Upstream resource block structure

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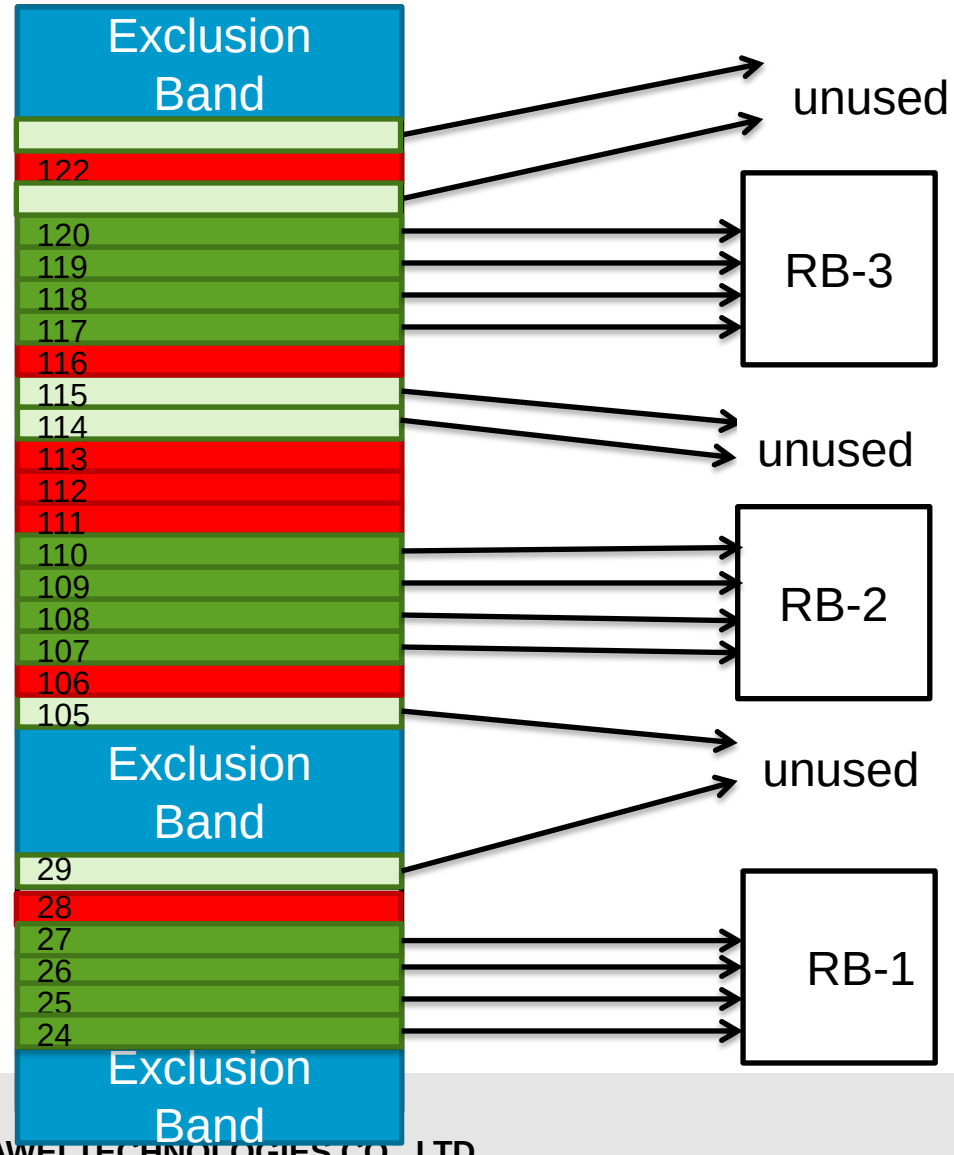
Definitions of terms used in this presentation

- “In active” sub-carriers are the null sub-carriers which are common to all profiles.
- All other sub-carriers (with the exception of exclusion zones) are “Active” sub-carriers.

Issues with a resource block of fixed number of sub-carriers.

- A resource block with fixed number of sub-carriers (which include both active and/or inactive sub-carriers), has following issue:
  - The capacity of resource blocks fluctuates between 0% (all in-active sub-carriers) to 100% (all active sub-carriers with highest order modulation).
- A resource block with fixed number of only active contiguous sub-carriers has the following issue:
  - A large number of active sub-carriers will not be part of any resource block, and will be left out, wasting bandwidth (see Figure-1)

Figure:1 Example of fixed contiguous active sub- carriers



- Each RB has N active sub-carriers and no in-active sub-carrier.
- Carriers that do not fit into a RB are unused
- The last RB may have less than N active sub-carriers.
- N=4 in this example.

