**3GPP TSG RAN meeting #105 RP-24xxxx**

**Melbourne, Australia, September 9 – 12, 2024**

## Status Report to TSG

**Agenda item:** 9.3.1.2

|  |  |
| --- | --- |
| **WI / SI Name** | Evolution of NR duplex operation: Sub-band full duplex (SBFD) |
| included in this status report | Study Item: No | Core part: Yes | Performance part:Yes | Testing part:No |
| **Acronym** | NR\_duplex\_evo |
| **Unique ID** | 1020090 |
| **TSG Tdoc of latest approved WI/SI description (if any)** | RP-241614 |
| **Target Completion Date****(indicate if changed)** | Study Item: n/a | Core part: 09/2025 | Performance part: 03/2026 | Testing part: n/a |
| **Overall Completion level** | Study Item: n/a | Core part: 28% | Performance Part: 0% | Testing part: n/a |

Note: Overall completion level percentage numbers should use one of the colors below:

* xx%: Normal progress, no RAN plenary action needed
* xx%: Progress behind schedule, may need RAN plenary intervention. If so, SR should clearly define requested action
* xx%: Progress critically behind, RAN plenary shall intervene. SR should define requested action

**Source:**

|  |  |
| --- | --- |
| **Leading WG** | RAN1 |
| **Rapporteur** | **Name** | Xinghua Song, He (Jackson) Wang |
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## 1 Work plan related evaluation

|  |  |
| --- | --- |
| **Do you want to modify the time budget for this WI/SI compared to what was endorsed at the last RAN meeting?** | No |

*If you answered No: Then please remove the Excel file from the zip file of this status report.*

*If you answered Yes: Then please fill out the attached Excel template to request a modification of the time budgets for your WI /SI. The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI. The basis are the endorsed time budgets of the last RAN meeting. Please highlight all changes of the values.
 One time unit (TU) corresponds to ~ 2 hours in the meeting.
 If this status report covers a WI with Core and Performance part, then please have one line for each in the attached Excel table.
 Note: If no Excel table is attached, then this means no time budget change.*

**Additional explanations/motivations for the time budget changes in the attached Excel table:**

## 2. Detailed progress in RAN WGs since last TSG meeting (for all involved WGs)

 NOTE: Agreements and Open issues impacted cross-TSG aspects shall be explicitly highlighted

## 2.1 RAN1

#### 2.1.1 Agreements

**In RAN1#118, the following agreements were made.**

**SBFD TX/RX/measurement procedures**

**Agreement**

For configuration of SBFD symbols within a TDD-UL-DL pattern period, the following parameters are supported

* A starting slot index
* A starting symbol index within the starting slot
* An ending slot index
* An ending symbol index within the ending slot

**Working Assumption**

For cell-specific configuration of frequency locations of SBFD UL subband, for each SCS configuration in *SCS-SpecificCarrierList* for UL, starting RB and bandwidth of SBFD UL subband are indicated by a RIV-based indication as defined in 38.214 setting $N\_{BWP}^{size}$=275.

For cell-specific configuration of frequency locations of SBFD DL subband(s), for each SCS configuration in *SCS-SpecificCarrierList* for DL, starting RB and bandwidth of each SBFD DL subband are indicated by a RIV-based indication as defined in 38.214 setting $N\_{BWP}^{size}$=275.

* One or two SBFD DL subbands can be configured

**Conclusion**

If PRG is determined as wideband, UE does not expect to be scheduled with non-contiguous PRBs in SBFD symbols.

**Agreement**

For collision Case 1/2/4 with DL receptions and/or UL transmissions with repetitions, the same collision handling rules and timeline for DL receptions and UL transmissions without repetitions are applied for each repetition.

**Agreement**

Support separate configurations of FH offsets for SBFD symbols and non-SBFD symbols, for a type 1 CG PUSCH with Configuration 2.

* Introduce a new RRC parameter in *rrc-ConfiguredUplinkGrant* in *ConfiguredGrantConfig* to configure FH offset for SBFD symbols.

Support separate configurations of FH offset lists for SBFD symbols and non-SBFD symbols, for PUSCH scheduled by DCI and type 2 CG PUSCH.

* Introduce new RRC parameters in *PUSCH-Config* to configure a set of FH offsets for SBFD symbols.
	+ Support separate configurations for DCI format 0\_2 and other DCI formats as legacy
	+ FFS: The number of bits used to indicate FH offset in DCI is determined as legacy

UE applies the FH offset/FH offset list according to the symbol type of the PUSCH transmissions.

FFS UE behaviour when FH offset/FH offset list is not provided for SBFD symbols, e.g. FH is disabled for PUSCH transmissions in SBFD symbols, or FH offset/FH offset list for non-SBFD symbols are applied for SBFD symbols etc.

**Agreement**

Support separate frequency configurations for SBFD symbols and non-SBFD symbols in the same *PUCCH-Resource*.

* *pucch-ResourceId* is not separately configured for SBFD and non-SBFD symbols
* Support separate configurations of *startingPRB* and *secondHopPRB* for SBFD symbols and non-SBFD symbols
	+ Introduce new RRC parameters in *PUCCH-Resource* to configure starting PRB and second hop PRB for SBFD symbols
* FFS whether to support separate configurations of *intraSlotFrequencyHopping* for Configuration 1 or for both Configuration 1 and 2
* No change on the maximum number of PUCCH resources supported by a UE
* Above PUCCH resources with the same *pucch-ResourceId* is counted as 1 resource

FFS: UE behaviour when no separate configuration is provided for SBFD symbols, e.g. PUCCH transmissions in SBFD symbols for this *pucch-ResourceId* is not expected, or configurations for non-SBFD symbols are applied for SBFD symbols (in which case it is not expected that the configurations would lead to unexpected transmissions) etc.

**Working Assumption**

For an SPS PDSCH configuration without repetitions, if the reception occasions are across SBFD symbols and non-SBFD symbols where each reception occasion has either all SBFD or all non-SBFD symbols (i.e. Configuration 2), PDSCH repetitions across SBFD symbols and non-SBFD symbols in different slots where each repetition has either all SBFD or all non-SBFD symbols (i.e. Configuration 2), and for multi-PDSCH scheduled by a single DCI across SBFD symbols and non-SBFD symbols, where each PDSCH within a slot has either all SBFD or all non-SBFD symbols (i.e. Configuration 2),

* Option 5: Only the assigned PRBs within DL usable PRBs in SBFD symbols are considered to be valid.
	+ For SPS PDSCH, FFS whether the number of PRBs for TBS determination is based on assigned PRBs or assigned PRBs within DL usable PRBs only
	+ For PDSCH repetitions, FFS whether the number of PRBs for TBS determination is based on assigned PRBs, or based on assigned PRBs within DL usable PRBs only, or based on assigned PRBs within DL usable PRBs of the first repetition.
	+ For multi-PDSCH scheduled by a single DCI, FFS whether the number of PRBs for TBS determination is based on assigned PRBs or assigned PRBs within DL usable PRBs only.

**Agreement**

For Configuration 1: The transmissions/receptions are restricted to SBFD symbols only or non-SBFD symbols only, the valid symbol type is determined as following.

* For semi-statically configured transmissions/receptions without activation DCI, the valid symbol type is explicitly configured by RRC.
	+ It is not applicable to PDCCH
* For dynamically scheduled transmissions/receptions, the valid symbol type is determined based on the symbol type of the first transmission/reception.
* For SP-CSI on PUCCH or PUSCH, type 2 CG PUSCH, SPS PDSCH and semi-persistent SRS, down-select from the following options:
	+ Option 1:
		- The valid symbol type for SP-CSI on PUCCH or PUSCH is explicitly configured in *CSI-ReportConfig*.
		- The valid symbol type for type 2 CG PUSCH is explicitly configured in *ConfiguredGrantConfig*.
		- The valid symbol type for SPS PDSCH is explicitly configured in *SPS-Config*.
		- The valid symbol type for semi-persistent SRS is explicitly configured in [*SRS-Config* /*SRS-ResourceSet*/*SRS-Resource*].
	+ Option 2:
		- The valid symbol type for SP-CSI on PUCCH or PUSCH is determined based on the symbol type of the first PUSCH/ PUCCH after activation.
		- The valid symbol type for type 2 CG PUSCH is determined based on the symbol type of the first CG PUSCH associated with activation DCI.
		- The valid symbol type for SPS PDSCH is determined based on the symbol type of the first SPS PDSCH associated with activation DCI.
		- The valid symbol type for semi-persistent SRS is determined based on the symbol type of the first SRS after activation.

