3GPP TSG-RAN WG4 Meeting #102-e R4- 2206919

E-meeting, February 21 – March 3, 2022

**Agenda item:** **10.16.8**

**Source: Qualcomm**

**Title: WF on NR extension to 71 GHz RRM requirements (Part 1)**

**Document for:** **Approval**

# Introduction

In this contribution we capture the agreements achieved during the email discussion on the topic Rel-17 NR ext. to 71GHz RRM core requirements (AI 10.16.8.1 and 10.16.8.2) in RAN4#102-e under email thread [102-e][224] NR\_ext\_to\_71GHz\_RRM\_1. This email thread covers following sub-agenda items:

* AI 10.16.8.1 General requirements
* AI 10.16.8.2 Timing requirements

The details on the discussion can be found at the [224] thread discussion summary [1].

The following color coding scheme is used in this document

* Agreements from GTW
* Agreements from the 1st round of email discussion
* Agreements from the 2nd round of email discussion

# Way forward

## General

**Rx beam sweeping scaling factor**

* Rx beam sweeping scaling factor is FFS
	+ Option 1: The Rx beam sweeping scaling factor is increased for FR2-2 compared with FR2-1
		- FFS: Scaling factor = (12 - 16)
		- Companies to provide the values for the scaling factor.
	+ Option 2: Reuse the existing FR2-1 scaling factor for Rx beam sweeping for FR2-2.

## Timing requirements

### UE transmit timing error

**SSB periodicity and set of requirements**

* For UL SCS of 480/960 kHz, a UE is required to meet the UL timing accuracy requirements if an SSB is available in the last X ms
	+ X=80 ms for UL SCS of 480 kHz
	+ X=40 ms for UL SCS of 960 kHz
* Note: test cases will be defined for both cases
* Note: the agreement can be revisited in case no feasible Te requirements values are identified.

**Percentage of UL CP length Te can occupy for UL SCS of 480/960 kHz**

* For UL SCS of 480/960 kHz, a UE is required to meet the UL timing accuracy requirements if an SSB is available in the last X ms.
	+ For X = 80ms

|  |  |  |
| --- | --- | --- |
| SSB SCS | UL SCS | Te/CP Ratio  |
| 120 | 480 | [0.35] |
| 480 | 480 | [0.30] |
| 960 | 480 | [0.25] |

* + For X = 40ms

|  |  |  |
| --- | --- | --- |
| SSB SCS | UL SCS | Te/CP Ratio |
| 480 | 960 | [0.40] |
| 960 | 960 | [0.38] |

**UE implementation margin to be considered in Te requirements**

* A UE implementation margin of **at-least** eDRIFT + eDAC is needed in addition to the DL timing estimation uncertainty of eRS
	+ FFS if eRF\_Calibration should be considered as part of the core requirements

**SSB and UL SCS combinations**

* Define the requirements for SSB SCS of 120kHz and UL SCS of 480kHz.
* Do not define the requirements for SSB SCS 120kHz and UL SCS of 960kHz.
* Define the requirements for SSB SCS of 480kHz and UL SCS of 960kHz

**Initial transmit timing accuracy test**

* The rate of UE meeting the Te requirement observed during repeated tests shall be at least [90] %.

**Timing advance adjustment accuracy**

* FFS: The UE timing advance adjustment accuracy for 480/960kHz SCS is defined as shown below:
	+ Option 1:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| UL Sub Carrier Spacing(kHz) | 15 | 30 | 60 | 120 | 480 | 960 |
| UE Timing Advance adjustment accuracy | ±256 Tc | ±256 Tc | ±128 Tc | ±32 Tc | [±12 Tc] | [±8 Tc] |

* + Option 2: Keep the original agreement

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| UL Sub Carrier Spacing(kHz) | 15 | 30 | 60 | 120 | 480 | 960 |
| UE Timing Advance adjustment accuracy | ±256 Tc | ±256 Tc | ±128 Tc | ±32 Tc | [±8 Tc] | [±4 Tc] |

### MRTD

**MRTD definition**

* FFS: RAN4 to change the definition of receive timing difference between carriers in case of NR CA to address the case when MRTD is larger than one slot. For instance, RTD can be considered between the slot boundaries
* FFS: Change the definition of MRTD for synchronous NR DC in FR2-2 as below, so that it could be larger than 0.5 slot
	+ For FR2-2 operation, a UE shall be capable of handling a relative receive timing difference between slot timing boundary of a cell belonging to MCG and slot timing boundary from the same slot index of a cell belonging to the SCG to be aggregated for synchronous NR DC operation

**MRTD for intra-band non-contiguous CA**

* MRTD = [0.26] µs for non-contiguous intra band CA in FR2-2

**MRTD for FR1 and FR2-2 inter-band CA**

* FFS: The existing MRTD requirements for inter-band CA for FR1 and FR2-1 can be reused for inter-band CA for FR1 and FR2-2, i.e., MRTD = 25 µs

**MRTD for FR1 and FR2-2 NR DC - Synchronous**

* FFS: The existing MRTD requirements for FR1 and FR2-1 synchronous NR-DC can be reused for FR1 and FR2-2, i.e., MRTD = 33 µs