Active sub-carrier

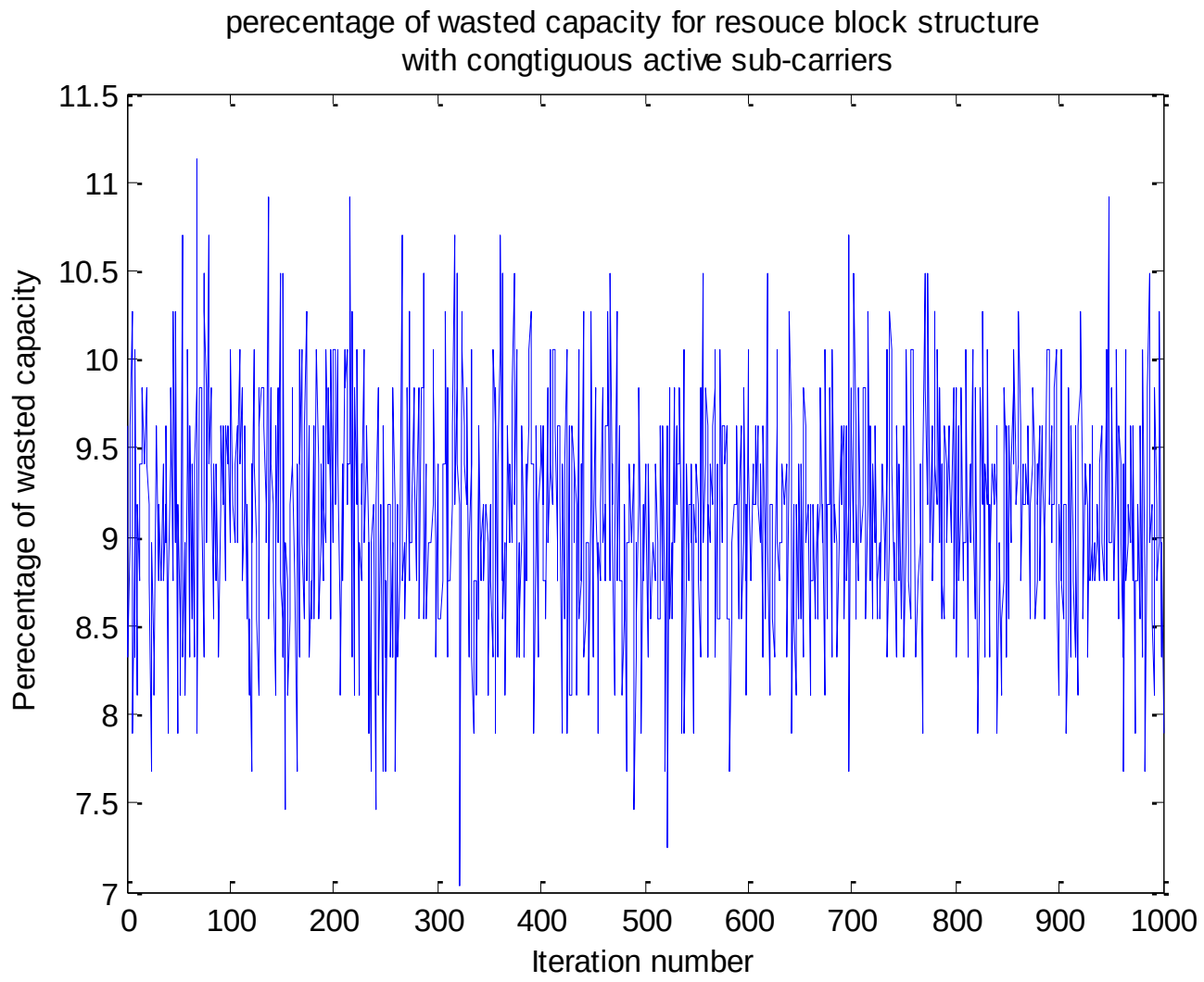
In active sub-carrier

Active but unusable sub-carrier

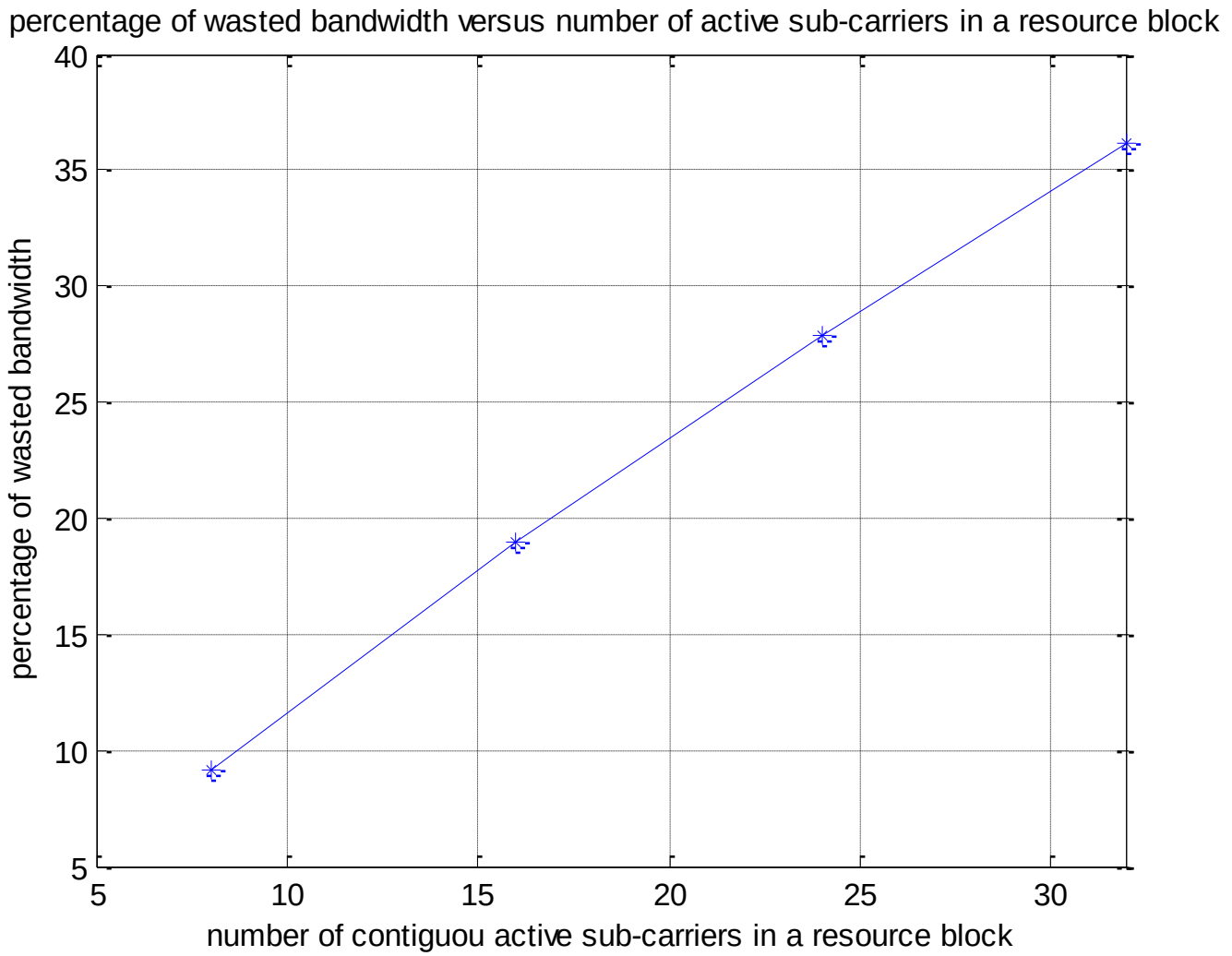
Simulation to show percentage of wasted capacity for the case of a resource block with fixed number of contiguous active sub-carriers

- Example of 4K FFT
- Number of active sub-carriers = 3700
- Number of In active sub-carriers = 100
- Rest of the sub-carriers are inside the exclusion zones.
- Resource blocks are formed using 8 /16/24/32 contiguous active sub-carriers.
- 1000 iterations. For each iteration the locations of the Inactive sub-carriers are chosen randomly.
- Left out active sub-carriers are the active sub-carriers which could not become part of any of the resource blocks.
- Capacity loss % = 100* (Number of left out Active sub-carriers)/(Total number of active sub-carriers).

Resource block length of 8 contiguous active sub-carriers



Wasted bandwidth as a function of RB length.



Proposed Upstream Resource block structure

- Objective: To define resource block structure to:
  - Utilize almost all “active” sub-carriers with minimum loss of bandwidth.
  - Facilitate tone re-ordering in achieving near constant capacity per resource block.