**Agreement**

For UL transmissions and DL receptions across SBFD symbols and non-SBFD symbols in different slots with Configuration 1,

* For PUSCH repetition type A with available slot counting, TBoMS and PUCCH repetitions, UE postpones transmissions in the invalid symbol type.
* For CG PUSCH and SPS PDSCH, P/SP SRS, P/SP CSI-RS, P/SP PUCCH, SP-CSI on PUSCH, PUSCH repetition type A without available slot counting, multi-PUSCH/PDSCH scheduled by a single DCI, and PDSCH repetitions, transmissions/receptions in the invalid symbol type are dropped.

**Agreement**

For a CG PUSCH configuration without repetitions, if the transmission occasions are across SBFD symbols and non-SBFD symbols where each transmission occasion has either all SBFD or all non-SBFD symbols (i.e. Configuration 2), for PUSCH repetition type-A across SBFD symbols and non-SBFD symbols in different slots where each repetition has either all SBFD or all non-SBFD symbols (i.e. Configuration 2), and for multi-PUSCH scheduled by a single DCI across SBFD symbols and non-SBFD symbols, where each PUSCH within a slot has either all SBFD or all non-SBFD symbols (i.e. Configuration 2), and for TBoMS across SBFD symbols and non-SBFD symbols in different slots, where each transmission within a slot has either all SBFD or all non-SBFD symbols (i.e. Configuration 2),

* Option 2: Single resource configuration/indication for non-SBFD symbols and RB offset(s) configuration/indication/determination to determine frequency resource for SBFD symbols
	+ The numbers of PRBs are the same for PUSCH transmissions in SBFD symbols and PUSCH transmissions in non-SBFD symbols

**Agreement**

For a single TRP scenario, for separate UL power control for PUSCH/PUCCH/SRS transmissions in SBFD symbols and non-SBFD symbols based on unified TCI state framework, down-select from the following options to support separate configurations of UL power control parameters.

* Option 1: One TCI codepoint is mapped to separate TCI states for SBFD symbols and non-SBFD symbols respectively
	+ FFS: No RRC impact
	+ FFS: New MAC CE or reuse existing MAC CE
* Option 2: Same unified TCI state is associated with separate UL power control parameters for SBFD symbols and non-SBFD symbols
	+ FFS whether a new *Uplink-powerControlId* is introduced for SBFD symbols, or new *P0AlphaSet*s are introduced in *Uplink-powerControl* for SBFD symbols for PUSCH, PUCCH and SRS respectively
	+ FFS: Impact on MAC CE
* Option 3: Same unified TCI state is associated with same UL power control parameters for SBFD symbols and non-SBFD symbols
	+ A power offset is introduced for transmission in SBFD symbols for PUSCH, PUCCH, and SRS
		- FFS: Same offset or different offsets for all channels
	+ FFS: RRC or MAC CE introduced to convey power offset
* FFS whether the maximum number of closed power control loops is increased to be more than 2.
* FFS: Whether/How to handle the case where UL power control is not associated within TCI state

**SBFD random access operation**

**Agreement**

Extend the previous agreements for UEs in RRC\_CONNECTED mode to UEs in RRC\_IDLE/INACTIVE mode.

**Agreement**

For RAN1 discussion purpose, ‘additional-ROs’ is defined as the following:

* For RACH configuration Option 1, additional-ROs include the ROs in SBFD symbols configured as downlink by *tdd-UL-DL-ConfigurationCommon*, and the ROs across SBFD symbols configured as downlink and SBFD symbols configured as flexible by *tdd-UL-DL-ConfigurationCommon*.
* For RACH configuration Option 2, additional-ROs are the ROs configured by the additional RACH configuration.

**Agreement**

Regarding RO validation for RACH configuration Option 1 with Alt 1-1, an RO across SBFD symbols configured as downlink and SBFD symbols configured as flexible by *tdd-UL-DL-ConfigurationCommon* is treated the same as an RO in SBFD symbols configured as downlink by *tdd-UL-DL-ConfigurationCommon*.

* The RO includes at least one DL symbol configured by *tdd-UL-DL-ConfigurationCommon*

**Agreement**

For RACH configuration Option 1 with Alt 1-1, for determination of lowest RO of additional-ROs in SBFD symbols, select one from the following alternatives.

* Alt 1: Theparameter *msg1-FrequencyStart* in *rach-ConfigCommon* is applied with no reinterpretation.
* Alt 2-1: Theparameter *msg1-FrequencyStart* in *rach-ConfigCommon* is reinterpreted as the frequency offset of lowest RO in frequency domain with respective to the lowest PRB of UL usable PRBs.
* Alt 2-2: Use a fixed value (e.g., 0) for the frequency offset of lowest RO in frequency domain with respective to the lowest PRB of UL usable PRBs.
* Alt 2-3: The frequency offset of lowest RO in frequency domain with respective to the lowest PRB of UL usable PRBs is equal to *mod* (*msg1-FrequencyStart*, bandwidth of UL usable PRBs).
* Alt 2-4: The frequency offset of lowest RO in frequency domain with respective to the lowest PRB of UL usable PRB is $\left⌊msg1-FrequencyStart\*scaling factor\right⌋$, where the $scaling factor=\frac{UL usable PRB size}{UL BWP size}$.
* Note: Other alternatives are not precluded

**Agreement**

For RACH configuration Option 1 with Alt 1-1, for the ROs in SBFD symbols configured as downlink by *tdd-UL-DL-ConfigurationCommon,* support the following conditions on top of what was agreed in RAN1#116bis for RO validation.

* Condition#1: A valid RO starts at least Ngap symbols after a last downlink non-SBFD symbol.
* Condition#2: A valid RO starts at least Ngap symbols after the SSB.
* Note: The Ngap here is the same as the Ngap in the current specification

**Agreement**

For RACH configuration Option 1 with Alt 1-1, the legacy SSB-RO mapping rule is reused for additional-ROs.

* FFS the association period and association pattern period.

**Agreement**

For SBFD aware UEs, at least support the following:

* PRACH transmission with preamble repetitions within additional-Ros (not across additional-Ros and legacy Ros)

Note: SBFD aware UEs support PRACH transmission with preamble repetitions only within legacy-ROs (not across additional-Ros and legacy Ros) as in legacy releases.

**Agreement**

For RACH configuration Option 2, and for interpretation of the parameter *prach-ConfigurationIndex* provided by the additional RACH configuration,

* For FR2, use existing random access configurations table for unpaired spectrum (i.e., Table 6.3.3.2-4 in TS38.211)
	+ FFS whether to introduce new parameter(s) to determine the slot number for ROs in SBFD symbols.
* **Working Assumption**: For FR1, use existing random access configurations table for unpaired spectrum (i.e., Table 6.3.3.2-3 in TS38.211)
	+ FFS whether to introduce new parameter(s) to determine the subframe number for ROs in SBFD symbols.

**Agreement**

For SBFD-aware UEs and RACH configuration Option 1 with Alt 1-1, consider the following options for initial PRACH transmission attempt in one random access procedure:

* Option 2: Select one type between legacy-ROs and additional-ROs based on certain specified/configured conditions/prioritizations
* Option 3: It’s up to UE implementation to select one type between legacy-ROs and additional-ROs

**Agreement**

For SBFD-aware UEs and RACH configuration Option 2, consider the following options for initial PRACH transmission attempt in one random access procedure:

* Option 2: Select one type between legacy-ROs and additional-ROs based on certain specified/configured conditions/prioritizations
* Option 3: It’s up to UE implementation to select one type between legacy-ROs and additional-ROs

**Agreement**

For SBFD aware UEs and RACH configuration Option 1 with Alt 1-1, consider the following options for PRACH transmission re-attempt in one random access procedure:

* Option 1: Always use ROs of the same type (i.e., legacy-RO or Additional-RO) as the earlier PRACH transmission for the rest of the random access procedure
* Option 2: First use ROs of the same type as the earlier PRACH transmission for a certain number of times, and if certain conditions are met, then use ROs of the other type for the rest of the random access procedure
* Option 3: Independently select legacy-ROs or additional-ROs for each PRACH transmission re-attempt in one random access procedure

**Agreement**

For SBFD aware UEs and RACH configuration Option 2, consider the following options for PRACH transmission re-attempt in one random access procedure:

* Option 1: Always use ROs of the same type (i.e., legacy-RO or Additional-RO) as the earlier PRACH transmission for the rest of the random access procedure
* Option 2: First use ROs of the same type as the earlier PRACH transmission for a certain number of times, and if certain conditions are met, then use ROs of the other type for the rest of the random access procedure
* Option 3: Independently select legacy-ROs or additional-ROs for each PRACH transmission re-attempt in one random access procedure

**Agreement**

For RACH configuration Option 2, support Alt 2-3 (the additional-ROs in non-SBFD symbols configured by additional RACH configuration are invalid for SBFD-aware UEs).

