Proposed Text of DL Subchannelization Section for the IEEE 802.16m Amendment

IEEE 802.16 Presentation Submission Template (Rev. 9)

Document Number:

IEEE S802.16m-08/1464

Date Submitted:

2008-11-10

Source:

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Re:

"IEEE 802.16m amendment text"
IEEE 802.16m-08/042, "Call for Contributions on Project 802.16m Draft Amendment Content".
Target topic: "Downlink Physical Structure".

Purpose:

To be discussed and adopted by TGm for the 802.16m amendment.

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Introduction

- This contribution proposes the DL subchannelization being comprised of …
  - Outer permutation: common to every cell
  - Second permutation: cell-specific
  - Subcarrier permutation: for distributed LRU (subcarrier-based)

- In this contribution, we show …
  - Procedure of the proposed DL subchannelization
  - Mapping functions at each stage of the procedure
  - Goal: show how to get PRU index by using LRU index
    for each subchannelization type

Required Functions/Features

- Band selection SubCH and diversity SubCH in a subframe (i.e. FDM)
- Different ratios of band selection SubCH and diversity SubCH among sectors/cells
- Frequency partitioning for FFR
  - N-disjoint partitions for reuse-N
  - Single partition for reuse-1

Subchannelization Types (1/2)

- Definition of terminology

In this slide	16m terminology
BandSel_N1	Localized LRU in the unit of N_1 PRUs
BandSel_N2	Localized LRU in the unit of N_2 PRUs
FreqDiv_N2	Distributed LRU in the unit of N_2 PRUs
FreqDiv_subc	Distributed LRU in the unit of subcarrier

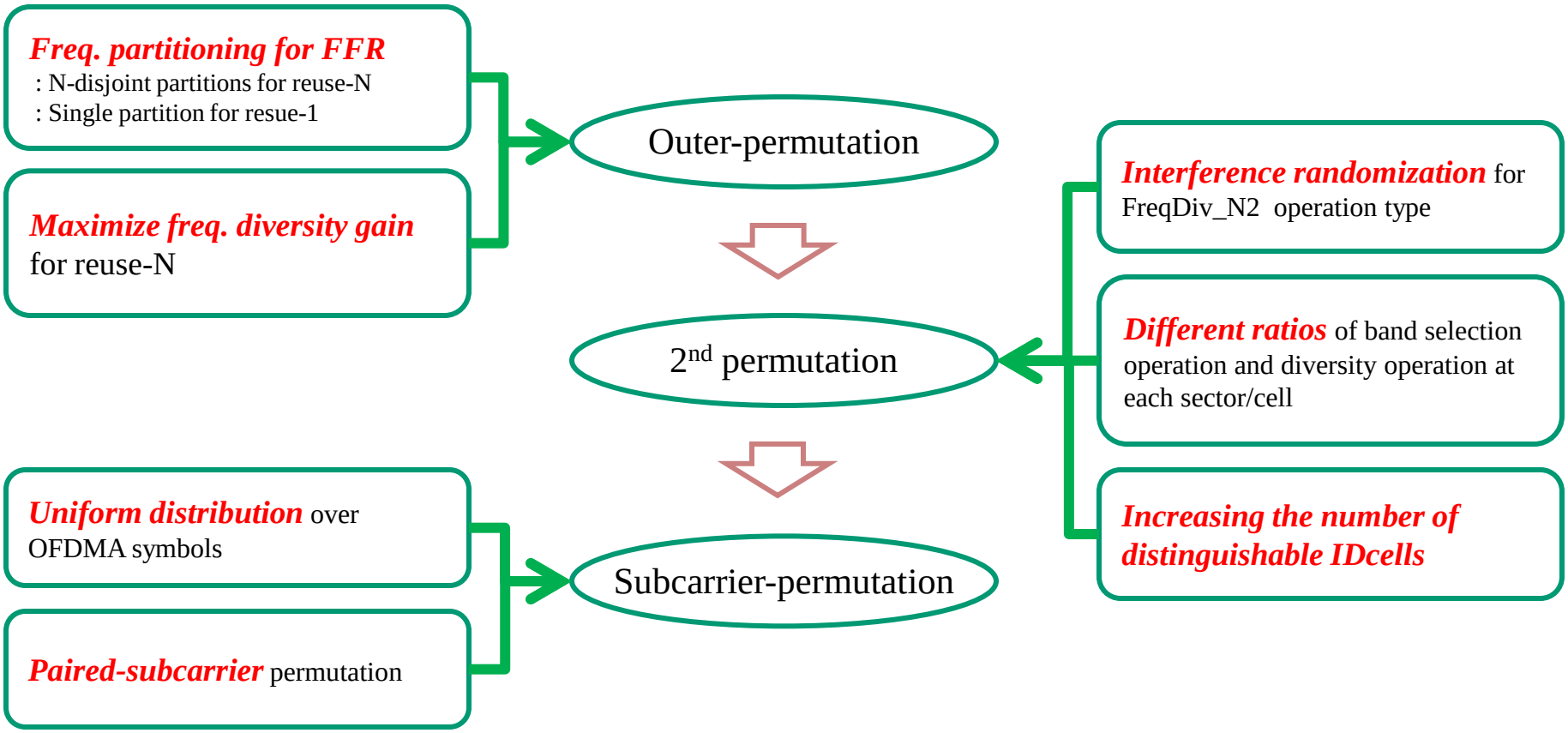
- Clarification for the usage of “BandSel_N2” and “FreqDiv_N2”
  - If a couple of N2 PRUs (more than one) are assigned for the user, “FreqDiv_N2” is considered as the operation type.
  - Else if only one N2 PRUs is assigned for the user, then “BaseSel_N2” is considered as the operation type.

