3GPP RAN #77
September 11 - 14, 2017
Sapporo, Japan
Agenda Item 9.2.1

RP-171605

Views on UL Sharing

Qualcomm Incorporated

Introduction

- Lots of discussions around NR Uplink Sharing & Supplemental Uplink.
  - Several deployment scenarios often hinted at without commonly agreed nomenclature
  - Lack of clarity / common understanding as to which scenarios are meant to be completed by which date

- In this contribution
  - We discuss our views including benefits of using FDD UL in addition to a TDD carrier
  - We propose a nomenclature exhaustively covering the related deployment cases

- Finally, we ask for 3GPP RAN to clearly express which cases are targeted to which deadline & we offer the Qualcomm proposal on the matter

Background: Work Item Objectives

Excerpt from NR WID (RP-170847)

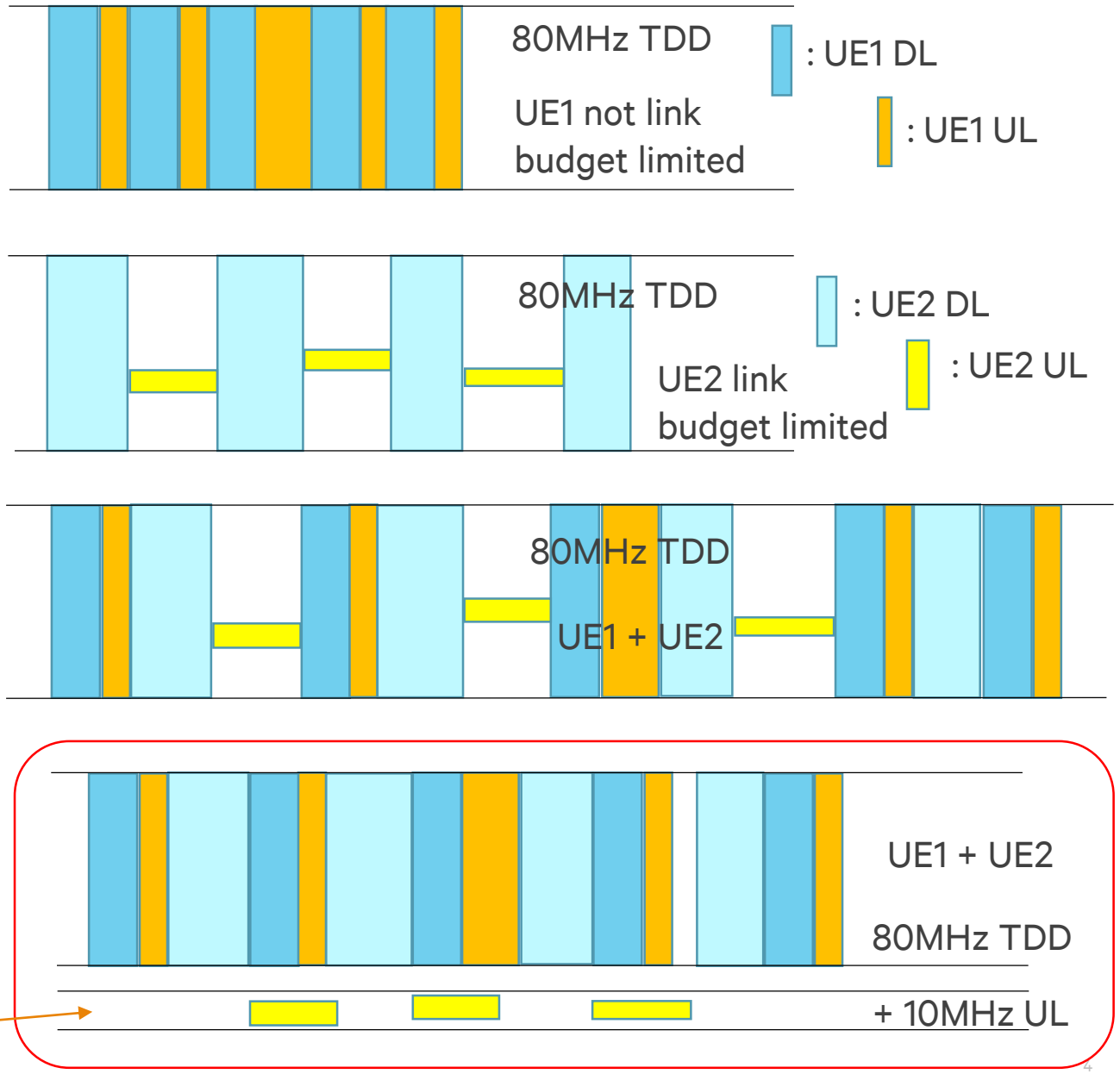
- NR-LTE co-existence mechanisms [RAN1, RAN2, RAN4];
  - Support co-existence of LTE UL and NR UL within the bandwidth of an LTE component carrier and co-existence of LTE DL and NR DL within the bandwidth of an LTE component carrier, and identify and specify at least one NR band/LTE-NR band combination for this operation.
  - Minimize impact to NR physical layer design to enable this co-existence.
  - No impact to the ability of legacy LTE devices to operate on the LTE carrier co-existing with NR
  - **No implication that UE has to support simultaneous connection of NR and LTE in the bandwidth of an LTE component carrier**