Working Assumption

For RACH configuration Option 2, use legacy SSB-RO mapping rule for the additional-ROs configured by the additional RACH configuration, separate from the SSB-RO mapping for the legacy-ROs configured by the legacy RACH configuration.

* FFS: Whether/How to handle the case where the legacy ROs overlap with additional ROs

**CLI handling**

**Agreement**

For the time location configuration of UL resource muting for a PUSCH, one of the following options is selected

* Option 1: Semi-statically configure the position for each of the up to two UL muting symbols within a slot
* Option 2: Semi-statically configure X (X>=1) possible positions for each of the up to two UL muting symbols within a slot

Note: Above has no implication on how UL muting symbol indication/determination is done.

Note: For both options, there will at most up to 2 UL muting symbols for the PUSCH.

**Agreement**

For the reference point of time location of UL resource muting for PUSCH, Option 1 is supported

* Option 1: Starting symbol of a slot for both PUSCH mapping type A and type B

**Agreement**

Send an LS to RAN3 with the following information (cc: RAN2)

~~From RAN1 perspective, support information exchange among gNBs of measurement resource configuration for both SSB and periodic NZP-CSI-RS.~~

From RAN1 perspective, exchange among gNBs of the configuration info for a set of one or more periodic ~~multi-port~~ NZP CSI-RS resources (relevant IE in 38.331 are *NZP-CSI-RS-Resource, NZP-CSI-RS-ResourceSet*) is supported. ~~Each resource in the set consist of P ports, where 1 ≤ P ≤ Pmax, and Pmax is the largest number of ports for a CSI-RS resource supported in RAN1 specifications (128 in Rel-19).~~

Strongest DL beam information in the context of NZP-CSI-RS is defined as a CSI-RS Resource Indicator (CRI) value. CRI is a relative index in the range [1 .. N], where N is the number of CSI-RS resources within a set of resources for which the configuration is provided to a gNB.

Strongest DL beam information in the context of SSBs is defined as an SSB index. SSB index is an absolute index among the SSB(s) for which the configuration is provided to a gNB.

Note: RAN1 will not discuss information exchange among gNBs for gNB-gNB CLI handling unless there is an LS from RAN3.

**Agreement**

LS to RAN3 on PHY/L1 aspects of information exchange among gNBs for CLI mitigation is agreed.

Final LS is in R1-2407533.

**Agreement**

For L1 UE-to-UE CLI measurement and reporting, CLI measurements is performed within the active DL BWP and the following are supported

* Method#1: UE measures RSSI within DL subband
* Method#2: UE measures RSRP of aggressor UE within UL subband
* FFS: Method#3: UE measures RSSI within UL subband

**Agreement**

For frequency resource allocation of a CLI-RSSI measurement resource, the following are supported

* Measurement resource type#1: One CLI-RSSI measurement resource is configured within a DL subband
* Measurement resource type#2: One CLI-RSSI measurement resource is configured across two DL subbands
* FFS: Number of resources that can be configured
* FFS: UE behavior for measurement

**Agreement**

To determine the value of k in $Pri\_{i,CSI}\left(y,k,c,s\right)$ for CSI reports carrying L1 UE-to-UE CLI report, the following options are considered

* Option 1-1: Reusing existing *k* value, *k* = 0
* Option 1-2: Reusing existing *k* value, *k* = 1
* Option 2: Adding a new *k* value other than 0 and 1.

**Agreement**

For L1 UE-to-UE CLI measurement and reporting, the following are supported

* Wideband CLI-RSRP reporting
* Wideband CLI-RSSI reporting
* FFS: Subband CLI-RSSI reporting

**Agreement**

For L1 UE-to-UE CLI measurement and reporting, support two additional report quantities {‘cli-RSSI’, ‘cli-SRS-RSRP’} to the higher layer parameter *reportQuantity.*

* FFS: configuration of number of reported CLI resources in the *reportConfig*
* FFS: reporting criteria

#### 2.1.2 Remaining Open issues

**SBFD TX/RX/measurement procedures**

* + Remaining details on semi-static indication of frequency domain location of SBFD subbands to UEs in RRC\_CONNECTED mode
	+ Remaining details on UE transmission, reception and measurement behavior and procedures in SBFD symbols and/or non-SBFD symbols for SBFD aware UE
	+ Remaining details on transmission and reception behaviours on SBFD subbands configured in DL and/or flexible symbol indicated by *TDD-UL-DL-ConfigCommon*
		- * UL transmissions within UL subband only
			* DL receptions within DL subband(s) only, except for CLI measurement by the UE outside of the DL subbands
	+ Remaining details on enhancement on resource allocation in frequency domain in SBFD symbols, including
		- * resource allocation in frequency domain for PDSCH/CSI-RS across two DL subbands in SBFD symbols
			* handling of unaligned boundaries between SBFD subband(s) and RBG, CSI reporting subband, CSI-RS resource, PRG
	+ Remaining details on enhancements on physical channels/signals and procedure across SBFD symbols and non-SBFD symbols in different slots, where each transmission/reception within a slot has either all SBFD or all non-SBFD symbols, including
		- * resource allocation in frequency domain for transmission or reception in SBFD symbols and non-SBFD symbols with different available frequency resource in different slots
			* CSI report of which associated CSI-RS instances occur in both SBFD symbols and non-SBFD symbols in different slots
	+ Remaining details on configurations for SRS, PUCCH and PUSCH on SBFD symbols and non-SBFD symbols, e.g., resources, frequency hopping parameters, UL power control parameters and/or beam/spatial relation
	+ Remaining details on collision handling between DL reception in DL subband(s) and UL transmission in UL subband in a SBFD symbol

**SBFD random access operation**

* + Remaining details on SBFD operation to support random access in SBFD symbols by UEs in RRC\_CONNECTED mode and RRC\_IDLE/INACTIVE mode

**CLI handling**

* + Remaining details on UL resource muting for PUSCH, including
		- * Indication/determination of UL resource muting for PUSCH based on semi-static configuration, assuming comb-2 for both DFT-S-OFDM and CP-OFDM in each allocated PRB and up to 2 symbols in time domain
			* PUSCH resource mapping, i.e., rate-matching around the muted REs
			* UCI resource determination in symbols with muted REs
	+ Remaining details on L1 based UE-to-UE CLI measurement and reporting based on existing CSI framework, including
		- * Periodic, semi-persistent, or aperiodic measurement resource (set), i.e., SRS-RSRP resource or CLI-RSSI resource, and configuration/determination of ‘typeD’ QCL assumptions for the CLI measurement resource
			* At least aperiodic reporting
			* New report quantities, e.g., L1-SRS-RSRP, L1-CLI-RSSI and/or measurement resource indices
			* UCI bits generation
			* Priority rules for multiple CSI reporting

## 2.2 RAN2

#### 2.2.1 Agreements

**In RAN2#127, the following agreements were made.**

**Random access in SBFD**

* Working assumption: Random access procedure in SBFD symbols is supported for all the existing RACH trigger events.
* RAN2 assume RACH configuration for SBFD via SIB and/or dedicated RRC signalling is supported. Detailed signalling FFS.
* RAN2 to strive for a common SBFD CBRA framework independent of RRC state.
* FFS whether/how early indication is used during a SBFD RA procedure.
* RAN2 focus on 4-step RACH for SBFD RA, FFS on 2-step if needed.

**Other aspects**

* Cell-specific SBFD time/frequency configuration is provided by SIB1 (or via dedicated signalling to covey cell specific configuration). FFS on UE specific dedicated RRC configuration if needed, pending on RAN1 progress.