Subchannelization Types (2/2)

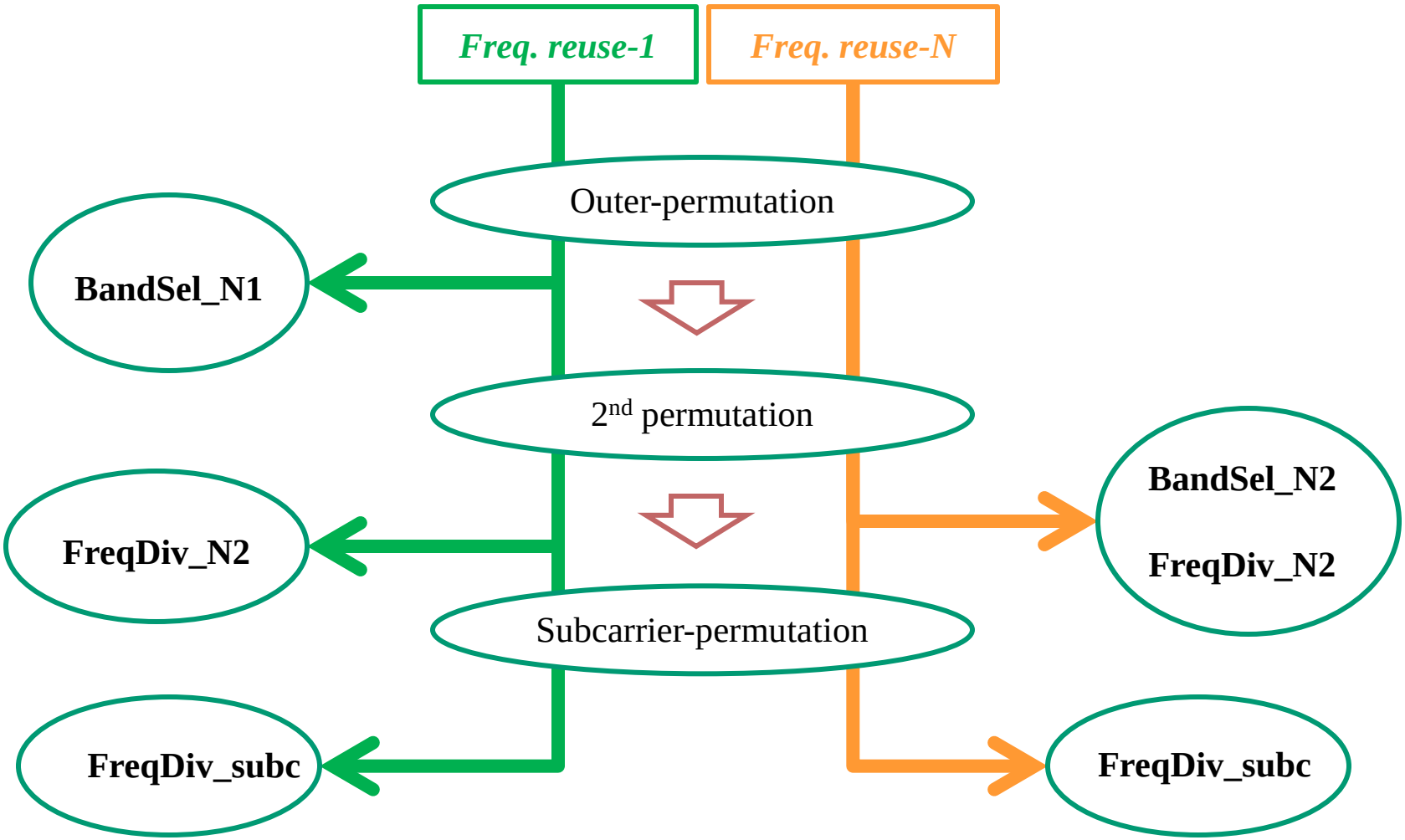
Subchannelization	Freq. reuse region	Note
[BandSel_N1] Band selection operation *in the unit of N_1 PRUs*	Freq. reuse = 1	. Typically N_1 = 4
[BandSel_N2] Band selection / [FreqDiv_N2] Freq. diversity operation *in the unit of N_2 PRUs*	Freq. reuse = 1	. Typically N_2=1 (10MHz) and 2 (20MHz) . Dedicated pilot
[FreqDiv_subc] Freq. diversity operation *in the unit of tone-pair*	Freq. reuse = 1	. Tone-pair for SFBC
[BandSel_N2] Band selection / [FreqDiv_N2] Freq. diversity operation *in the unit of N_2 PRUs*	Freq. reuse = 3	. Typically N_2=1 (10MHz) and 2 (20MHz) . Dedicated pilot
[FreqDiv_subc] Freq. diversity operation *in the unit of tone-pair*	Freq. reuse = 3	. Tone-pair for SFBC

