

3GPP TSG RAN#101

Bangalore, India – September 11th – 15th, 2023

RP-232321

Agenda Item 8A.2.3

rev. of RWS-230112

[RAN1 led] Update on Duplex Evolution

MediaTek Inc.

gNB-SBFD ongoing Study Item

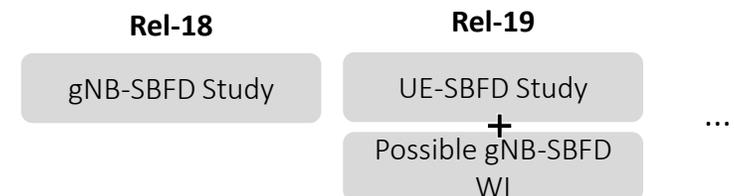
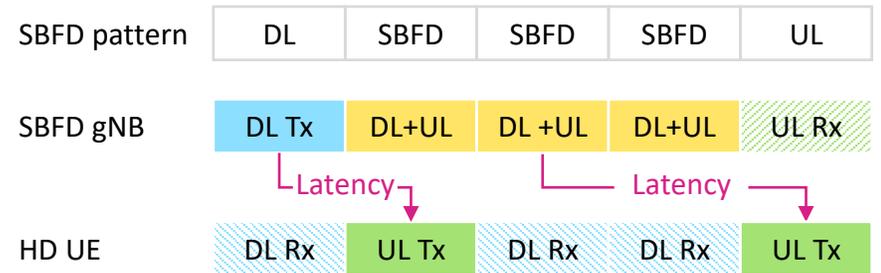
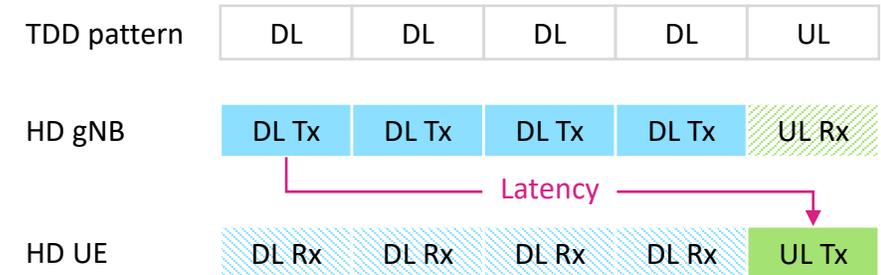
Status update

- RAN1 concluded their part of the study on gNB SBFD scheme, covering
 - Performance evaluation using SLS for different deployments (Indoor, Dense Urban & Urban Macro) for single-operator case and adjacent-channel coexistence (two operators)
 - Link-level evaluation for the possible coverage gain
- Main observations from RAN1 SI
 - gNB-SBFD provides UL throughput gain: mainly in Indoor and Dense Urban deployments
 - Negative impact of inter-UE and inter-gNB CLIs on the system performance
 - ~14% degradation in DL spectral efficiency due to inter-UE CLI
 - Any future WI (if any) on SBFD operation should prioritize handling inter-UE and inter-gNB CLIs
- RAN4 part of the study is still ongoing, with the following still open:
 - Implementation feasibility, impact to gNB & UE RF requirements
 - Regulatory aspects for deploying SBFD

UE-SBFD Study

Motivation

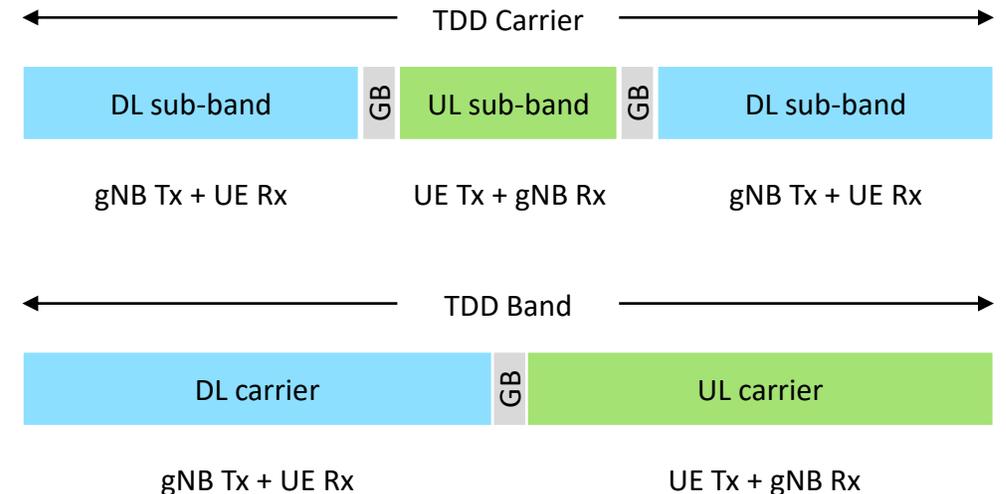
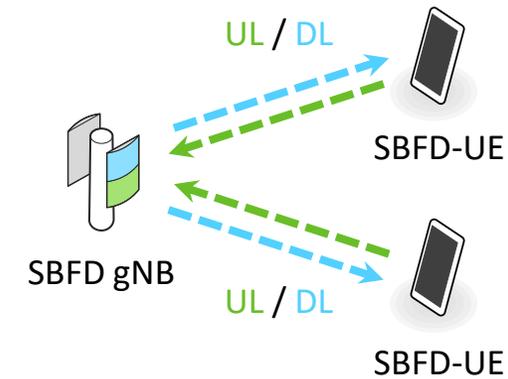
- TDD bands offer large bandwidth. However, fixed TDD UL/DL patterns result in **increased latency**, and **limited capacity and coverage**
 - This negatively impacts system capacity for latency-sensitive services
- gNB-SBFD full duplex alleviates the issue to some extent
 - However, UE HD operation remains the latency **bottleneck** due to non-simultaneous UL/DL UE operation
- **UE-SBFD would fully address these issues and:**
 - Enable FDD-like low-latency in TDD bands, to improve capacity for latency-sensitive services, particularly important for the successes of XR



