

# **[RAN1 led] Further Coverage Enhancements**

## **[WI]**

# Motivation

## Problem Statement

### Extreme long-range coverage

- Rel-19 5G service requirements (Stage 1) define extreme long-range coverage with following requirements<sup>1</sup>:
  - Up to 100 km in low-density areas (~2 user/km<sup>2</sup>)
  - Minimum user throughput of 100 kbit/s on UL at the cell-edge
- **PUSCH enhancements** can be considered to address extreme long-range coverage requirements for low throughput case.



(1) TS 22.261 v19.2.0, Service requirements for the 5G system; Stage 1 (Release-19), 2023-03.

### Coverage enhancements for connection setup

- Rel-17 introduced Msg3 PUSCH repetitions
- Rel-18 introduced multiple PRACH transmissions (Msg1).
- Some companies expressed the view that **Msg5 PUSCH** may act as **coverage bottleneck** during initial access in some cases
  - we would be happy to investigate this further, and consider **enabling repetitions if the benefits are justified**.

### Power domain improvements in specific operating scenarios

- Rel-18 focused on power domain improvements to further boost coverage and UL throughput for generic usage
- There may be certain network operating scenarios or conditions where UL power domain enhancements may be viable *without* incurring additional UE complexity

# Proposal

SA/CT Dependency: No

**Key Message:** We propose a RAN1-led work item to further enhance B5G coverage that focuses on higher throughput target (~1-2 Mbps), extreme long-range coverage (~up to 100km), and potentially some work to enhance Msg5 coverage.

**Objective I: Enhancements to support extreme long-range coverage [RAN1]**

- Specify “sub-PRB” allocation using TB over multiple slots (TBoMS) [RAN1]

**Objective II: Enhancements for Msg5 coverage [RAN1]**

- Study the msg 5 coverage impact and investigate whether enabling type-A repetitions for PUSCH when scheduled with DCI format 0\_0 with C-RNTI would be beneficial. If justified, follow-up specification work may proceed [RAN1]

**Objective III: UL power domain enhancements for specific operating scenarios [RAN4]**

- Study UL power domain enhancements applicable for specific network operating scenarios, and specify enhancements if justified [RAN4]

# Expected TU

	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
<b>RAN</b>	<b>103</b>			<b>104</b>			<b>105</b>			<b>106</b>			<b>107</b>			<b>108</b>			<b>109</b>			<b>110</b>			<b>111</b>		
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			0.5		0.5	0.5			0		0	0										
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	0			0.25		0.25	0.25			0.25		0.25	0.25			0.25							

Study TU  
Feature TU



**Thank you!**