DL Subchannelization

- Features of each permutation stage

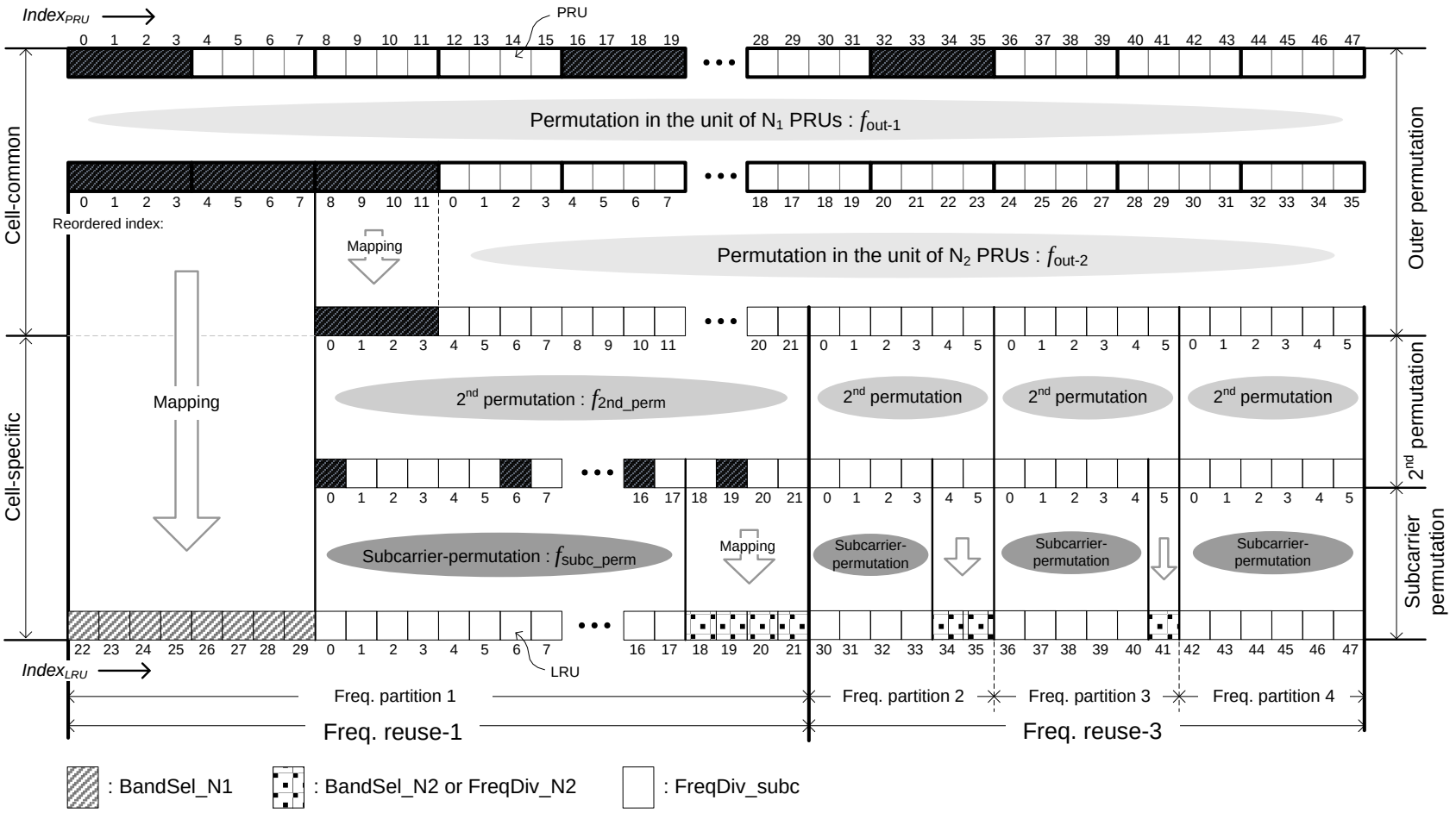


Subchannelization Procedure

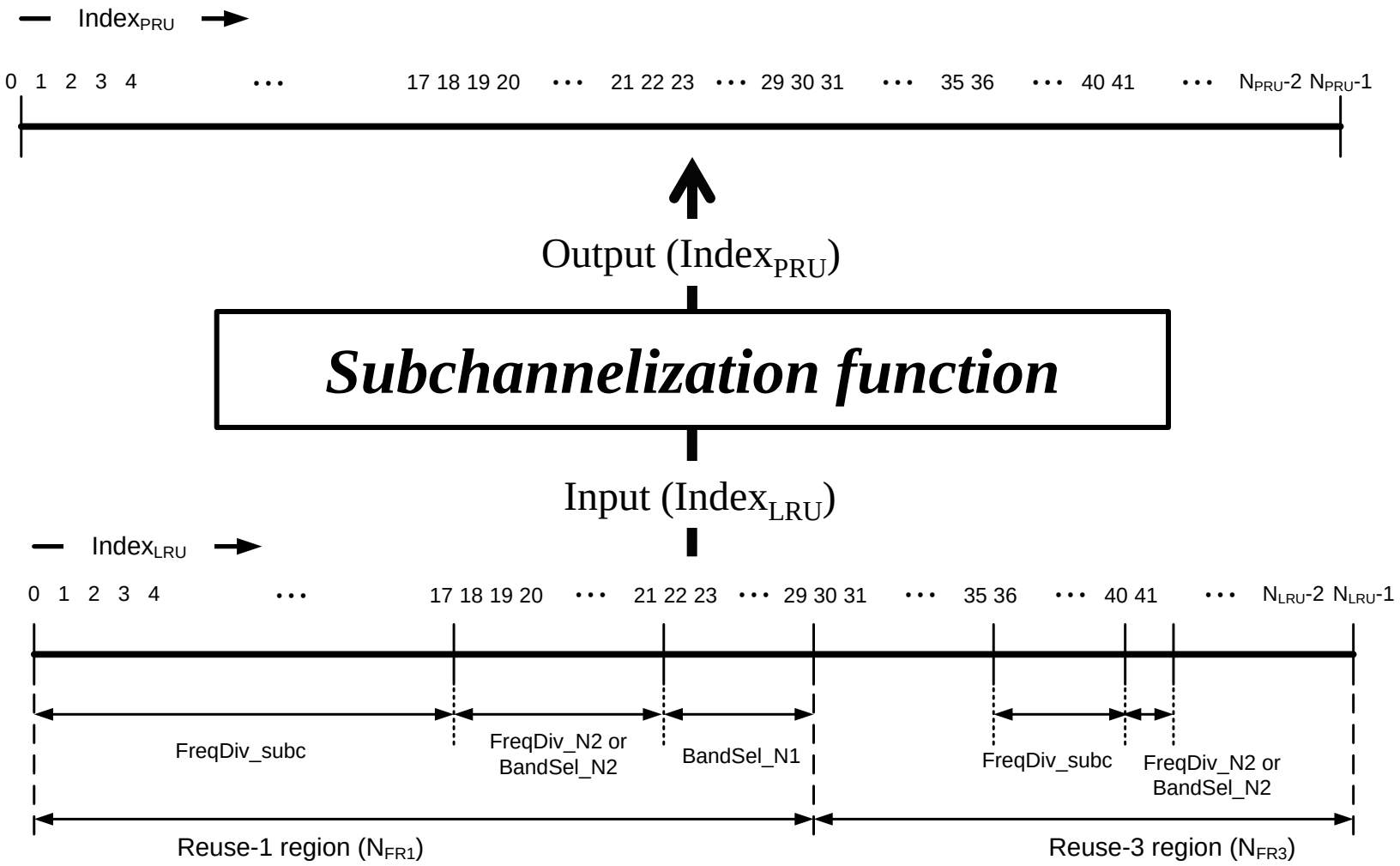


Proposed Outline of DL subchannelization

- Example (N1=4, N2=1):
