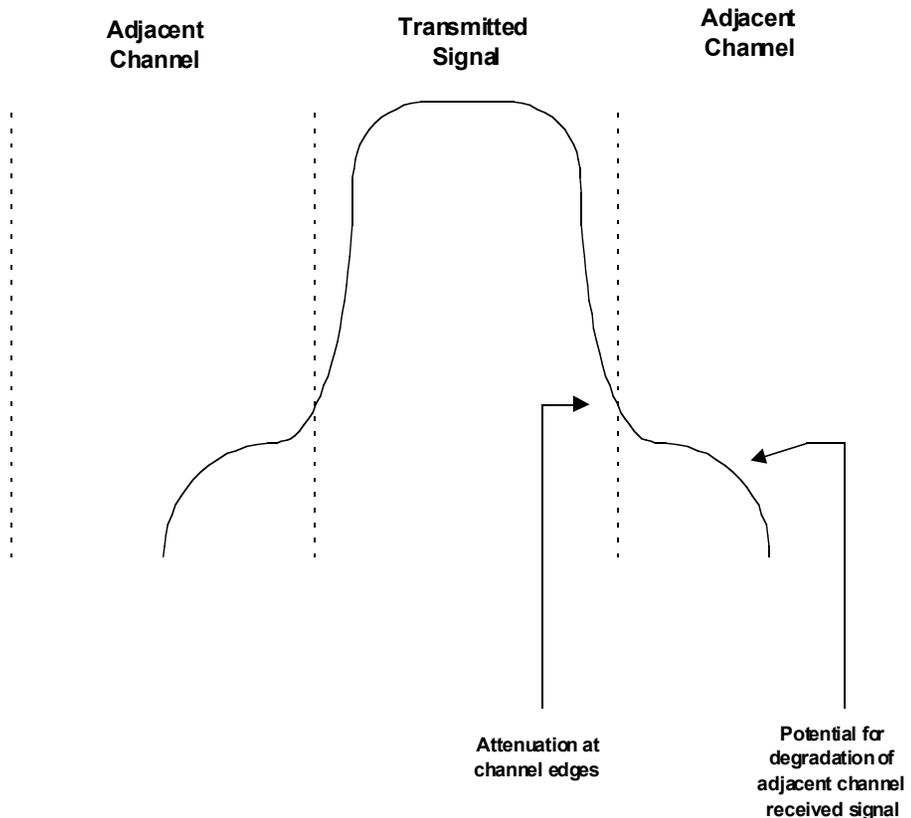
# Spectrum Etiquette Issues

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- ◆ **Emission mask: adjacent channel interference**
- ◆ **Antenna polarization**
- ◆ **Antenna patterns**
- ◆ **Automatic transmit power control**
- ◆ **Coordination at BTA or license area boundaries**
- ◆

# Emissions Mask

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## ◆ Issues:

- { Higher level modulation requires greater protection from adjacent channel interference.
- { Overlapping antenna patterns: coverage areas, sectors, overlays
- { Near/Far problem
- { -50 dB at channel edges is minimal for frequency re-use

# Antenna Polarization

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- ◆ **Proposal**: limit to linear, horizontal and vertical only; specify a minimum cross-pol. isolation
- ◆ **Provides cross polarization as interference immunity**
  - ⌈ Implies polarization-agile ODU mounting for PP and PMP CPE
  - ⌈ Facilitates overlay PMP or PP at co-locations (hub sites)
  - ⌈ Another coordination tool at BTA boundaries



# Antenna Patterns

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- ◆ **Issue:** specify minimum sidelobe and backlobe suppression above some minimum gain
- ◆ Provides assurance that radiated power is directed toward the intended receiver from CPE and PP links
- ◆ If sidelobe requirements are somewhat less stringent than current FCC requirements (for licensed bands), low cost flat antennas are feasible
- ◆

# Automatic Transmitter Power Control

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- ◆ **Maximize frequency re-use and minimize mutual interference**
- ◆ **Proposal**: limit Tx power output to that needed for desired BER in the absence of fades or rain attenuation, boost during fades/attenuation to ensure desired availability (99.99% or 99.999%)
  - ⌈ Implies closed loop for detection and auto power adjustment
- ◆ **Issues**:
  - ⌈ Response time (up/dn), over-compensation
  - ⌈ How to control for PMP with range of distances to CPE

# Inter-BTA Frequency Coordination

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- ◆ **Proposal:** define a process for coordination between licensees whose geographic regions are adjacent
- ◆ **Issues:**
  - { Sharing spectrum equitably near boundary regions
  - { Avoiding interference and service degradation
  - { Arbitration mechanism