**3GPP TSG-RAN WG4 Meeting #111 R4-2409889**

**Fukuoka City, Fukuoka, Japan, 20th – 24th May, 2024**

**Agenda item:** 10.12.3

**Source:** Samsung

**Title:** Way Forward for [110bis][313] NR\_duplex\_evo

**Document for:** Approval

# Introduction

This document is provided for capturing agreements and way forward on the WI of NR\_duplex\_evo based on the discussion in RAN4#110bis.

# For Agreement (already discussed in offline)

## General aspects (including RAN4 aspects for SBFD system parameters)

#### Issue 1-1-1: SBFD as band specific or general feature to all TDD bands

* Agreement:
  + SBFD is a feature which can potentially be utilized for all TDD band, under the following considerations:
    - Option 1: Declaration based method
      * The band supported for SBFD shall be declaration based
      * The channel bandwidth supported for SBFD shall be declaration based
        + The supported channel bandwidth can be impacted by the subband/guard band size discussion
    - Option 2: General principle but with consideration(s) for a specific band
      * General principle: The channel bandwidth shall be larger than X MHz
        + FFS the value of X

X can be different for high and middle TDD bands

* + - * + For a specific band, the following further restriction(s) can be considered:

Certain restriction can be provided by operator(s) for certain band

Other restrictions are not precluded.

#### Issue 1-1-3: Applicability of SBFD and non-SBFD requirements

* Agreement:
  + The conformance testing is needed for both SBFD and non-SBFD slots/symbols even though RF requirement might be same.

#### Issue 1-1-6: CLI handling impact on RF requirement

* Agreement:
  + The CLI handling impact on RF requirement:
    - Option 1: RAN4 define RF requirements for the frequency outside of wanted carrier based on no CLI handling as baseline.
    - Option 2: FFS CLI handling impact on RF requirements

#### Issue 1-2-2: How to handle guard band and subband configurations in specification

* Agreement:
  + Add clarification that only DUD and DU patterns are specified for the sub-band configuration for RF requirement definition.
  + FFS which channel bandwidth(s) or all channel bandwidths shall be defined for RF requirements
  + For a certain channel bandwidth which RAN4 agree to introduce RF requirements:
    - FFS RAN4 only define the UL/DL subbands configuration(s) for RF requirements
      * FFS which UL/DL subbands configuration(s) will be defined in RAN4
      * FFS Guard band size is declaration based and can be different for different BS classes
      * FFS the limitation on the maximum guard band
      * FFS possible range for UL/DL subband sizes
    - From RAN4 perspective, FFS restriction or no restriction to RAN1 definition for UL/DL subband sizes within the transmission configuration for this channel bandwidth, except:
      * 1RB granularity (already introduced in RAN1)

#### Issue 1-4-1: BS RF Specification structure for SBFD requirements

* Agreement:
  + How to introduce BS RF new requirements for SBFD-capable BS:
    - FFS firstly the feasibility of creating new and standalone sub-clauses (e.g., with a suffix) in TS 38.104 for SBFD-specific existing or new gNB RF requirements
      * FFS detailed how to implement such approach in the later phase of WI.
    - FFS secondly the new specification for SBFD-capable BS

## Modification of existing requirements - TX

#### Issue 2-1-1: PSD scaling for normal and SBFD slots/symbols

* Agreement:
  + PSD scaling for normal and SBFD slots/symbols:
    - No need to introduce the restriction on PSD scaling for normal and SBFD slots/symbols
    - Vendors can declare different TX power values for normal and SBFD slots/symbols

#### Issue 2-2-1: TX intermodulation requirement

* Agreement:
  + The transmitter intermodulation requirement is applicable in SBFD slots/symbols:
    - Follow the existing requirement
    - No receiver requirement is specified.

#### Issue 2-3-1: The necessity of Co-location ACLR requirement

* Agreement:
  + RAN4 further study the ACLR requirement by applying the existing ACLR requirement for SBFD-capable BS in SBFD symbols/slots
    - FFS the applicable deployment scenario where different ACLR requirement could be useful, whether it justify the different ACLR requirement.

# For Agreement (not yet fully discussed in offline)

## Modification of existing requirements - TX

#### Issue 2-3-2: OBUE

* Agreement:
  + Further discuss how to define OBUE requirement for SBFD capable BS in order to ensure feasible co-existence performance for SBFD BSs operating in adjacent frequency.

## Potentially new requirements for SBFD

#### Issue 4-3-1: Requirement for transient period between SBFD and non-SBFD

* Agreement:
  + Requirement for transient period between SBFD and non-SBFD:
    - The existing TDD BS transmitter transient period, i.e., 10us for FR1 and 3us for FR2-1, can be reused for all four cases:
      * Case-A (SBFD to DL): transmitter OFF-to-ON in SBFD UL band and guard band(s)
      * Case-B (SBFD to UL): transmitter ON-to-OFF in SBFD DL band
      * Case-C (DL to SBFD): transmitter ON-to-OFF in SBFD UL band and guard band(s)
      * Case-D (UL to SBFD): transmitter OFF-to-ON in SBFD DL band
    - Location of transient period between SBFD and non-SBFD:
      * The transmitter transient period shall be located within the SBFD slot

#### Issue 4-3-2: Requirement for transient period between different SBFD configurations

* Agreement:
  + FFS requirement for transient period between different SBFD configurations

# Way Forward (new)

## Modification of existing requirements - RX

#### Issue 3-4-1 & Issue 3-4-2: Necessity for additional co-existence study for In-band blocking and Scenario/Case for additional co-existence study (if agreed)

* Way forward:
  + ~~The group will define the case/scenarios for additional co-existence, with the assumptions to be discussed in details.~~
  + Companies are encouraged to provide the evaluation results for in-band blocking in the next meeting:
    - The scenarios to be studied are Scenario 1, 3, 5, 6, 9, defined in TR 38.858
    - The case to be studied is Case 3 (TDD DL to SBFD UL subband).
    - FFS the power level which should be collected from the simulation results to derive in-band blocking levels:
      * Option-1: absolute power level of interference from adjacent channel only, i.e., SBFD network internal interference should not be considered in the simulation, from the perspective of definition of in-band blocking requirement.
      * Other options are not precluded.
    - FFS the reference point for the power level which should be before or after RX beamforming.
      * Option-1: after RX subarray beamforming gain and before array gain, i.e, at TAB.
    - FFS different grid-shift values should be considered.
      * Option-1: 10%.
      * Option-2: Other percentage values are not precluded.
    - FFS how to use the power level probability distributions to derive the in-band blocking levels
      * Option-1: Find the X% tile of the UL SBFD wideband received power CDF to define the blocking requirement in each of the down-selected scenarios.
        + FFS the value of X
        + FFS the impact of CLI handling scheme introduced in RAN1 which can be used for adjacent channel CLI mitigation.