Proposal

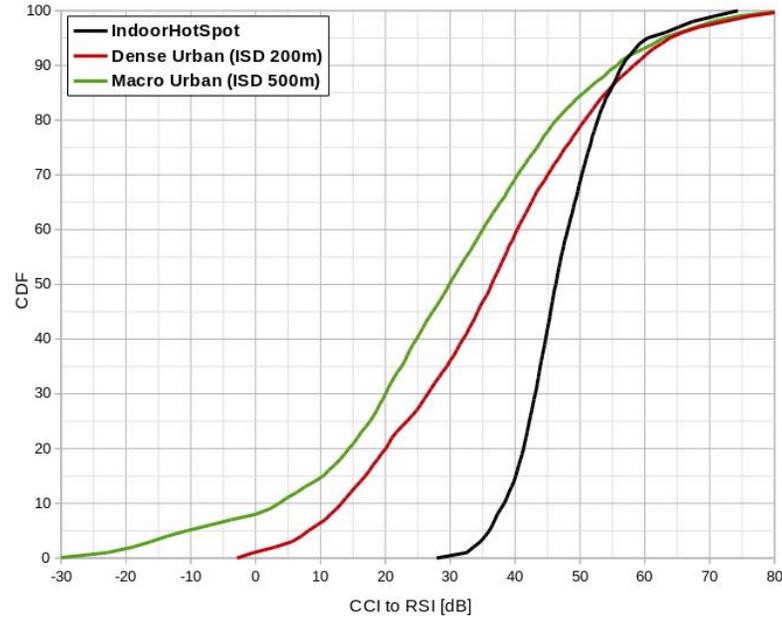
Study full-duplex operation at UE

- Study full-duplex operation at UE
 - Non-overlapped simultaneous transmission and reception
 - Within a carrier or across different carriers (in intra-band CA)
- Investigate aspects to allow constraining UE complexity, such as
 - Level of frequency separation (if needed) between Rx and Tx sub-bands
 - Opportunistic operating conditions (e.g., UE Tx power level, inter-cell-interference level, UE Tx allocation, etc.)
 - Different device types

