3GPP TSG RAN Meeting #102
Edinburgh, UK, December 11-15, 2023

RP-233686

Views on Rel-19 RAN4 RF and OTA topics

Agenda Item:	9.1.4.2
Source:	Intel Corporation
Document for:	Discussion & Decision

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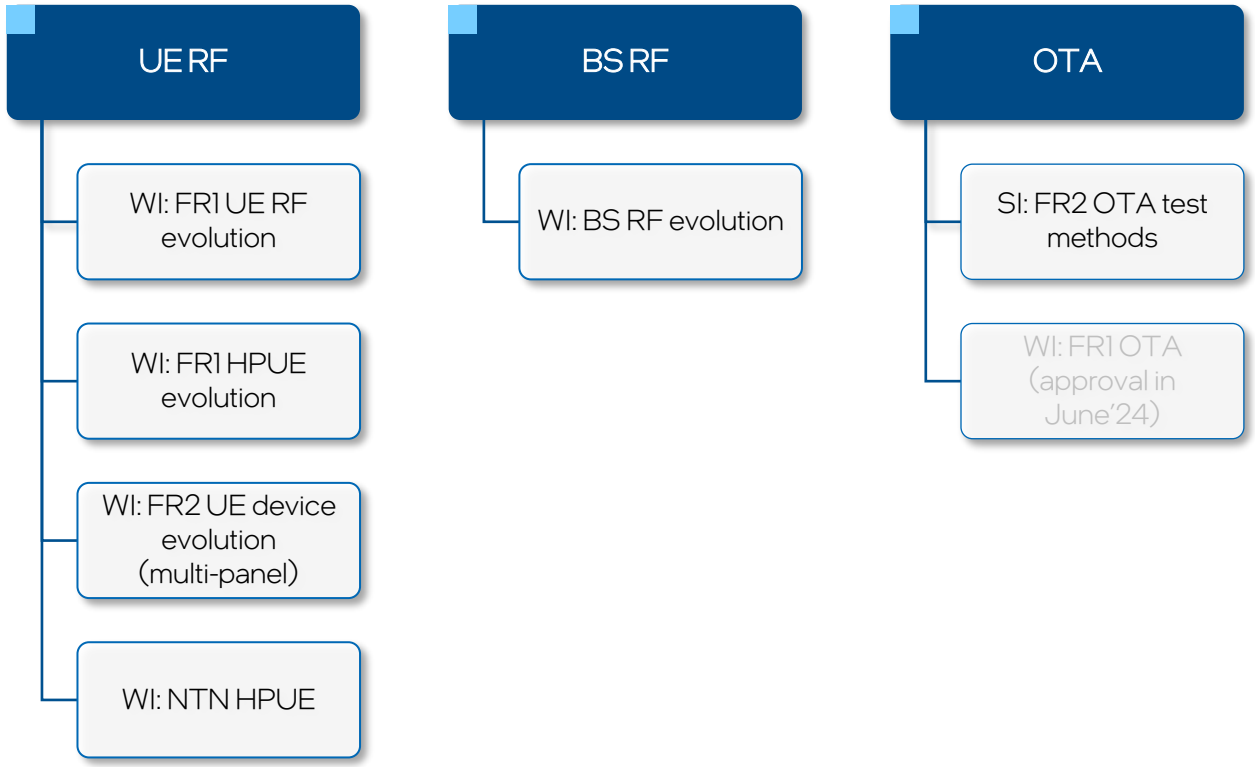
Introduction

The general views on RAN4 Rel-19 SI/WI package is provided in RP-233685

The following SI/WIs are recommended to be considered for RF/OTA areas:

- WI: FR1 UE RF evolution
- WI: FR1 HPUE evolution
- WI: FR2 UE device evolution (multi-panel)
- WI: NTN HPUE
- WI: BS RF evolution
- SI: FR2 OTA test enhancements

Note 1: Discussion on FR1 OTA item(s) scope can be postponed till completion of ongoing items.



