3GPP TSG RAN meeting #92e
Electronic Meeting, June 14 – 18, 2020

RP-211267

Views on WI extending NR operation to 71GHz

Qualcomm

AI: 9.7.1.2

FR designations

- In RAN#91E, RAN1, RAN2 and RAN4 were asked to provide their analysis or recommendation to RAN#92e on how to introduce the 52.6-71GHz frequency range in the respective specifications

FR designations

Input from RAN1

- Regarding the impact on specifications maintained by RAN1, there are only relatively small differences between potential options.
- RAN1 can adapt to other groups' preferences on the notation for 52.6-71 GHz.
- Irrespective of whether the frequency range 52.6 to 71 GHz is an extension of FR2 or a new FR, the related UE capabilities and their applicability to the frequency range 52.6 to 71 GHz will have to be analysed on a case-by-case basis.
- From RAN1's perspective, an easy distinction between features, capabilities and other characteristics in the specifications that apply specifically to the following ranges may be useful:
  - 24.25-52.6 GHz
  - 52.6-71 GHz
  - 24.25-71 GHz
- NOTE: The distinction can be realized with or without a designated frequency range (FRx) definition.

FR designations

Input from RAN2

- RAN2 can adapt to other groups decision on FRx notation for 52-71 GHz. No critical dependency in RAN2.
- From RAN2 TS point of view, the impact will be smaller if it is chosen to re-use FR2 for 52-71 GHz.

FR designations

Input from RAN4

- RAN WG4 would like to inform that the discussion on the terminology for the NR operation in 52.6 - 71 GHz frequency range will continue in RAN WG4, including pros and cons analyses of concepts based on Option A, Option B and Option C, as listed below:
  - Option A:
    - Introduce FR2-1 (or FR2.1) for 24.25 – 52.6 GHz, and FR2-2 (or FR2.2) for 52.6 – 71 GHz,
    - The above two ranges to be introduced under the FR2 common range.
  - Option B:
    - All UE RF/demodulation requirements defined as function of band, BW, PC or band combo within FR2,
    - BS requirements can be updated to cater for an extension of FR2 to include 52.6 – 71 GHz,
    - All RRM requirements for higher SCS applicable for 52.6 – 71 GHz can be defined as function of SCS within FR2.
  - Option C: in addition to reusing the existing FR2 for 24.25 – 52.6GHz:
    - Introduce FR2-2 (or FR2x) for 52.6 – 71 GHz,
    - Possibly introduce FR2-comb for 24.25 – 71 GHz.

FR designations

Proposal

- Combining the recommendations from RAN1/RAN2/RAN4, we have the following observations
  - Introducing a new FR (i.e., FR3) is not preferred
  - A simple notation will be more convenient from RAN1 work perspective
  - There is shared subcarrier spacing (120KHz) between current FR2 and 52.6-71GHz band, thus it will be hard to distinguish FRs using SCS alone
- **Proposal**: Consider further Option A and Option C from RAN4 list of FR designation for final decision in RAN#93e
  - Option A: Introduce FR2-1 (or FR2.1) for 24.25 - 52.6 GHz, and FR2-2 (or FR2.2) for 52.6 - 71 GHz
    - The above two ranges to be introduced under the FR2 common range.
  - Option C: in addition to reusing existing FR2 for 24.25 - 52.6GHz, introduce FR2-2 (or FR2x) for 52.6 - 71 GHz
    - Possibly introduce FR2-comb for 24.25 - 71 GHz.

	Option A
Frequency range designation	Corresponding frequency range
FR1	410 MHz - 7125 MHz
FR2	FR2-1 (or FR2.1): 24250 MHz - 52600 MHz
	FR2-2 (or FR2.2): 52600 MHz - 71000 MHz
NOTE: Whenever the FR2 is referred, both FR2.1 and FR2.2 frequency sub-ranges shall be considered, unless otherwise stated.	

	Option C
Frequency range designation	Corresponding frequency range
FR1	410 MHz - 7125 MHz
“FR2-comb”, or no common term	FR2: 24250 MHz - 52600 MHz
	FR2-2 (or FR2x): 52600 MHz - 71000 MHz

SCS for SSB for initial access

Current status

- Up to RAN1 #105e, we agreed to support 120KHz SCS for SSB supporting initial access
  - 480/960 KHz SCS SSB are supported for non-initial access use cases

SCS for SSB for initial access

Proposal to further support 480KHz SCS SSB for initial access

- Proposal from RAN1 #105e: In addition to 120kHz, support **480** kHz SSB for initial access with support of CORESET0/Type0-PDCCH configuration in the MIB with following constraints.
  - Limited sync raster entry numbers
    - It is assumed that RAN4 supports a channelization design which results in the total number of synchronization raster entries considering both licensed and unlicensed operation in a 52.6 – 71 GHz band no larger than **665** (Note: the total number of synchronization raster entries in FR2 for band n259 + n261 is 602). If the assumption cannot be satisfied, it's up to RAN4 to decide its applicability to bands in 52.6 – 71 GHz.
  - only 480kHz CORESTE#0/Type0-PDCCH SCS supported for 480 kHz SSB SCS.
  - SSB time domain candidate resource pattern (within a slot or pair of slots) for 480 and 960kHz SSB are identical
  - Prioritize support SSB-CORESET0 multiplexing pattern 1. Other patterns discussed on a best effort basis.
  - Note: Strive to minimize specification impact by reusing tables for CORESET#0 and type0-PDCCH CSS set configuration defined for FR2 in Rel-15, as much as possible