Background: TDD spectrum utilization

Will become an increasing problem for wideband TDD systems

- Related to TDD link budget issue
- Even if we can add sufficient number of UL slots for link budget limited UEs, these resources will be poorly utilized
  - Assuming limited UL multiplexing capability, e.g. due to beamforming

- Can use FDD UL
- Use of FDD UL is not related to frequency differences (e.g. high band vs. low band)



FDD UL

Addition of a narrowband UL to a wideband carrier

CA-based solutions

- In the next slide we give example scenarios of aggregating a narrowband FDD carrier with a wideband TDD carrier

Example scenarios for NSA with NR CA

Low band **f1 FDD** (NSA anchor) | Low band **f2 FDD** | High band **f3 TDD** (eg 3.5 GHz)

Case 0:
NSA baseline

DL: LTE
UL: LTE
NR NR DL/UL

Rel-15, December drop

Case C1:
NSA + NR FDD-TDD CA
(2 NR UL)

DL: LTE NR
UL: LTE NR
NR NR DL/UL

Rel-15, December drop

Case C2:
NSA + NR DL CA + no SRS switching
(1 NR UL)

DL: LTE NR
UL: LTE NR
NR DL only

Rel-15, December drop

Case C3:
NSA + NR DL CA + SRS switching
(1 NR UL)

DL: LTE NR
UL: LTE NR
NR SRS
TDM

Rel-15, December drop

Notes for CA-based solutions

- In Cases C1-C3, frequency f2 may or may not be shared with LTE from the network perspective
  - There is no LTE-NR sharing from the UE perspective

Addition of a Supplemental UL to a wideband carrier

SUL solutions

- In the next slide we give example scenarios of aggregating a Supplemental UL carrier with a wideband TDD carrier

Example scenarios for NSA with SUL

UL sharing from the UE perspective

		Low band f1 FDD (NSA anchor)	Low band f2 FDD	High band f3 TDD (eg 3.5 GHz)		
Case 0: NSA baseline	DL	LTE		NR NR	DL/UL	*Rel-15, December drop*
	UL	LTE				
Case S1: NSA + SUL (2 NR UL)	DL	LTE		NR NR	DL/UL	*Part of NR work item but not in December drop*
	UL	LTE	NR			
Case S2: NSA + SUL (2 NR UL TDM'd)	DL	LTE		NR N R	DL/UL	*Part of NR work item but not in December drop*
	UL	LTE	N R *TDM*			
Case S3: NSA (NR DL only) + SUL + no SRS switching (1 NR UL)	DL	LTE		NR	DL only	*Part of NR work item but not in December drop*
	UL	LTE	NR			
Case S4: NSA (NR DL only) + SUL + SRS switching (1 NR UL)	DL	LTE		NR S R S		*Part of NR work item item but not in December drop*
	UL	LTE	NR *TDM*			
Case S5: NSA + UL sharing @ UE in TDM	DL	LTE		NR NR	DL/UL	*Not in NR work item*
	UL	L T E N R *TDM*				
Case S6: UL sharing @ UE in FDM	DL	LTE		NR NR	DL/UL	*Not in NR work item*
	UL	LTE NR *FDM*				
Case S7: UL sharing @ UE in TDM, 1 NR UL, SRS switching	DL	LTE		NR S R S	DL/UL	*Not in NR work item*
	UL	L T E N R *TDM*				
Case S8: UL sharing @ UE in FDM, 1 NR UL, SRS switching	DL	LTE		NR S R S	DL/UL UL @ f3 optional	*Not in NR work item*
	UL	LTE NR *FDM* *TDM*				

Notes for SUL solutions

SUL solutions

- In Cases S1-S4, frequency f2 may or may not be shared with LTE from the network perspective
  - There is no LTE-NR sharing from the UE perspective

- In Cases S5-S8, there is LTE-NR sharing from the UE perspective
  - These are not in scope for the Rel-15 WID

Conclusion & Proposal

Necessary for 3GPP to have clarity on which scenarios are to be completed by when

The following completion dates are proposed for endorsement by RAN #77, subsequent to which RAN WGs need to be instructed accordingly

Rel-15 December version	Rel-15 June version	Not in Rel-15
Case 0: NSA baseline **Cases C1, C2, C3**: NR CA	**Cases S1, S3, S4**: SUL without UL sharing from the UE perspective	**Cases S2, S5, S6, S7, S8**: SUL with UL sharing from the UE perspective

Thank you

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