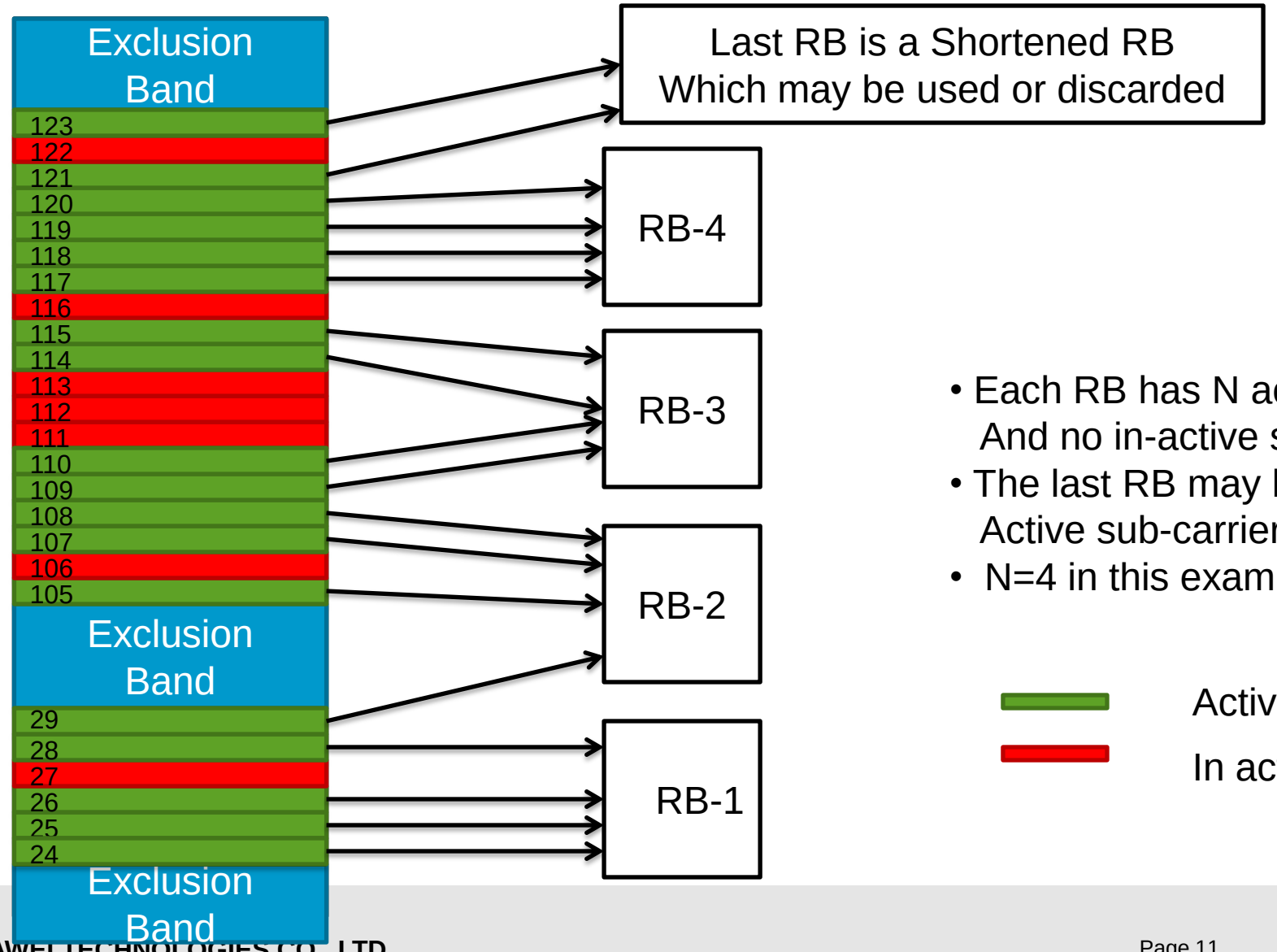
Proposed Resource block structure

- Option-1:
  - A resource block shall consists of ‘N’ number of only “active” sub-carriers.
  - The ‘N’ sub-carriers may be contiguous and or non-contiguous.
  - There are no “in-active” sub-carriers within a resource block.

Proposed Resource block structure

- Option-2:
  - A resource block shall consists of a fixed number (‘N’) of “active” sub-carriers.
  - The “active” sub-carriers need not be contiguous.
  - In addition to the ‘N’ active sub-carriers, a resource block may have one or more “in-active” sub-carriers.
  - The length of the resource block is not fixed and is greater than or equal to N.