Intel's priorities for RAN4 Rel-19 RF/OTA

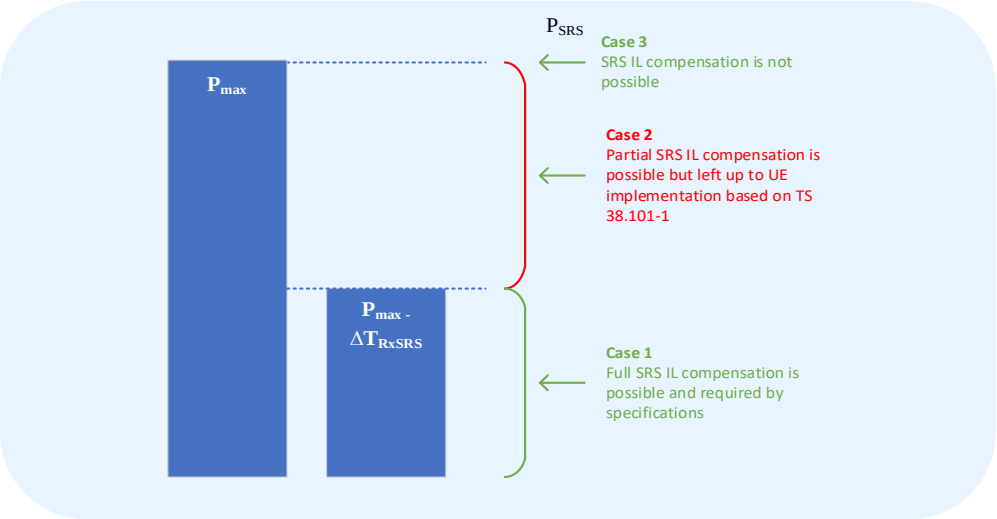
	Prioritized objectives/scope	Comments
FR1 RF	• SRS IL compensation and reporting • 6Rx and 3Tx for handheld/CPE/FWA • Irregular Channel Bandwidth	An umbrella WI focusing on FR1 UE RF topics is recommended with [2-3] RF TU per meeting.
FR1 HPUE RF	• HPUE with CA/DC	A separate WI focusing on FR1 HPUE topics across different use cases is recommended to avoid fragmented discussions across multiple WIs. [1] RF TU per meeting
FR2 RF	• Low priority: CA enhancements	The FR2 RF objectives except for multi-panel Tx/Rx (see RP-233688 for more details) have low priority. Open to have a small project focusing on commercial needs (e.g., CA enhancements based on operator requests) or fine to have no dedicated FR2 RF umbrella WI.
NTN HPUE	• HPUE for NR NTN • HPUE for IoT NTN	A separate project focusing on NTN HPUE aspects with [0.5] RF TUs. Can be a part of FR1 HPUE WI.
BS RF	• Multi-band FR2 BS • BS OTA test time reduction	A small project with [0.5] RF TUs per meeting
OTA	FR2 OTA • Dynamic OTA test methods • Test methods for STxMP	FR1 OTA: The work scope of FR1 OTA work can be discussed at a later stage (June'24) after completion of Rel-18 WIs performance part. FR2 OTA: Further studies on additional test methods are recommended. 0.5 – 1.0 TUs per meeting.

FR1 UE RF (1)

SRS Insertion Loss compensation and reporting

Motivation

- The support of 8RX UEs was introduced in the scope of Rel-18 NR FR1 UE WI (NR_ENDC_RF_FR1_enh2)
- Insertion Loss (IL) has a strong impact on the UL transmissions using 8RX architectures (R4-2303519)
- SRS Insertion loss for diversity branches might be different from the main branch and be up to 7.3 dB for 8RX UEs
- SRS antenna switching is an important feature to enable DL CSI acquisition for TDD systems
- SRS IL compensation is currently left up to UE implementation for power-limited UEs
- SRS IL may lead to an inaccurate channel estimation at gNB receiver, which could lead to incorrect SRS-based DL CSI estimation that would degrade the overall DL system performance (R1-2308458)
- No conclusions on enhanced solutions were reached for SRS IL compensation and handling in Rel-18



SRS IL compensation is left up to implementation for power-limited UEs (R4-2319810)

Objectives

- *Study and introduce solutions for SRS insertion loss compensation and UE assistance reporting for 2Rx, 4Rx and 8Rx FR1 UEs*

FR1 UE RF (2)

FR1 UEs with 6RX antennas

Motivation

- Support of operation with up to 8RX antennas for CPE/FWA type of devices was introduced in Rel-18, while smartphone type of devices are equipped with up to 4RX.
- Further enhancement of the number of RX antennas at the UE side for NR can be considered to meet the market requests.
- To allow more flexibility for UE implementations support of 6RX shall be considered for different form factors including smartphone and CPE/FWA type of devices.

Objectives

- *Enable 6Rx for smartphone/CPE/FWA form factors*
  - *Specify the UE RF requirements to support 6Rx*
  - *Specify RLM test cases with 6Rx*
  - *Specify UE demodulation performance and CSI requirements to support 6Rx (up to 4 MIMO layers)*

FR1 UEs with 3TX antennas on the same carrier

Motivation

- Support of operation with up to 4TX antennas for on a single carrier for CPE/FWA/vehicle/industrial devices was introduced in Rel-18
- Support of operation with up to 3TX antennas for band combinations with two bands was defined in Rel-18 for FWA type of devices.
- The existing specifications allow up to 2Tx operation for smartphone type of devices in the same carrier. Further enhancement of the number of TX antennas for smartphone type of UEs shall be considered to build the technology path for pre-6G device enhancements.