  - 10MHz BW (N_{PRU}=48 PRUs), FR1:FR3 = 5:3
  - N_{tot_band}=12, N_{res_band}=3, N_{BS_N1}=2,
  - $N_{BS_N2_FR1}$=4, $N_{BS_N2_FR3}$=1 (Freq. partition 3)

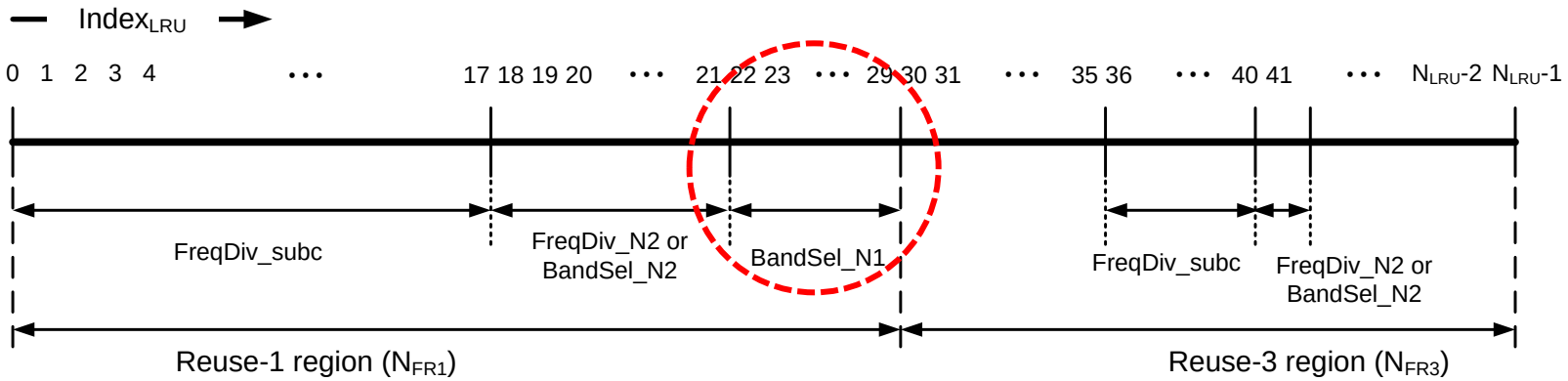


Ultimate Object of DL Subch.