Example of option-1

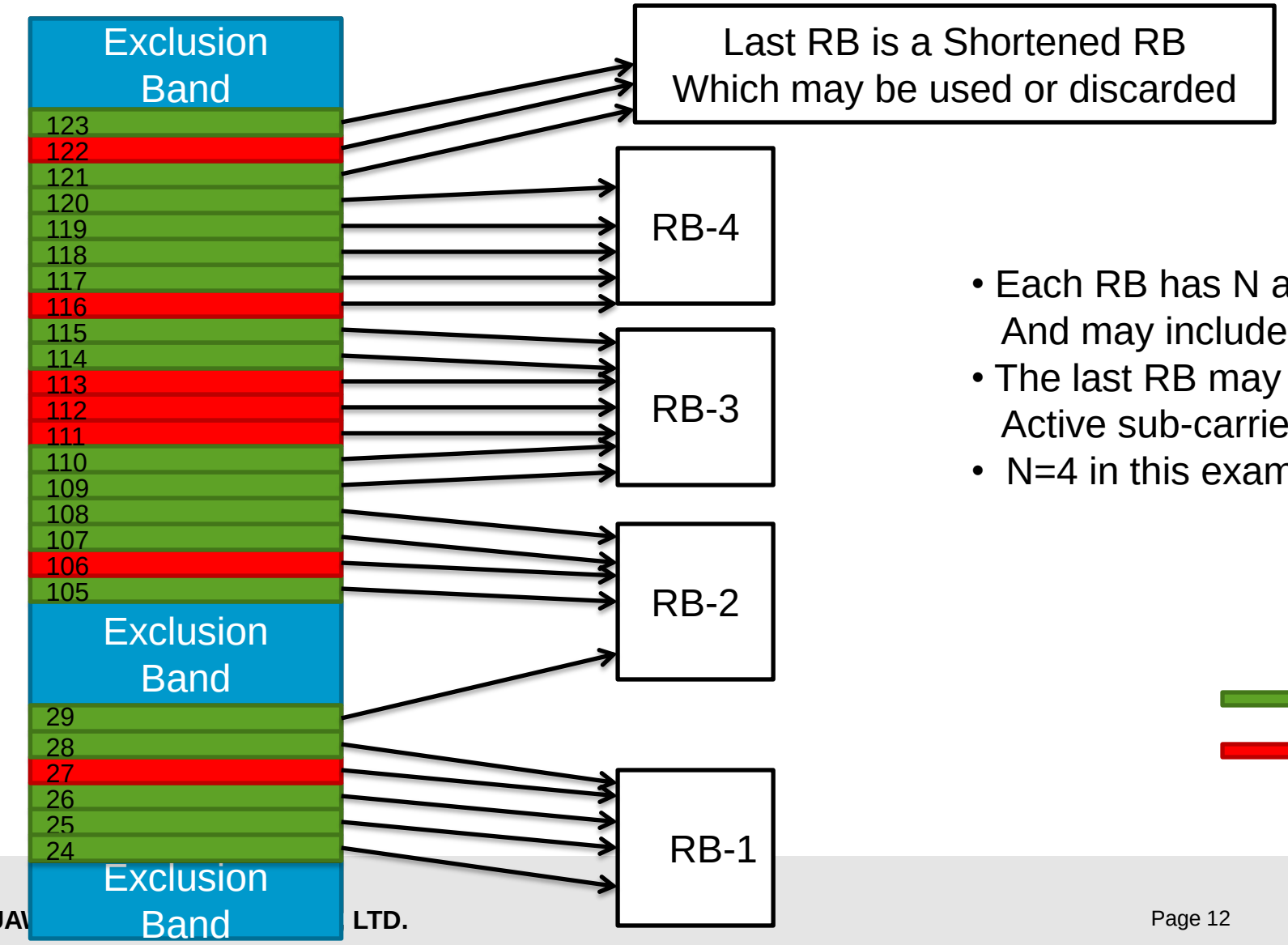


- Each RB has N active sub-carriers And no in-active sub-carrier.
- The last RB may have less than N Active sub-carriers.
- N=4 in this example.

Active sub-carrier

In active sub-carrier

Example of Option-2



- Each RB has N active sub-carriers
  And may include in-active sub-carriers.
- The last RB may have less than N
  Active sub-carriers.
- N=4 in this example.

Active sub-carrier

In active sub-carrier

Conclusion

- Using a resource block structure with fixed number of contiguous active sub-carriers will result in a huge loss of bandwidth. Approximately 9/18/27/36 % bandwidth loss for the resource block lengths of 8/16/24/32 contiguous active sub-carriers.
- The proposed resource block structure utilizes almost all of the active sub-carriers, with essentially no loss of bandwidth (approximately 0.002% loss).
- The proposed definition facilitates tone re-ordering in achieving near constant capacity per resource block.
- The same resource block structure can be applied to scattered sub-carriers for tone re-ordering.

Thank you

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