#### 2.2.2 Remaining Open issues

* + Remaining details on SBFD operation to support random access in SBFD symbols by UEs in RRC\_CONNECTED mode and RRC\_IDLE/INACTIVE mode
	+ Other remaining details that have RAN2 impact such as SBFD time/frequency subbands configuration

## 2.3 RAN3

#### 2.3.1 Agreements

#### 2.3.2 Remaining Open issues

Not started yet.

## 2.4 RAN4

#### 2.4.1 Agreements

**In RAN4#112, the following agreements were made.**

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

**Band/channel bandwidth support for SBFD**

Agreement:

* Declaration-based method, and SBFD is possible to be used on any TDD band, with the following principle:
	+ The supported channel bandwidth(s) is declared by gNB vendors
	+ The supported channel bandwidth(s) is from existing channel bandwidth defined in TS 38.104
	+ The supported channel bandwidth shall be no less than X MHz
		- X = [20]
			* For next meeting, we will further discuss the potential to increase the value of X beyond X = [20]. Companies are encouraged to bring t-docs to discuss the benefits or drawback to increase this value.
		- FFS for some specific band if this principle rules out this band, which is required for SBFD by operators.
		- FFS how to implement in the spec:
			* Option 1: To include the following text in Clause 5.2 in TS 38.104: subband full duplex can be applied to TDD bands with channel bandwidth >= X MHz, given in Table 5.2-1.
			* Option 2: Add SBFD entry in Table 5.2-1 in Clause 5.2 in TS 38.104 for the TDD bands with channel bandwidth >= X MHz.

Agreement:

* BS channel bandwidth for SBFD-capable BS:
	+ *BS channel bandwidth for SBFD-capable BS*: RF bandwidth supporting a single NR RF carrier with the transmission bandwidth configured in the uplink or downlink or SBFD operation.
	+ The existing definition of *BS channel bandwidth* (for information only):
		- BS channel bandwidth: RF bandwidth supporting a single NR RF carrier with the transmission bandwidth configured in the uplink or downlink.

**Transmission bandwidth configuration for SBFD**

Agreement:

* BS transmission bandwidth configuration for SBFD:
	+ *BS transmission bandwidth configuration for SBFD* NRB,SBFD: set of resource blocks located within the BS channel bandwidth which may be used for transmitting or/and receiving by the BS.
	+ *The transmission bandwidth configuration for SBFD* NRB,SBFD for each BS channel bandwidth and subcarrier spacing shall reuse the values for BS transmission bandwidth configuration in table 5.3.2-1 for FR1 and table 5.3.2-2 for FR2-1.
	+ FFS a corresponding figure for SBFD is needed
	+ The existing definition of *BS transmission bandwidth configuration* (for information only):
		- BS transmission bandwidth configuration: set of resource blocks located within the BS channel bandwidth which may be used for transmitting or receiving by the BS.

**DL/UL subband configurations support for SBFD**

Agreement:

* Transmission bandwidth configuration for SBFD UL/DL subband:
	+ NRB,SBFD,DL: Transmission bandwidth configuration for SBFD DL subband, expressed in resource blocks.
	+ NRB,SBFD,UL: Transmission bandwidth configuration for SBFD UL subband, expressed in resource blocks.
* Guardband between SBFD UL and DL subband:
	+ NRB,SBFD,GB: The size of guardband between SBFD UL subband and DL subband, expressed in resource blocks.

Agreement:

* To specify DL/UL subband configuration in BS RF requirements, the following 3 options for DL/UL subband configuration are identified:
	+ Option-1 (with the least flexibility):
		- Only a number of selected DL/UL subband configurations are specified for RAN4 BS RF requirement.
		- Example (given in Nokia Tdoc R4-2413238):
			* For FR1 DUD configuration in 100 MHz channel and 30 kHz SCS: < NRB,SBFD,DL, NRB,SBFD,UL, NRB,SBFD,GB > = <106, 51, 5>
			* For FR1 DU or UD configuration in 100 MHz channel and 30 kHz SCS: < NRB,SBFD,DL, NRB,SBFD,UL, NRB,SBFD,GB > = <217, 51, 5>
	+ Option-2 (with the middle flexibility):
		- Option-2a:
			* DL subband configuration shall be selected from the existing values of BS transmission bandwidth configuration, as provided in Table 5.3.2-1 for FR1 and Table 5.3.2-2 for FR2-1.
			* UL subband size and guardband size(s) depends on BS implementation
			* Example (FR1 DU or UD in 100MHz and 30kHz SCS, 80-20MHz case): As long as BS transmission configuration for SBFD shall be 273 (NRB,SBFD for 100MHz and 30kHz SCS) and NRB,SBFD,DL is selected from Table 5.3.2-1 (according to the 30kHz SCS), from BS RF requirement perspective, no limitation on the values NRB,SBFD,UL and NRB,SBFD,GB.
		- Option-2b:
			* UL subband configuration shall be selected from the existing values of BS transmission bandwidth configuration, as provided in Table 5.3.2-1 for FR1 and Table 5.3.2-2 for FR2-1.
			* DL subband size(s) and guardband size(s) depends on BS implementation
			* Example (FR1 DU or UD in 100MHz and 30kHz SCS, 80-20MHz case): As long as BS transmission configuration for SBFD shall be 273 (NRB,SBFD for 100MHz and 30kHz SCS) and the value of NRB,SBFD,UL is selected from Table 5.3.2-1 (according to the 30kHz SCS), from BS RF requirement perspective, no limitation on the values NRB,SBFD,DL and NRB,SBFD,GB.
	+ Option-3 (with the highest flexibility):
		- No restriction on the subband sizes, i.e., RF requirement shall be specified to enable all DL and UL subband configurations (and implicitly guardband configurations).
		- Example (FR1 DU or UD in 100MHz and 30kHz SCS): From BS RF requirement perspective, no limitation on the values of NRB,SBFD,DL, NRB,SBFD,UL, NRB,SBFD,GB
* FFS how to implement BS RF requirements based on the above options for different levels of flexibility.
* BS transmission configuration in BS RF requirements (*for information only*):

Table 5.3.2-1: *Transmission bandwidth configuration* NRB for FR1

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SCS (kHz)** | **3****MHz** | **5****MHz** | **10****MHz** | **15****MHz** | **20 MHz** | **25 MHz** | **30****MHz** | **35****MHz** | **40 MHz** | **45 MHz** | **50 MHz** | **60 MHz** | **70****MHz** | **80 MHz** | **90****MHz** | **100 MHz** |
|  | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB | NRB |
| 15 | 15 | 25 | 52 | 79 | 106 | 133 | 160 | 188 | 216 | 242 | 270 | N/A | N/A | N/A | N/A | N/A |
| 30 | N/A | 11 | 24 | 38 | 51 | 65 | 78 | 92 | 106 | 119 | 133 | 162 | 189 | 217 | 245 | 273 |
| 60 | N/A | N/A | 11 | 18 | 24 | 31 | 38 | 44 | 51 | 58 | 65 | 79 | 93 | 107 | 121 | 135 |

Table 5.3.2-2: *Transmission bandwidth configuration* NRB for FR2-1

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| SCS (kHz) | 50 MHz | 100 MHz | 200 MHz | 400 MHz |
|  | NRB | NRB | NRB | NRB |
| 60 | 66 | 132 | 264 | N/A |
| 120 | 32 | 66 | 132 | 264 |

**Restriction on guardband size for SBFD**

Agreement:

* Restriction on guardband size for SBFD:
	+ Option 1: Definition based on existing guardbands requirement in TS38.104 (i.e., minimum guardband)
	+ Option 2: Typical values of guardband defined for requirement, but the guardband should not be restricted to those in RAN4 specifications.
	+ Option 3: No restriction (manufacturer declaration-based), but with restriction on maximum allowed number of RBs for guardband:
	+ Option 3a: No restriction (manufacturer declaration-based), and no restriction on maximum/minimum number of RBs for guandband:

**SBFD time-domain terminology**

Agreement:

* When specifying RAN4 requirements for SBFD-capable BS, SBFD symbols (instead of SBFD slots/symbols) shall be used to designate the time domain duration in which SBFD related requirements is applied.

**CLI handling impact on RF requirement**

Agreement:

* RAN4 shall define RF requirements for the frequency outside of wanted carrier based on no gNB-to-gNB CLI handling as baseline
	+ FFS Revisit particular RF requirements pending on RAN1 progress on the gNB-to-gNB CLI handling work.