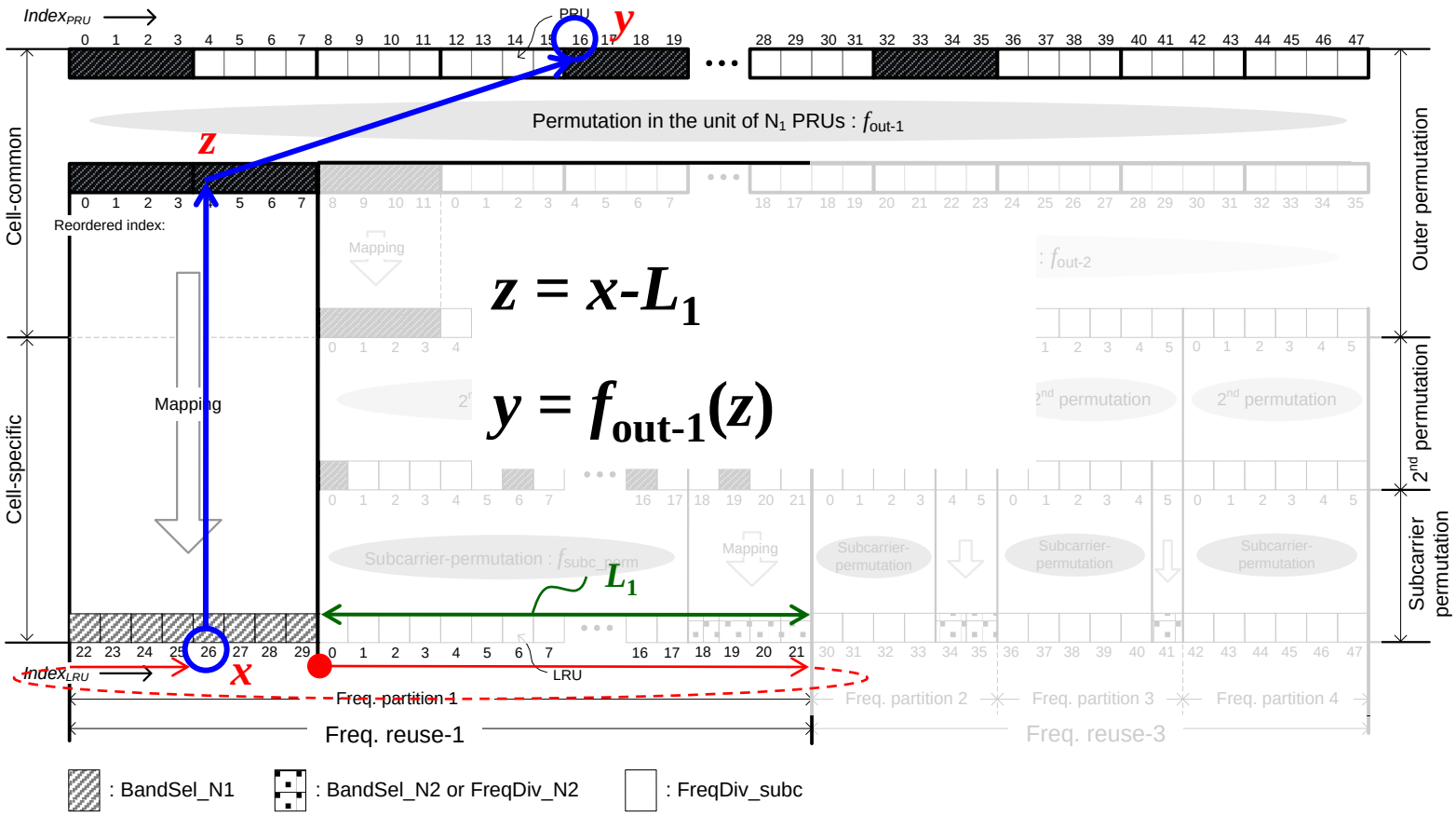


Case-(1) : BandSel_N1

- DL Subchannelization types
  - **(1) Band selection operation in the unit of N1 PRUs (Reuse=1)**
  - (2) Band selection/Freq. diversity operation in the unit of N2 PRUs (Reuse=1)
  - (3) Freq. diversity operation in the unit of tone-pair (Reuse=1)
  - (4) Band selection/Freq. diversity operation in the unit of N2 PRUs (Reuse=3)
  - (5) Freq. diversity operation in the unit of tone-pair (Reuse=3)