Objectives

- *Enable 3Tx for on a single carrier for smartphone/CPE/FWA form factors*

FR1 UE RF (3)

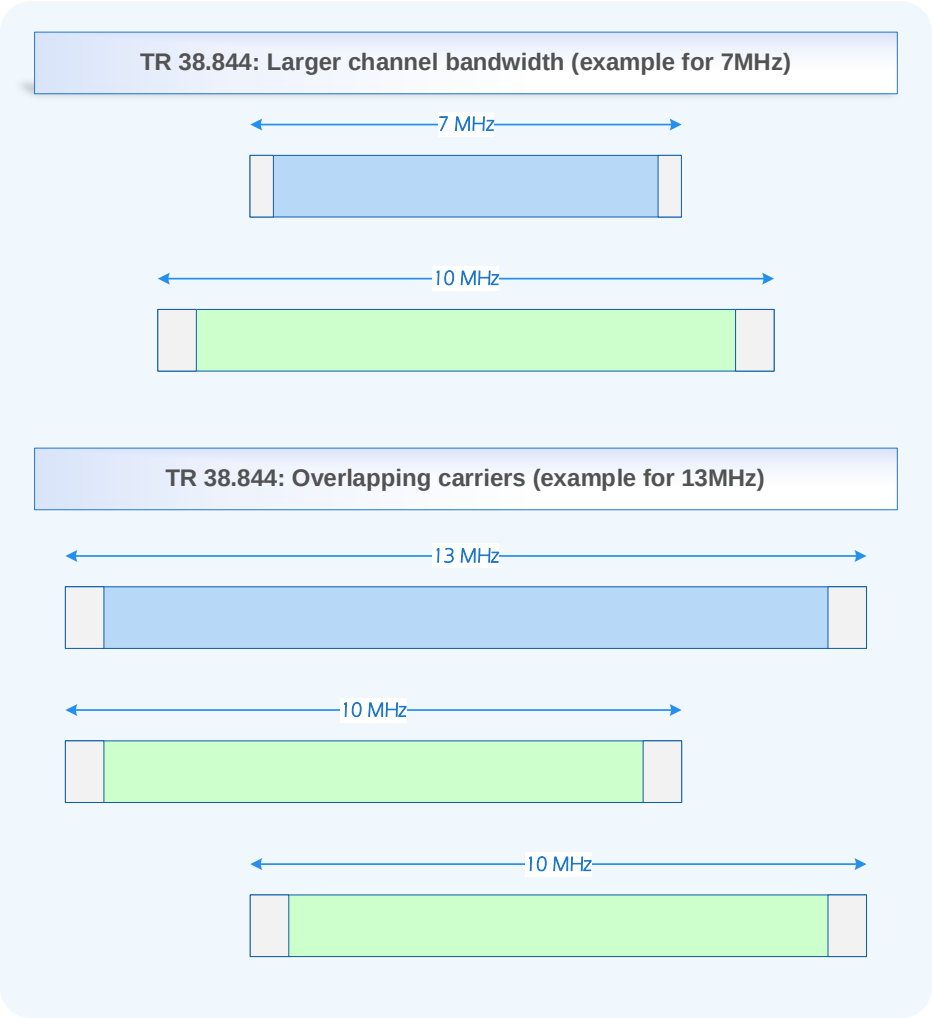
Irregular Channel Bandwidth

Motivation

- Increase spectrum utilization by allowing operators to flexibly use available spectrum blocks of any RB granularity instead of only traditional BW sizes at multiples of 5MHz.
- Several solutions were identified in the Rel-18 NR Irregular CBW SI (TR 38.844), but no follow up WI was approved.

Objectives

- Introduce specification support for the following irregular CBW methods
  - Larger Channel BW than licensed BW
  - Overlapping UE CBW from Network Perspective
- Address potential issues with initial access for irregular channel BW less than 10MHz



Other RF/OTA topics

FR1 HPUE evolution

Motivation

- Multiple proposals submitted for R19 workshop and RAN #101 on extending the HPUE for CA and other scenarios.
- The Rel-18 HPUE framework is very diverse and handled across multiple different Wis.
- **A single umbrella item (FR1 HPUE WI)** is recommended for all HPUE topics to efficiently control the work scope and benefit from joint approach for handling adjacent technical problems.

Prioritized objectives

- **HPUE with CA/DC (extension to additional scenarios)**

FR2 RF

Motivation

- In RAN#101 multiple enhancements for FR2 RF were proposed focusing on different aspects:
  - Enhancements for multi-panel simultaneous Tx and Rx UEs
  - Coverage / Power domain enhancements (UL Rx non-linearity compensation, MPR improvement)
  - Carrier aggregation enhancements (new types of combinations)
  - Higher-order modulation support for new bands and device types)
  - New devices (higher power)

Prioritized objectives

- **Enhancements for multi-panel simultaneous Tx and Rx UEs** (note: can be handled in a separate WI due to cross-area impacts, see RP-233688)
- **CA enhancements**

Other RF/OTA topics

BS RF evolution

Prioritized objectives

- **mmWave multi-band BS** : Rel-18 SI concluded on feasibility of multi-band mmWave BS implementations and a follow up Rel-19 WI is required to make the specification changes.
- **BS OTA test time reduction** (as proposed in RP-232383)

NTN HPUE

Extensive discussions on NTN HPUE took discussion in RAN'#101 in the scope of RAN2-led NTN work item.

Prioritized topics

- **NR NTN HPUE** with 26dBm (1st priority)
- **IoT NTN HPUE** (2nd priority)

FR2 OTA Test Methods

Recommend continuing the work on FR2 test methods enhancements to enable testing of new features and emulate realistic environment

Prioritized objectives:

- Dynamic OTA test methods
- Test methods for STxMP

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