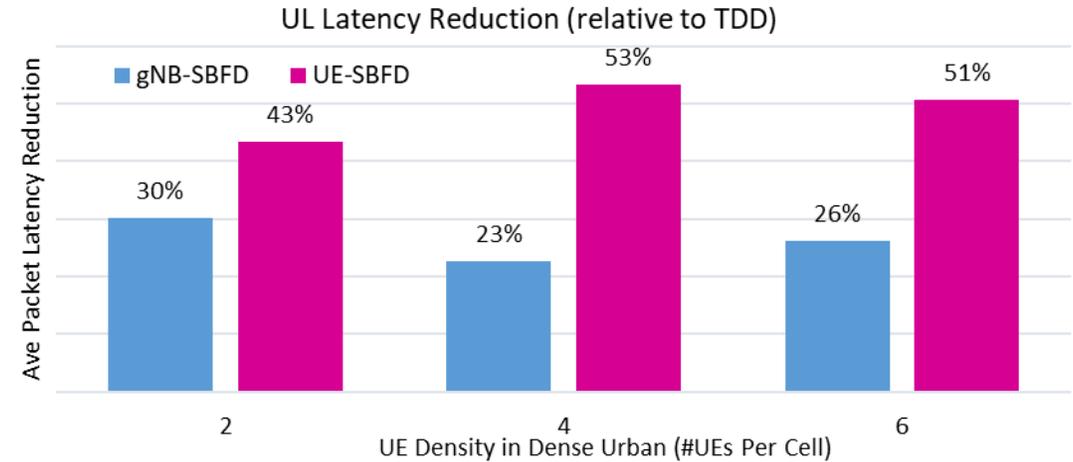


Feasibility and Performance results

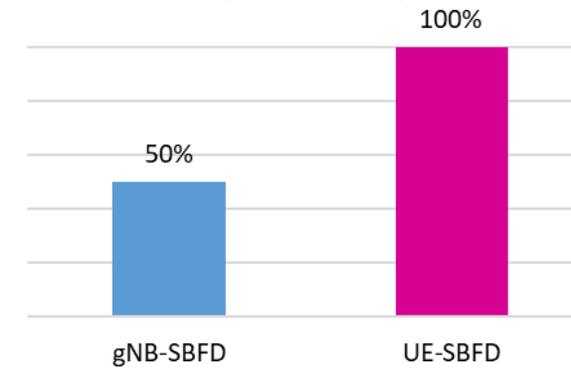
UE-SBFD feasibility



System performance gain

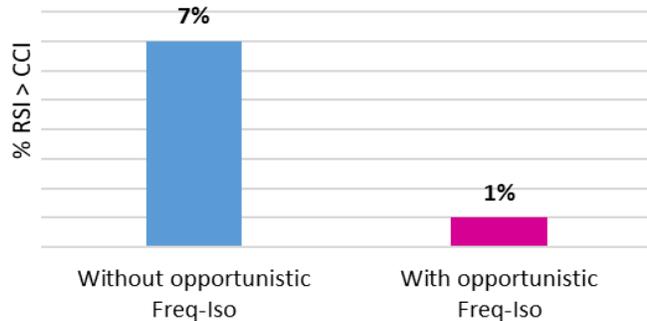


UL capacity gain relative to TDD (#satisfied UEs)



- Dense Urban (200m ISD)
- XR Traffic (10Mbps data-rate, 30ms PDB)

Opportunistic frequency isolation to minimize self-interference @UE



CCI: inter-cell interference
RSI: Residual self-interference

Proposal

SA/CT Dependency: No

Study non-overlapping full-duplex at the UE, with the following proposed detailed objectives

Objective I: Identify possible schemes for non-overlapping full-duplex UE and evaluate their feasibility and performance for the following (RAN1, RAN4);

- UE baseband and RF aspects, covering both FR1 and FR2 ranges.
- Different types of devices; smartphones, compact devices for XR, CPE, etc.
- The following types of UE configuration, with different levels of guard-band between UL and DL:
 - non-overlapped full-duplex on different subbands within a carrier.
 - non-overlapped full-duplex on different carriers (intra-band).
- Applicable deployment scenarios

Objective II: Identify potential functionality to mitigate self-interference and enable acceptable SBFD-UE complexity (RAN1, RAN4)

- Frequency isolation between Rx and Tx sub-bands to minimize self-interference
- Opportunistic activation of full-duplex-UE mode in favourable conditions (e.g., UE Tx power level, inter-cell-interference level, UE Tx allocation, etc.)
- Procedures and signals for self-interference cancellation training

Note: Coexistence and CLI handling mechanisms to be addressed in the WI on gNB-SBFD.

Expected TU

RAN	2024												2025 [Calendar TBC at the time of writing]												2026		
	Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4			Q1		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
	103			104			105			106			107			108			109			110			111		
R1	115b	116		116b	117			118		118b	119		119b	120		120b	121			122		122b	123		123b	124	
R2	124b	125		125b	126			127		127b	128		128b	129		129b	130			131		131b	132				
R3	122b	123		123b	124			125		125b	126		126b	127		127b	128			129		129b	130				
R4	109b	110		110b	111			112		112b	113		113b	114		114b	115			116		116b	117		117b	118	
R1		0.5		0.5	0.5			1		0.5	0.5			1		0.5	1										
R2				N/A	N/A			N/A		N/A	N/A			N/A		N/A	N/A			N/A							
R3				N/A	N/A			N/A		N/A	N/A			N/A		N/A	N/A			N/A							
R4 RD				N/A	N/A			N/A		N/A	N/A			N/A		N/A	N/A			N/A							
R4 RF				0.25	0.25			0.5		0.25	0.25			0.5		0.25	0.25			0.5							

RAN4 Core

RAN4 Perf

Study TU
Feature TU

RAN1: 6 TUs
RAN4/RF: 3 TUs

Thank you!