Subch. Function of BandSel_N1

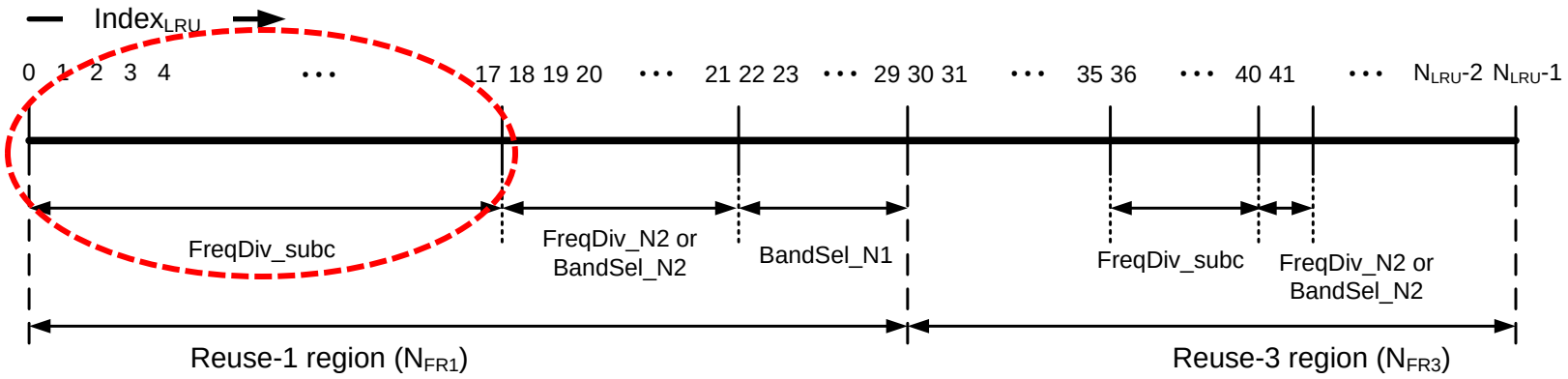


[Note-1] $f_{out\text{-}1}(x)$: *see the latest contribution of C80216_08-1464*

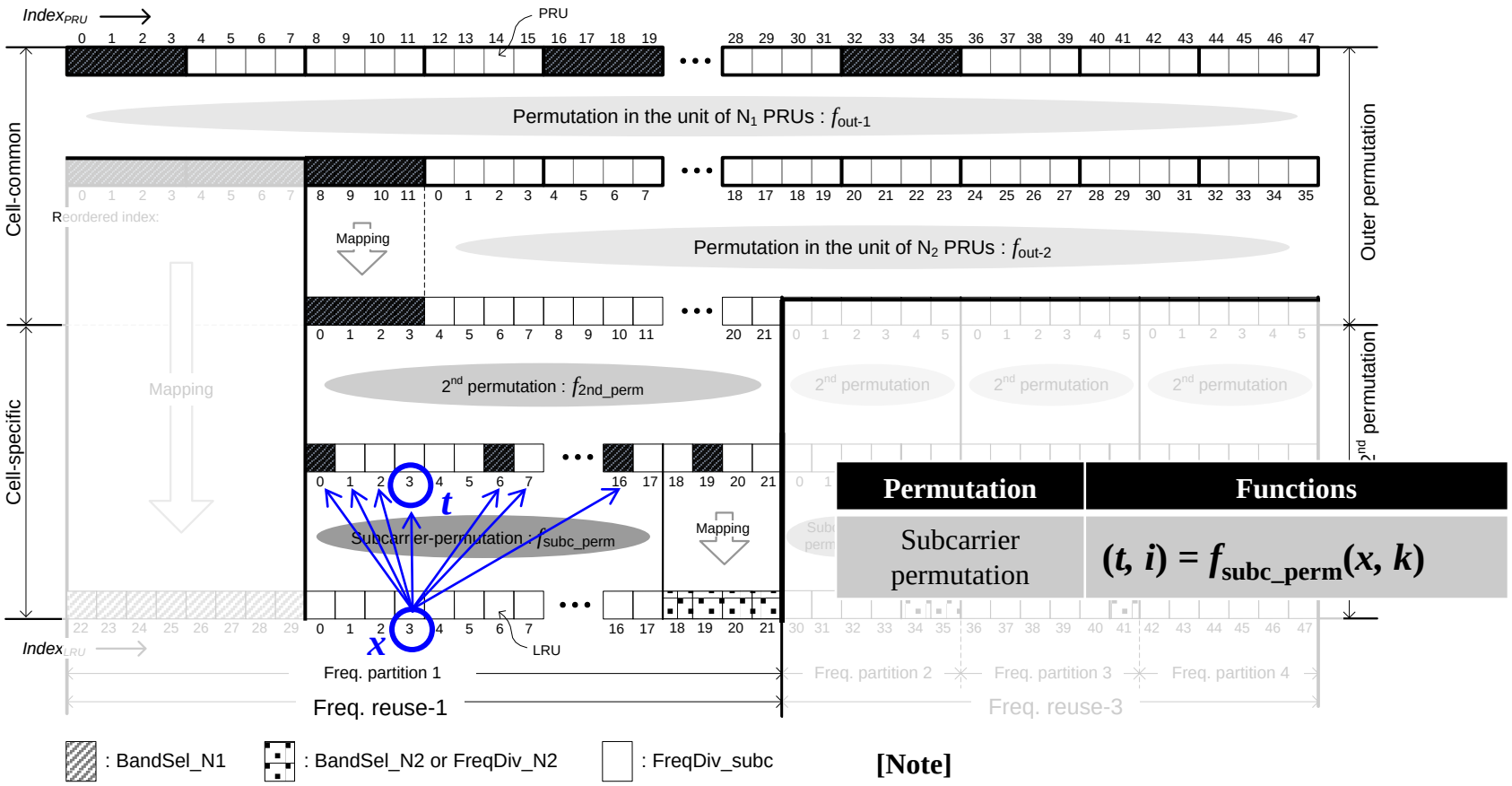
[Note-2] L_1 : the number of PRUs assigned for freq. diversity operation (tone-pair) and band selection/ freq. diversity operation (N_2 PRUs) in reuse=1 region. See Appendix

Case-(3) : FreqDiv_subc (reuse=1)

- DL Subchannelization types
  - (1) Band selection operation in the unit of N1 PRUs (Reuse=1)
  - (2) Band selection/Freq. diversity operation in the unit of N2 PRUs (Reuse=1)
  - **(3) Freq. diversity operation in the unit of tone-pair (Reuse=1)**
  - (4) Band selection/Freq. diversity operation in the unit of N2 PRUs (Reuse=3)
  - (5) Freq. diversity operation in the unit of tone-pair (Reuse=3)



Subch. Function of FreqDiv_subc (reuse=1)