**BS RF Specification structure for SBFD requirements**

Way forward:

* RAN4 shall study how to introduce BS RF new requirements for SBFD-capable BS:
	+ Option 1: Embedding the corresponding SBFD RF requirements in the corresponding section of TS 38.104 (similar as NB-IoT RF requirement in TS36.104)
	+ Option 2: Creating new sub-clauses in TS 38.104 for RF requirements that applies for SBFD
		- Option 2a: details (like new suffix or not) can be FFS when RF requirements are stable.
		- Option 2b: Set up new sub-clause with suffix-B for modified existing RF requirements and SBFD-dedicated new RF requirements
	+ Option 3: A new specification for SBFD BS RF requirements

**Potentially new requirements for SBFD**

**Requirement for transient period between SBFD and non-SBFD**

Agreement:

* RAN4 shall use existing transient period requirement as baseline for the following four cases identified for SBFD:

|  |  |  |
| --- | --- | --- |
|  | **Frequency regions for Transition** | **BS transmitter behavior during transition** |
| Case-A (SBFD to DL) | SBFD UL subband and guardband(s) | BS transmitter OFF-to-ON |
| Case-B (SBFD to UL) | SBFD DL subband | BS transmitter ON-to-OFF |
| Case-C (DL to SBFD) | SBFD UL subband and guardband(s) | BS transmitter ON-to-OFF |
| Case-D (UL to SBFD) | SBFD DL subband | BS transmitter OFF-to-ON |

**Transient period length between SBFD and non-SBFD**

Agreement:

* Transient period length between SBFD and non-SBFD:
	+ The existing TDD BS transmitter transient period reused, i.e., 10us for FR1 and 3us for FR2-1.

**Location of transient period between SBFD and non-SBFD**

Agreement:

* Location of transient period between SBFD and non-SBFD in RAN4 RF requirement:
	+ FFS the location of transient period between SBFD and non-SBFD shall be located within the SBFD slot/symbol if it needs to be decided.

**Requirement for transient period between different SBFD configurations**

Agreement:

* No need to specify transmitter transient period requirement between different SBFD configurations.

**Necessity of in-channel adjacent subband leakage ratio requirements**

Way forward:

* FFS the necessity of in-channel adjacent subband leakage ratio requirements
	+ Option 1: No necessity to introduce new requirement for in-channel adjacent subband leakage ratio.
	+ Option 2: New requirement for in-channel adjacent subband leakage ratio should be defined.
		- Define a requirement on TX sub-band ACLR similar to the ACLR requirement and use existing ACLR requirement as baseline.

**Necessity of in-channel adjacent subband selectivity requirements**

Way forward:

* FFS the necessity of in-channel adjacent subband selectivity requirements
	+ Option 1: No necessity to introduce new requirement for in-channel adjacent subband selectivity.
	+ Option 2: New requirement for in-channel adjacent subband selectivity should be defined.
		- Define a requirement on RX sub-band ACS similar to the ACS requirement and use existing ACS requirement as baseline.

**Necessity of in-channel adjacent subband blocking requirement**

Way forward:

* FFS the necessity of in-channel adjacent subband blocking requirements
	+ Option 1: No necessity to introduce new requirement for in-channel adjacent subband blocking.
	+ Option 2: New requirement for in-channel adjacent subband blocking should be defined.

**Modification of existing Tx requirements for FR1 and FR2-1**

**Total dynamic range**

Agreement:

* Formulate the total power dynamic range requirement for SBFD slots using equation based on declaration (of rated output power with all DL sub-band RBs active for SBFD), instead of table used for existing total power dynamic range requirement.

**Transmit ON/OFF power**

Agreement:

* Transmitter ON/OFF power should apply to normal symbol and it is not applicable within SBFD symbol.

**ACLR and OBUE**

Agreement:

* When coexisting with legacy TDD system in adjacent channel, RAN4 shall apply the legacy ACLR and OBUE requirement for SBFD-capable BS.

WF:

* FFS on the followings:
	+ For FR1 macro deployments, when coexisting with new SBFD system in adjacent channel, RAN4 to define additional ACLR and/or OBUE requirement to ensure feasible coexistence with SBFD-capable gNB. The assumption for the victim BS DESENS and CL of BS2BS is FFS.

**Joint measurement for normal DL symbols/slots and SBFD symbols/slots**

WF:

* FFS on the followings:
	+ Averaged EVMs for SBFD slots and non-SBFD slots shall be measured separately.
	+ Averaged EVM for SBFD slots shall be calculated only based on the data samples where DLs are allocated within the SBFD slots. The data samples where ULs are allocated within the SBFD slots shall be removed from the calculation of averaged EVM.

**Modification of existing Rx requirements for FR1 and FR2-1**

**OTA sensitivity degradation**

Agreement:

* OTA sensitivity is measured with only self-interference. FFS on the OTA sensitivity degradation within [0.5~1.0] dB.

**Dynamic range**

WF:

* FFS on the followings:
	+ Option 1: RAN4 to discuss if the IoT level and wanted signal power level will be derived based on simulation work.
	+ Option 2: The existing dynamic range requirement, RAN4 assume 20dB interference over thermal noise, which is enough to cover the co-channel interference from other base stations.
	+ Option 3: for receiver dynamic requirement, both uplink signals and BS2BS CLI signal should be considered for IoT levels.

**ACS requirement**

WF:

* FFS on the followings:
	+ Option 1: If co-location ACS is not defined, the note in the spec that the ACS requirement is not applied to the co-location scenario is needed.
	+ Option 2: The OTA sensitivity degradation should be taken into account for the baseline REFSENS for ACS requirement.

**In-band blocking**

Agreement:

* On contributing source for in-band blocking requirement, it is only the DL adjacent channel interference.
* RAN4 to not consider any CLI handling scheme effects when defining the in-band blocking requirements.
* For co-existence study,
	+ The reference point for the power level which should be before array gain

WF:

* FFS on the followings:
	+ RAN4 needs to discuss on how in-band blocking requirement are derived:
		- Option 1: MCL assumption for BS2BS CLI interference
		- Option 2: Co-existence study
		- Option 3: Both
* For co-existence study, RAN4 need firstly agree on the open parameters for simulation assumption:
	+ FFS grid-shift values should be considered.
		- Option 1: 10%
		- Option 2: 20%
		- Option 3: 50%
		- Option 4: 100%
	+ 99% of the UL SBFD wideband received power CDF

**Necessity of New RX intermodulation requirement with 1 interfering signal**

WF:

* FFS on the followings:
	+ Option 1: Whether IMD requirement for single interfering signal scenario is needed. Investigate whether such a requirement is implicitly captured by the SBFD RX blocking requirement.
	+ Option 2: If RAN4 want to introduce the additional RX intermodulation requirement (a single input signal placed to cause IM with the RX sub-band), the new intermodulation scenario shall be confirmed firstly with evidence showing the proposed scenario exists in practice.

**Necessity of New RX intermodulation requirement with 2 interfering signals**

WF:

* FFS on the following:
	+ Option 1: for the receiver intermodulation requirements, BS2BS CLI should be taken into account for power level for interference signal.

**RRM Work Plan**

Agreements (from online session)

* The work plan in R4-2412534 is approved.

**RRM impacts of UE-to-UE CLI handling**

**Scope of requirements for UE-to-UE CLI handling**

Agreements (from online session)

* RAN4 to define RRM requirements for L1 based UE-to-UE CLI measurement and reporting.

**Side condition**

Agreements (from online session)

* RAN4 to define side conditions for L1 based UE-to-UE CLI measurement requirements.
* RAN4 to discuss at least time offset between DL timing and SRS arrival timing, SRS Es/Iot, SRS configuration and maximum/minimum SRS-RSRP.
	+ The RAN1 progress will be taken into account when discussing the values for the side conditions.

**Measurement period**

Agreements (from online session)

* RAN4 to define measurement periods for L1 based UE-to-UE CLI measurement requirements,
* RAN4 to discuss the number of shots for the measurement, which can be based on RAN4 simulation results and RAN1 design.
	+ Number of shots for simulation: 1, 2, 3.
	+ Companies to bring proposals on other simulation parameters in the next meeting.

**Measurement quantities**

Recommended WF

* RAN4 to define core requirements for L1-SRS-RSRP and L1-CLI-RSSI measurements. This can be revisited based on further RAN1 agreement.
* FFS if other measurement quantities to be considered in the core requirements based on further RAN1 agreement.