Formal objection sustained by: Huawei, MediaTek (would like to discuss at next meeting)

SCS for SSB for initial access

Proposal to further support 480KHz and 960KHz SCS SSB for initial access

- Proposal from RAN1 #105e: In addition to 120kHz, support **both 480 and 960** kHz SSB for initial access with support of CORESET0/Type0-PDCCH configuration in the MIB with following constraints.
  - Limited sync raster entry numbers
    - It is assumed that RAN4 supports a channelization design which results in the total number of synchronization raster entries considering both licensed and unlicensed operation in a 52.6 – 71 GHz band no larger than **665** (Note: the total number of synchronization raster entries in FR2 for band n259 + n261 is 602). If the assumption cannot be satisfied, it's up to RAN4 to decide its applicability to bands in 52.6 – 71 GHz.
  - only 1 CORESTE#0/Type0-PDCCH SCS supported for each SSB SCS i.e., (480,480) and (960,960).
  - SSB time domain candidate resource pattern (within a slot or pair of slots) for 480 and 960kHz SSB are identical
  - Prioritize support SSB-CORESET0 multiplexing pattern 1. Other patterns discussed on a best effort basis.
  - Note: Strive to minimize specification impact by reusing tables for CORESET#0 and type0-PDCCH CSS set configuration defined for FR2 in Rel-15, as much as possible

Formal objection sustained by: Huawei, MediaTek (object to 960 kHz)

SCS for SSB for initial access

Proposed Way Forward

- **Proposal**: Consider majority support to introduce at least one high SCS SSB for initial access. Suggesting to support 480KHz SCS for initial access SSB, under the conditions that
  - It is UE optional
  - Reduced spec impact by leveraging as much as possible 120KHz designs on CORESET#0/Type0-PDCCH multiplexing rules

SCS for ANR

Current status

- Currently for 480/960KHz SSB is only agreed to be supported for the case when CORESET#0/Type0-PDCCH is not provided by the SSB
- Proposal from RAN1 #105e: To support ANR and PCI confusion detection for 480/960kHz SCS based SSB, support CORESET#0/Type0-PDCCH configuration in MIB of 480 and 960kHz SSB
  - FFS: additional method(s) to enable support to obtain neighbor cell ~~PCI and~~ SIB1 contents related to CGI reporting
  - Only 1 CORESTE#0/Type0-PDCCH SCS supported for each SSB SCS, i.e., (480,480) and (960,960).
  - Prioritize support SSB-CORESET0 multiplexing pattern 1. Other patterns discussed on a best effort basis.
  - Note: Strive to minimize specification impact by reusing tables for CORESET#0 and type0-PDCCH CSS set configuration defined for FR2 in Rel-15, as much as possible
  - Note: From UE perspective, ANR detection for 480/960kHz SCS based SSB is not supported if the UE does not support 480/960 SCS for SSB.
  - Note: for ANR, when reading the MIB, the cell containing the SSB is known to the UE, as defined in 38.133 specification.

  Formal objection sustained by: Huawei

SCS for ANR

Proposed Way Forward

- **Proposal**: Consider majority support for CORESET#0/Type0-PDCCH configuration in MIB of 480 and 960kHz SSB
  - Clarifying that this is UE optional
  - Reduced spec impact by leveraging as much as possible 120KHz designs on CORESET#0/Type0-PDCCH multiplexing rules

Channel access

Current status

- Channel access is a highly contentious sub-agenda item, but we only have 3 meetings left to complete the design
- Open discussion points (not a complete list)
  - How to perform LBT (per CC or per subband)
  - Sensing structure for 8us initial deferral period
  - COT sharing
  - Cat 2 LBT
  - LBT based receiver assisted LBT and enhanced AP-CSI or enhanced RSSI based receiver assistance
  - How to perform directional LBT and the relationship between transmission beam and sensing beam
    - Also include additional adjustment to ED threshold
  - How to perform LBT for multi-beam (TDM or SDM) COT

Channel access

Proposed Way Forward

- Given limited time, proposing to focus on absolutely necessary items
- Deprioritize (only discuss if there is time available):
  - LBT based receiver assistance
  - Enhanced AP-CSI or enhanced RSSI based receiver assistance
  - Cat 2 LBT (replacing Cat 2 LBT use cases with Cat 4 LBT with up to 15us more sensing)
  - TDM multi-beam sensing
    - Multi-beam (TDM/SDM/FDM) COT can be still supported by simultaneous multi-beam sensing or wider beam sensing
- Decide if directional LBT discussion (relationship between sensing beam and transmission beam) is handled in RAN1 or RAN4

RAN2 scope

Work Plan

- RAN2 has not started any work regarding the following WI objective within RAN2 responsibility:
  - Radio interface protocol architecture and procedures [RAN2]:
    - For operation in this frequency range: Introduce higher layer support of enhancements listed above that are agreed to be specified.
- As it was seen in Rel-16 NR-U WI, introducing the necessary changes in RRC and other RAN2 specs to support the PHY layer takes considerable amount of work and time.
- Therefore, in the remaining Rel-17 time-frame, RAN2 should prioritize the above main WI objective:
  - Other enhancements and work not related to RAN1 design should be down-prioritized.

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