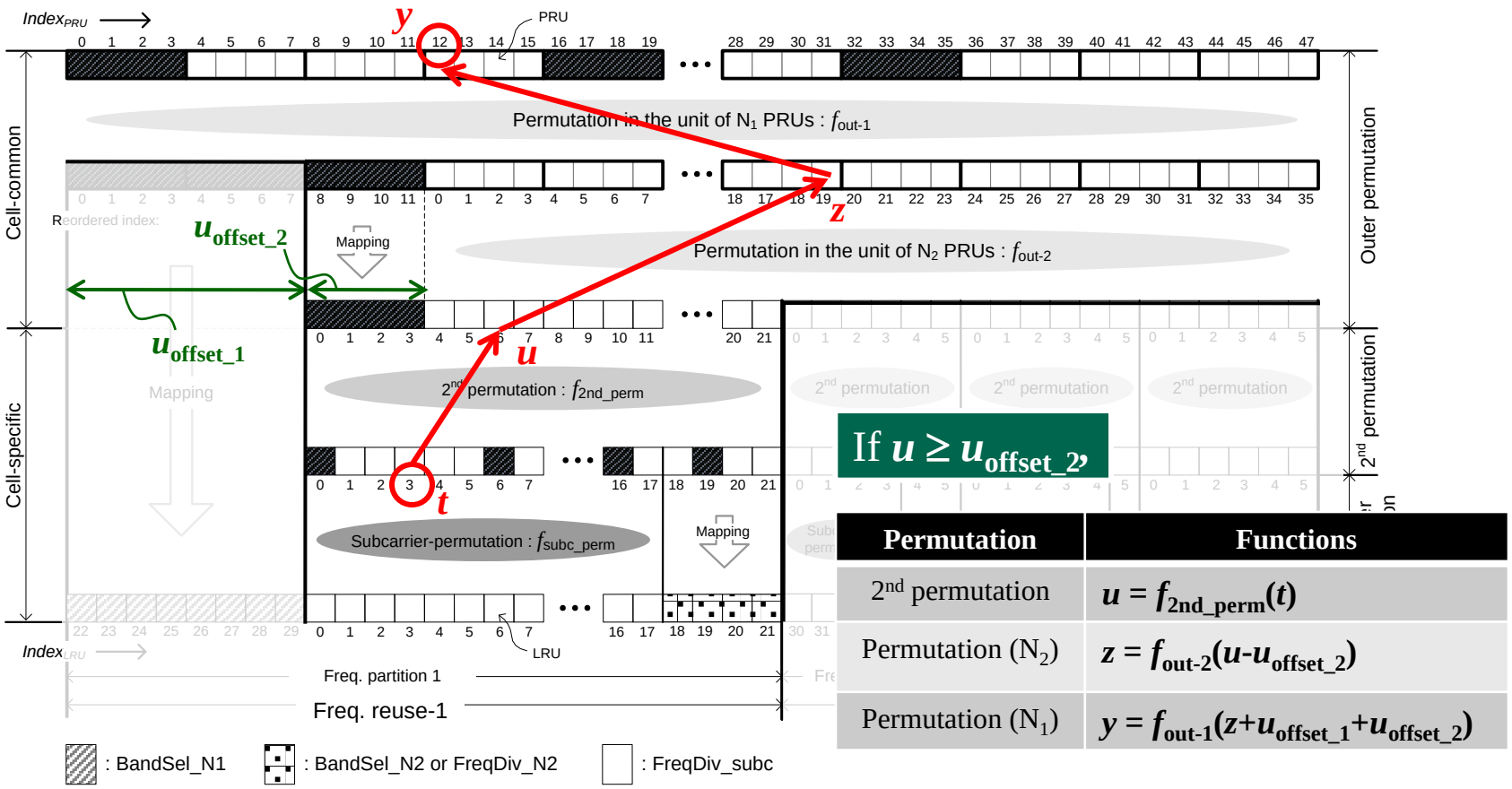


Permutation	Functions
Subcarrier permutation	$(t, i) = f_{subc_perm}(x, k)$

[Note]
- (t, i) : t-th DRU, i-th tone-pair
- $f_{subc_perm}(x, k)$: x-th LRU, k-th tone-pair

[Note] $f_{subc_perm}(x)$: *see the latest contribution of C80216_08-1464*

Subch. Function of FreqDiv_subc (reuse=1)