**Baseline for defining requirements**

Recommended WF

* Both R16 CLI measurement requirements and L1-RSRP measurement requirements are to be considered for defining requirements for L1 based UE-to-UE CLI measurement.
* RAN4 can directly discuss the requirements for L1 based UE-to-UE CLI measurement in next meeting.

**Measurement methods**

Recommended WF

* RAN4 to wait for RAN1 conclusion on the supported methods of L1 based UE-to-UE CLI measurement.
* Meanwhile, RAN4 to discuss the impacts of different measurement methods on the requirements.

**Rx beam**

Recommended WF

* RAN4 to wait for RAN1 conclusion on the Rx beam for L1 based UE-to-UE CLI measurement.
* Meanwhile, RAN4 to discuss the impacts of Rx beam configuration/determination on the requirements.

**Measurement resources**

Recommended WF

* RAN4 to wait for RAN1 conclusion on measurement resources to discuss whether is an impact on the requirements.

**Side condition**

Options for further discussion and down-selection (for information purpose):

* Time offset between DL timing and SRS arrival timing
	+ Option 1: Rel-16 CLI SRS RSRP assumption
	+ Option 2: Remove cell phase error from option 1
	+ Other options are not precluded, pending on RAN1 progress.
* SRS Es/Iot, SRS configuration and maximum/minimum SRS-RSRP
	+ Option 1: Rel-16 CLI SRS RSRP assumption
	+ Other options are not precluded.

**Measurement reporting**

Recommended WF:

* RAN4 to define measurement reporting requirements for L1 based UE-to-UE CLI measurement at least for aperiodic reporting
* FFS on reporting requirements for periodic and semi-persistent reporting pending on RAN1 agreement
* FFS whether L1-RSRP measurement reporting requirement can be re-used.

**Measurement accuracy**

Recommended WF:

* RAN4 to define measurement accuracy requirements for L1 based UE-to-UE CLI measurement based on the agreed side condition and measurement period.

**Scheduling and measurement restriction**

Recommended WF

* RAN4 to define scheduling and measurement restriction for L1 based UE-to-UE CLI measurement if it is needed.
* FFS the impact of measurement methods and Rx beam assumption

**Measurement capability**

Recommended WF

* FFS whether RAN4 needs to discuss measurement capability for L1 based UE-to-UE CLI measurement in terms of number of resources UE shall be able to monitor.

**Report mapping**

Recommended WF

* FFS whether RAN4 needs to discuss report mapping for L1 based UE-to-UE CLI measurement.
* FFS whether R16 report mapping can be re-used.

**RRM impacts of gNB-to-gNB CLI handling**

**Scope of requirements for gNB-to-gNB CLI handling**

Agreements (from online session)

* RAN4 not to define RRM requirements for gNB to gNB CLI handing.

**RRM impacts of SBFD operation**

**Requirements for legacy UE**

Agreements (from online session)

* The legacy UEs shall perform and operate according to the legacy RRM requirements and no new RAN4 RRM requirement for legacy UEs, despite being served by a gNB operating with SBFD.
* Clarification on the applicability of the existing RRM requirements in RAN4 spec is not precluded.
* The legacy UEs refer to non-SBFD aware UE.

**Requirements for SSB based measurement**

Agreements (from online session)

* For SBFD-aware UE, existing requirements apply for SSB-based serving cell measurement. Further discuss for SSB based neighbour cell measurement in RAN4.
* Note: The serving cell is SBFD cell, and the neighbour cell is SBFD or non-SBFD cell.

**Requirements for SSB based measurement**

Recommended WF

* RAN4 further discuss impact on SSB based neighbour cell measurement in RAN4.

**Requirements for CSI-RS based measurement**

Recommended WF

* RAN4 to discuss the impact of SBFD operation on the CSI-RS measurement requirements.

**Requirements for scheduling restriction**

Recommended WF

* RAN4 to discuss whether scheduling restriction requirements are impacted due to SBFD operation based on RAN1 agreements.

**Requirements for RACH requirements**

Recommended WF

* RAN4 to discuss whether RACH requirements are impacted due to SBFD operation based on RAN1 agreements.

**Requirements for UL PC and or spatial relation update**

Recommended WF

* RAN4 to discuss whether requirements for UL PC and or spatial relation switch are impacted due to SBFD operation based on RAN1 agreements.

**Requirements for MG and BWP switch**

Recommended WF

* RAN4 to discuss whether to clarify the term “UL slot” in MG and BWP switch requirements when SBFD operation is enabled.

**Requirements for UL resource muting**

Recommended WF

* RAN4 further to discuss whether additional RRM requirements would be defined for UL resource muting for PUSCH feature.

**Requirements for generic SBFD operation**

Recommended WF

* RAN4 to discuss whether there is any RRM impact e.g. to scheduling restrictions/interruptions requirements due to SBFD operation.

**Limits on the maximum number of DL/UL switching**

Recommended WF

* RAN4 to discuss whether to put limits on the maximum number of DL/UL switching during SBFD slots within the SBFD periodicity

#### 2.4.2 Remaining Open issues

* Remaining details on RAN4 aspects for SBFD system parameters
* Remaining details on BS RF requirements for SBFD operation at gNB:
	+ Potentially new requirements for SBFD
	+ Modification of existing Tx/RX requirements for FR1 and FR2-1
* Remaining details on applicable RRM core requirements for UE-to-UE CLI handling mechanisms
* Remaining details on other RRM core requirements for SBFD operation, if identified

## 2.5 RAN5

#### 2.5.1 Agreements

#### 2.5.2 Remaining Open issues

#### 2.5.3 Remaining Open issues with cross-WG dependencies

## 2.6 RAN6

#### 2.6.1 Agreements

#### 2.6.2 Remaining Open issues

## 3. Detailed progress in SA/CT WGs since last TSG meeting (for all involved WGs)

NOTE: This section only needs to be filled in for WI/SIs where there is a corresponding relevant WI/SI in SA/CT.

## 3.1 SAx/CTs

#### 3.1.1 Agreements with cross-TSG impacts

#### 3.1.2 Remaining Open issues with cross-TSG impacts

NOTE: This section should also flag any critical dependencies that need TSG attention.

## 4. References

NOTE: This can be e.g. a list of all related Tdocs in the affected WGs since last TSG, references to LSs, produced TRs/TSs, the work/study item description or status reports of previous TSGs.

**RAN1#118**

R1-2405815 Discussion on SBFD TX/RX/measurement procedures MediaTek Inc.

R1-2405831 Discussion for SBFD TX RX measurement procedures New H3C Technologies Co., Ltd.

R1-2405847 On subband full duplex design Huawei, HiSilicon

R1-2405907 Discussion on SBFD TX/RX/measurement procedures Spreadtrum Communications

R1-2405933 Discussion on transmission, reception and measurement procedures for SBFD operation ZTE Corporation, Sanechips

R1-2405940 Discussion for SBFD TX/RX/ measurement procedures Tejas Networks Limited

R1-2405984 Discussion on SBFD TX/RX/measurement procedures CMCC

R1-2406059 Discussion on SBFD TX/RX/measurement procedures LG Electronics

R1-2406087 Discussion on SBFD TX/RX/measurement procedures China Telecom

R1-2406102 Discussion on SBFD TX/RX/measurement procedures TCL

R1-2406134 SBFD TX/RX/measurement procedures Ericsson

R1-2406181 Discussion on Rel-19 SBFD operation vivo

R1-2406209 Discussion on SBFD TX/RX/measurement procedures Kookmin University

R1-2406237 Discussion on SBFD Tx/Rx/measurement procedures OPPO

R1-2406283 Discussion on reception and transmission procedure for SBFD operation Xiaomi

R1-2406314 Discussion on Tx/Rx/measurement procedures for SBFD operation Fujitsu

R1-2406367 Discussion on SBFD TX/RX/measurement procedures CATT

R1-2406470 SBFD Operations Sony

R1-2406568 Discussion on SBFD TX/RX/measurement procedures Panasonic

R1-2406578 Discussion on SBFD TX/RX/measurement procedures HONOR

R1-2406596 Discussions on SBFD TX/RX/measurement procedures Ruijie Networks Co. Ltd

R1-2406598 Views on SBFD TX/RX Measurement Procedures Lenovo

R1-2406649 SBFD operation and procedures Samsung

R1-2406684 On SBFD TX/RX/measurement procedures Nokia, Nokia Shanghai Bell

R1-2406691 Discussion on subband non-overlapping full duplex Tx-Rx and measurement operations NEC

R1-2406702 Discussion on SBFD operation Transsion Holdings

R1-2406707 PRG allocation for SBFD ASUS

R1-2406725 Discussion on SBFD TX/RX/measurement procedures ETRI

R1-2406749 Discussion on TX RX and measurement procedures for SBFD operation InterDigital, Inc.