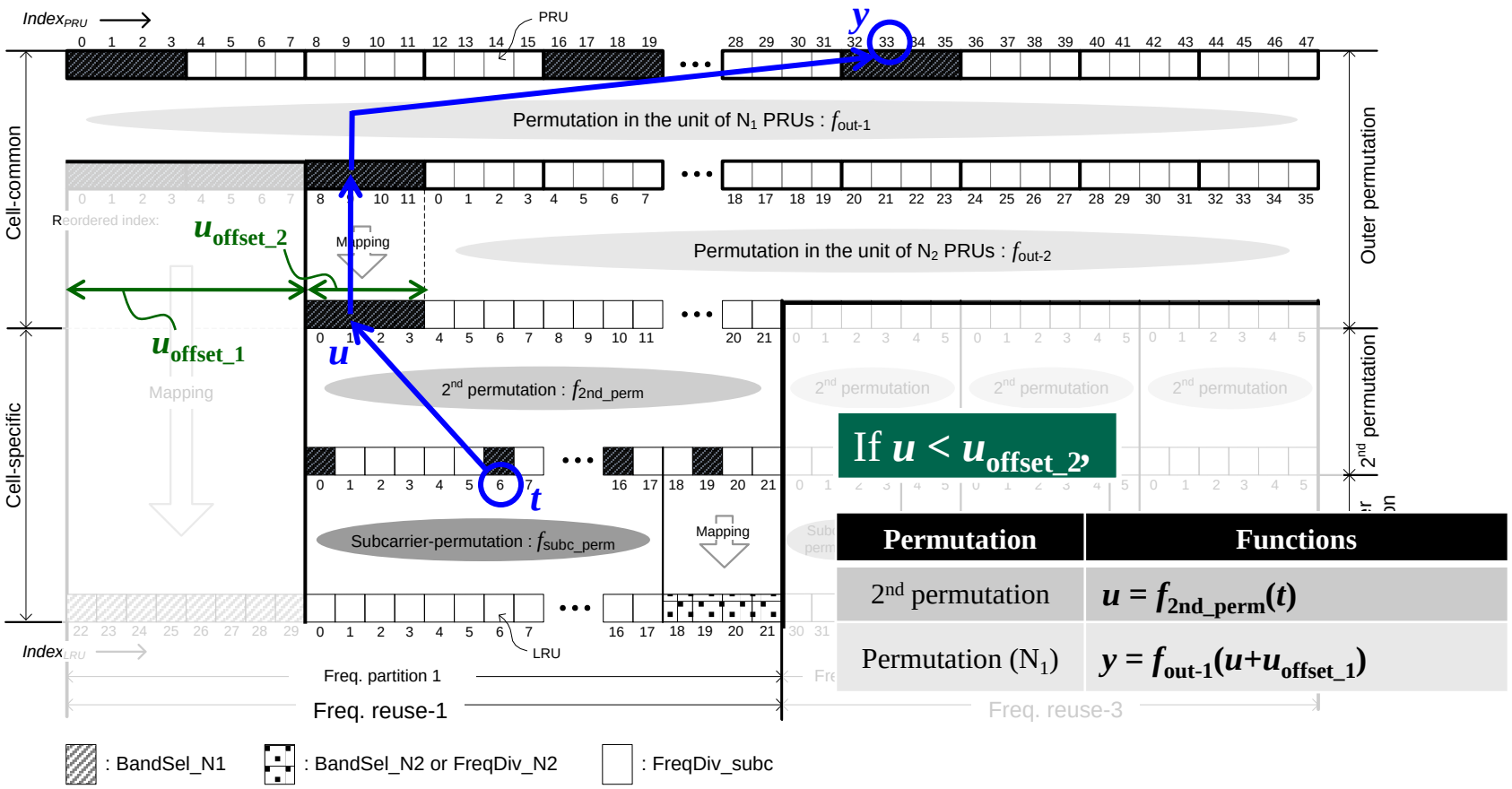


If $u \geq u_{offset_2}$,

Permutation	Functions
2nd permutation	$u = f_{2nd_perm}(t)$
Permutation (N_2)	$z = f_{out\text{-}2}(u - u_{offset_2})$
Permutation (N_1)	$y = f_{out\text{-}1}(z + u_{offset_1} + u_{offset_2})$

[Note-1] $f_{out\text{-}1}(x)$, $f_{out\text{-}2}(x)$, $f_{2nd_perm}(x)$: *see the latest contribution of C80216_08-1464*
[Note-2] u_{offset_1}, u_{offset_2} : see Appendix

Subch. Function of FreqDiv_subc (reuse=1)



[Note-1] $f_{out\text{-}1}(x)$, $f_{out\text{-}2}(x)$, $f_{2nd_perm}(x)$: *see the latest contribution of C80216_08-1464*
[Note-2] u_{offset_1}, u_{offset_2} : see Appendix

Other cases

- DL Subchannelization types
  - (1) Band selection operation in the unit of N1 PRUs (Reuse=1)
  - **(2) Band selection/Freq. diversity operation in the unit of N2 PRUs (Reuse=1)**
  - (3) Freq. diversity operation in the unit of tone-pair (Reuse=1)
  - **(4) Band selection/Freq. diversity operation in the unit of N2 PRUs (Reuse=3)**
  - **(5) Freq. diversity operation in the unit of tone-pair (Reuse=3)**

See the latest contribution of C80216_08-1464

[Appendix] Definition of variables and parameters

Input parameters

- N_{res_band} : # of reserved bands
- N_{BS_N1} : # of PRUs for BandSel_N1
- Partition configuration (e.g., FFR ratio = FR1:FR3)
- $N_{BS_N2_FR1}$: # of PRUs allocated to BandSel_N2 or FreqDiv_N2 in FR=1
- $N_{BS_N2_FR3}$: # of PRUs allocated to BandSel_N2 or FreqDiv_N2 in FR=3

Given parameters

- N_{PRU} : total # of PRUs
- N_{band} : # of PRUs per band

Cal. parameters

- $N_{FR1} = N_{PRU} * FR1/(FR1+FR3)$ → # of PRUs for FR=1 region
- $N_{FR3} = N_{PRU} * FR3/(FR1+FR3)$ → # of PRUs for FR=3 region

Param.	Value	Operation
u_{offset_1}	$N_{BS_N1} \times N_{band}$	FreqDiv_subc, BandSel_N2 (FR=1)
u_{offset_2}	$N_{res_band} \times N_{band} - u_{offset_1}$	FreqDiv_subc, BandSel_N2 (FR=1)
L_1	$N_{FR1} - N_{BS_N1} \times N_{band}$	BandSel_N1 (FR=1)