R1-2406800 SBFD Tx/Rx/measurement aspects Sharp

R1-2406835 Views on SBFD TX/RX/measurement procedures Apple

R1-2406929 Discussion on SBFD TX/RX/measurement procedures NTT DOCOMO, INC.

R1-2406963 Discussion on SBFD TX/RX/measurement procedures Google Ireland Limited

R1-2407028 SBFD Transmission, Reception and Measurement Procedures Qualcomm Incorporated

R1-2407067 Discussion on SBFD TX/RX/measurement procedures ITRI

R1-2407084 Discussion on SBFD TX/RX/measurement procedures CEWiT

R1-2407158 Discussion on SBFD TX/RX/measurement procedures WILUS Inc.

R1-2407218 Summary #1 of SBFD TX/RX/measurement procedures Moderator (CATT)

R1-2407219 Summary #2 of SBFD TX/RX/measurement procedures Moderator (CATT)

R1-2407220 Summary #3 of SBFD TX/RX/measurement procedures Moderator (CATT)

R1-2405816 Discussion on SBFD Random Access Operation MediaTek Inc.

R1-2405832 Discussion for SBFD random access operation New H3C Technologies Co., Ltd.

R1-2405848 On subband full duplex random access operation Huawei, HiSilicon

R1-2405908 Discussion on SBFD random access operation Spreadtrum Communications

R1-2405934 Discussion on SBFD random access operation ZTE Corporation, Sanechips

R1-2405941 Discussion on SBFD Random Access Operation Tejas Networks Limited

R1-2405985 Discussion on SBFD random access operation CMCC

R1-2406060 Discussion on SBFD random access operation LG Electronics

R1-2406088 Discussion on SBFD random access operation China Telecom

R1-2406103 Discussion on SBFD random access operation TCL

R1-2406106 Discussion on SBFD random access operation Korea Testing Laboratory

R1-2406135 SBFD Random access operation Ericsson

R1-2406182 Discussion on random access for Rel-19 SBFD vivo

R1-2406210 Discussion on SBFD random access operation Kookmin University

R1-2406238 Discussion on SBFD random access operation OPPO

R1-2406284 Discussion on SBFD random access operation Xiaomi

R1-2406368 Discussion on SBFD random access operation CATT

R1-2406471 SBFD PRACH Operations Sony

R1-2406514 Discussion on SBFD random access operation Fujitsu

R1-2406562 Discussion on random access for SBFD NEC

R1-2406569 Discussion on SBFD random access operation Panasonic

R1-2406575 Discussion on SBFD random access operation Hyundai Motor Company

R1-2406650 Random access on SBFD resources Samsung

R1-2406685 SBFD random access operation Nokia, Nokia Shanghai Bell

R1-2406688 SBFD random access operation Lenovo

R1-2406703 Discussion on SBFD random access operation Transsion Holdings

R1-2406726 SBFD random access operation ETRI

R1-2406750 On SBFD random access operation InterDigital, Inc.

R1-2406781 On SBFD random access operation Google Ireland Limited

R1-2406801 SBFD random access aspects Sharp

R1-2406836 Views on SBFD random access operation Apple

R1-2406886 Discussion on SBFD Random Access operation KT Corp.

R1-2406930 Discussion on SBFD random access operation NTT DOCOMO, INC.

R1-2407029 SBFD Random Access Operation Qualcomm Incorporated

R1-2407068 Discussion on SBFD random access operation for SBFD aware UEs in RRC CONNECTED state ITRI

R1-2407085 Discussion on SBFD random access operation CEWiT

R1-2407159 Discussion on SBFD random access operation WILUS Inc.

R1-2407228 Summary#1 on SBFD random access operation Moderator (CMCC)

R1-2407229 Summary#2 on SBFD random access operation Moderator (CMCC)

R1-2407230 Summary#3 on SBFD random access operation Moderator (CMCC)

R1-2405817 Discussion on CLI Handling in SBFD system MediaTek Inc.

R1-2405833 Discussion on CLI handling New H3C Technologies Co., Ltd.

R1-2405849 On cross-link interference handling for subband full duplex Huawei, HiSilicon

R1-2405909 Discussion on CLI handling Spreadtrum Communications

R1-2405935 Discussion on CLI handling for Rel-19 duplex operation ZTE Corporation, Sanechips

R1-2405942 Discussion on gNB-gNB CLI handling Tejas Networks Limited

R1-2405986 Discussion on CLI handling CMCC

R1-2406061 Discussion on CLI handling LG Electronics

R1-2406136 SBFD CLI handling Ericsson

R1-2406183 Discussion on CLI handling for Rel-19 NR duplex vivo

R1-2406239 CLI handling in NR duplex operation OPPO

R1-2406285 Discussion on CLI handling for SBFD operation Xiaomi

R1-2406369 Discussion on CLI handling for NR duplex evolution CATT

R1-2406472 CLI handling for SBFD Sony

R1-2406563 CLI handling for NR duplex operations NEC

R1-2406570 Discussion on CLI handling Panasonic

R1-2406651 Cross-link interference handling for SBFD Samsung

R1-2406686 Cross-link interference handling for duplex evolution Nokia, Nokia Shanghai Bell

R1-2406716 Further Considerations and REcommendations for CLI mitigation for Subband Full Duplex Charter Communications, Inc

R1-2406727 Discussion on CLI handling for SBFD operation ETRI

R1-2406751 On CLI handling for SBFD operation InterDigital, Inc.

R1-2406782 On the gNB-to-gNB CLI and the UE-to-UE CLI handling Google Ireland Limited

R1-2406837 Views on CLI handling Apple

R1-2406931 Discussion on CLI handling NTT DOCOMO, INC.

R1-2407030 Enhancements for CLI handling Qualcomm Incorporated

R1-2407062 Cross-link interference management for duplexing evolution Lenovo

R1-2407086 Discussion on CLI handling CEWiT

R1-2407160 Discussion on CLI handling for NR duplex operation WILUS Inc.

R1-2407353 Summary #1 of CLI handling Moderator (Huawei)

R1-2407354 Summary #2 of CLI handling Moderator (Huawei)

R1-2407355 Summary #3 of CLI handling Moderator (Huawei)

**RAN2#127**

R2-2406314 RAN2 workplan for Rel-19 Evolution of NR duplex operation Huawei, HiSilicon

R2-2406342 Random Access for SBFD Operation NEC discussion

R2-2406363 Discussion on RACH in SBFD Xiaomi discussion

R2-2406452 Impacts on the random access by the evolution of duplex operation Huawei, HiSilicon

R2-2406486 Discussion on SBFD random access operation CATT

R2-2406630 SBFD configuration and supporting Random access Sony

R2-2406690 Framework to support RACH in SBFD Apple

R2-2406724 Discussion on random access in SBFD vivo

R2-2406794 Discussion on random access procedure in SBFD ZTE Corporation

R2-2406822 Random Access Aspect of SBFD Nokia Corporation

R2-2406962 Discussion on random access in SBFD CMCC discussion

R2-2407078 Discussion on subband full duplex (SBFD) RA operation Ericsson

R2-2407143 Random Access in Sub-Band Full Duplex Google Ireland Limited

R2-2407192 Views on random access for SBFD Qualcomm Incorporated

R2-2407313 Random access in SBFD Samsung

R2-2407461 Discussion on Random Access procedure for SBFD LG Electronics Inc.

R2-2406410 SBFD resource indication and CLI handling Xiaomi

R2-2406466 Other impacts by the evolution of duplex operation Huawei, HiSilicon

R2-2406487 Discussion on other aspects of SBFD

R2-2406725 Discussion on other issues in SBFD vivo

R2-2406795 Discussion on CLI measurement in SBFD ZTE Corporation

R2-2406957 Other aspects of SBFD Nokia

R2-2406983 Discussion on SBFD related issues CMCC

R2-2407079 Non-RA aspects for subband full duplex (SBFD) operation Ericsson

R2-2407194 Other aspects of SBFD Qualcomm Incorporated

R2-2407427 SBFD Overall and Support of Cross Link Interference Samsung

**RAN4#112**

R4-2411018 CR for Adding a summary sentence in sub-clause 12.2.1 Charter Communications, Inc

R4-2411019 Adding a summary sentence in sub-clause 12.2.1 Charter Communications, Inc

R4-2411070 Discussion on SBFD general issues CATT

R4-2411080 Discussion on modification of existing Tx requirements for SBFD operation CATT

R4-2411081 Discussion on modification of existing Rx requirements for SBFD operation CATT

R4-2411082 Discussion on potentially new requirements for SBFD operation CATT

R4-2411083 SBFD in-band blocking and dynamic range simulation results CATT

R4-2411297 SBFD as a band specific feature and SBFD restrictions for bands with low channel bandwidth configurations Charter Communications, Inc

R4-2411298 SBFD Restrictions for bands with low channel bandwidth Configurations Charter Communications, Inc

R4-2411344 Views on SBFD RRM requirements CATT

R4-2411406 On UE RRM requirement Apple

R4-2411512 Views on general aspects for SBFD Qualcomm Germany

R4-2411513 Views on new requirements for SBFD Qualcomm Germany

R4-2411514 Views on existing Tx BS RF requirements for SBFD Qualcomm Germany

R4-2411515 Views on existing Rx BS RF requirements for SBFD Qualcomm Germany

R4-2411571 RRM requirements for evolution of NR duplex operation Nokia, Nokia Shanghai Bell

R4-2411637 Discussion on SBFD general aspects Samsung

R4-2411638 On the modification of existing TX requirements for SBFD-capable BS Samsung

R4-2411639 On the modification of existing RX requirements for SBFD-capable BS Samsung

R4-2411640 On the potentially new requirements for SBFD operation for FR1 and FR2-1 Samsung

R4-2411723 SBFD/TDD coexistence receiver in-band blocking CableLabs, Charter Communications

R4-2411734 (NR\_duplex\_evo-Core) Discussion on new RF requirement for SBFD CMCC

R4-2411735 (NR\_duplex\_evo-Core) Discussion on existing Rx requirements for SBFD CMCC

R4-2411736 (NR\_duplex\_evo-Core) Discussion on SBFD general part CMCC

R4-2411737 (NR\_duplex\_evo-Core) Discussion on existing Tx requirements for SBFD CMCC

R4-2411816 Topic summary for [112][221] NR\_duplex\_evo Moderator (Huawei)

R4-2412039 Discussion on RRM requirements for NR duplex operation LG Electronics Inc.

R4-2412080 Discussion on the subband configurations and guardbands for gNB SBFD vivo

R4-2412122 Discussion on RRM core requirements for evolution of NR duplex operation China Telecom

R4-2412279 Initial discussion on RRM core requirements for Rel-19 Evolution of NR duplex operation SBFD Ericsson

R4-2412292 Initial discussion on RRM for SBFD vivo

R4-2412533 Initial view on Rel-19 Duplex Evo WI RRM impact Samsung

R4-2412534 Work plan for Rel-19 Duplex Evo WI (RRM part only) Samsung, Huawei

R4-2412576 On general aspects for SBFD Huawei, HiSilicon

R4-2412577 On potentially new requirements for SBFD Huawei, HiSilicon

R4-2412671 Initial discussion on RRM requirements for SBFD Huawei, HiSilicon

R4-2412721 Discussion on system parameters for SBFD BS ZTE Corporation, Sanechips

R4-2412722 Discussion on potentially new requirements for SBFD operation ZTE Corporation, Sanechips

R4-2412723 Discussion on modification of existing Tx requirements for FR1 and FR2-1 for SBFD BS ZTE Corporation, Sanechips

R4-2412724 Discussion on modification of existing Rx requirements for FR1 and FR2-1 for SBFD BS ZTE Corporation, Sanechips

R4-2412913 SBFD general aspects Ericsson

R4-2412914 Potentially new SBFD BS RF requirements Ericsson

R4-2412915 Impact on SBFD BS RF TX requirements Ericsson

R4-2412916 Impact on SBFD BS RF RX requirements Ericsson

R4-2413081 Discussion on RRM aspects of R19 SBFD ZTE Corporation, Sanechips

R4-2413209 Discussion on SBFD MediaTek inc.

R4-2413235 On existing BS RF RX requirements for SBFD operation Nokia

R4-2413236 On existing BS RF TX requirements for SBFD operation Nokia

R4-2413237 On potentially new BS RF requirements for SBFD operation Nokia

R4-2413238 On SBFD system parameters Nokia

R4-2413283 On modification of existing TX RF requirements for SBFD Huawei, HiSilicon

R4-2413284 On modification of existing RX RF requirements for SBFD Huawei, HiSilicon

R4-2413407 Topic summary for [112][307] NR\_duplex\_evo\_General Moderator (Samsung)

R4-2413408 Topic summary for [112][308] NR\_duplex\_evo\_BSRF Moderator (Huawei)

R4-2413454 RRM requirements for SBFD Qualcomm Incorporated

R4-2413507 Ad-hoc meeting minutes for [112][307] NR\_duplex\_evo\_General Samsung

R4-2413513 LS to RAN1 on clarification of section 12.2.1 of TR 38.858 Charter Communications, Inc.

R4-2413514 Way Forward for [112][307] NR\_duplex\_evo\_General Samsung

R4-2413515 Way Forward for [112][308] NR\_duplex\_evo\_BSRF Huawei

R4-2413900 WF on SBFD RRM Huawei, HiSilicon

 30.04.2024 minor adaptations for RAN #104

 16.02.2024 minor adaptations for RAN #103

 10.11.2023 minor adaptations for RAN #102

 02.08.2023 minor adaptations for RAN #101

 26.04.2023 minor adaptations for RAN #100

 01.02.2023 minor adaptations for RAN #99

 27.10.2022 minor adaptations for RAN #98e

 01.08.2022 minor adaptations for RAN #97e

 21.05.2022 minor adaptations for RAN #96

 10.01.2022 minor adaptations for RAN #95e

 04.10.2021 minor adaptations for RAN #94e

 08.08.2021 minor adaptations for RAN #93e

 17.05.2021 minor adaptations for RAN #92e

 28.01.2021 minor adaptations for RAN #91e

 09.11.2020 minor adaptations for RAN #90e

 31.08.2020 minor adaptations for RAN #89e

 20.04.2020 minor adaptations for RAN #88e

 18.02.2020 minor adaptations for RAN #87e

 14.11.2019 minor adaptations for RAN #86

 18.08.2019 minor adaptations for RAN #85

 12.05.2019 minor adaptations for RAN #84

 27.02.2019 minor adaptations for RAN #83

 21.11.2018 completion levels with colours added (for RAN #82)

v04.81 31.07.2018 simplification of template and addition of cross-TSG aspects (for RAN #81)

v04.80 21.05.2018 minor adaptations for RAN #80

v04.79 26.02.2018 minor adaptations for RAN #79

v04.78 18.11.2017 minor adaptations for RAN #78

v04.77 06.08.2017 minor adaptations for RAN #77

v04.76 15.05.2017 minor adaptations for RAN #76

v04.75 31.01.2017 minor adaptations for RAN #75

v04.74 28.10.2016 minor adaptations for RAN #74

v04.73 01.09.2016 adaptations for RAN #73 (time units in extra Excel table, RAN6 reporting included)

v04.72 26.05.2016 adaptations for RAN #72 (introduction of NR & GERAN TUs)

v04.71 10.02.2016 minor adaptations for RAN #71

v04.70 30.10.2015 minor adaptations for RAN #70

v04.69 12.08.2015 minor adaptations for RAN #69

v04.68 21.05.2015 minor adaptations for RAN #68

v04.67 01.02.2015 minor adaptations for RAN #67

v04.66 16.11.2014 minor adaptations for RAN #66

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v04.64 22.05.2014 minor adaptations for RAN #64

v04.63 24.01.2014 restructuring for RAN #63 to cover Core & Perf. in one doc file

v03.62 11.11.2013 section 1.2.3 adapted for RAN #62

v03 11.08.2013 section 1.2.3 added on time budget

v02 07.05.2010 history added, some spelling corrections

v01 13.11.2009 First version of the template