### MTTD

**Basic principles**

* Define MTTD requirements in FR2-2 based on the following rule:
	+ MTTD = MRTD + (TA step size / 2+ TA adjustment accuracy + Te) in cc1 + (TA step size / 2 + TA adjustment accuracy +Te) in cc2

**MTTD for FR1 and FR2-2 inter-band CA**

* FFS: The existing MTTD requirements for inter-band CA for FR1 and FR2-1 can be reused for inter-band CA for FR1 and FR2-2, i.e., MTTD = 26.1 us

**MTTD for FR1 and FR2-2 NR DC – Synchronous**

* FFS: The existing MTTD requirements for inter-band synchronous NR DC for FR1 and FR2-1 can be reused for inter-band synchronous NR DC for FR1 and FR2-2, i.e., MTTD = 34.1 us

### *deriveSSB-IndexFromCell*

**Assumptions on deriveSSB-IndexFromCell**

* Specify the frame boundary alignment tolerance for the case when deriveSSB-IndexFromCell is disabled for 960kHz SCS.
	+ Requirements are defined under assumption that UE may read PBCH payload.
* *deriveSSB-IndexFromCell* is not always enabled in unlicensed band in FR2-2.

**Frame boundary alignment tolerance**

* Define frame boundary alignment tolerance of SSB symbols as below:
	+ For 480kHz SCS – 3 SSB symbols
	+ For 960kHz SCS:
		- When deriveSSB-IndexFromCell is enabled – 3 SSB symbols
		- When deriveSSB-IndexFromCell is disabled – 6 SSB symbols
* Define frame boundary alignment tolerance of PDSCH when *deriveSSB-IndexFromCell* is enabled as below:

|  |  |  |
| --- | --- | --- |
| **SSB SCS (KHz)** | **Data SCS (KHz)** | **Frame boundary alignment tolerance of PDSCH symbols (deriveSSB-IndexFromCell enabled)** |
| 120 | 120 | / |
| 120 | 480 | 3 480KHz symbol |
| 120 | 960 | 6 960KHz symbol |
| 480 | 120 | 1 120KHz symbol |
| 480 | 480 | 3 480KHz symbol |
| 480 | 960 | 6 960KHz symbol |
| 960 | 120 | 1 120KHz symbol |
| 960 | 480 | 2 480KHz symbol |
| 960 | 960 | 3 960KHz symbol |

* Define frame boundary alignment tolerance of PDSCH when *deriveSSB-IndexFromCell* is disabled as below:

|  |  |  |
| --- | --- | --- |
| **SSB SCS (KHz)** | **Data SCS (KHz)** | **Frame boundary alignment tolerance of PDSCH symbols (deriveSSB-IndexFromCell disabled)** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
| 960 | 120 | [1] 120KHz symbol |
| 960 | 480 | [3] 480KHz symbol |
| 960 | 960 | [6] 960KHz symbol |

## Scheduling restrictions

**Scheduling restrictions when *deriveSSB-IndexFromCell* is enabled**

* Define the scheduling restrictions, when deriveSSB-IndexFromCell is enabled, based on Table below

|  |  |  |
| --- | --- | --- |
| **SSB SCS (kHz)** | **Data SCS (kHz)** | **Scheduling restriction including beam switching** |
| 120 | 120 | Existing requirements |
| 120 | 480 | (3+1) 480KHz symbols |
| 120 | 960 | (6+1) 960KHz symbols |
| 480 | 120 | 1 120KHz symbol |
| 480 | 480 | (3+1) 480KHz symbols |
| 480 | 960 | (6+1) 960KHz symbols |
| 960 | 120 | 1 120KHz symbol |
| 960 | 480 | (2+1) 480KHz symbols  |
| 960 | 960 | (3+1) 960KHz symbols |

**Scheduling restrictions when *deriveSSB-IndexFromCell* is disabled**

* When *deriveSSB-IndexFromCell* is not enabled for 960kHz SCS, no need to define scheduling restriction on all the symbols within the SMTC window
* Define the scheduling restrictions, when deriveSSB-IndexFromCell is disabled, based on Table below

|  |  |  |
| --- | --- | --- |
| **SSB SCS (kHz)** | **Data SCS (kHz)** | **Scheduling restriction including beam switching** |
| 960 | 120 | [1+1] 120KHz symbol |
| 960 | 480 | [3+1] 480KHz symbols  |
| 960 | 960 | [6+1] 960KHz symbols |

## Measurement procedures

**Cell detection**

* FFS: The impact of higher sampling rate and number of samples in PSS/SSS detection requirements.

**PBCH detection for SSB index acquisition**

* FFS: PBCH detection time for SSB index acquisition for 480/960 kHz SCS
* When *deriveSSB-IndexFromCell* is not enabled, use the following definition of TSSB\_time\_index\_intra for FR2-2:

|  |  |  |
| --- | --- | --- |
| DRX cycle | Without measurement gaps | With measurement gaps |
| No DRX | Max(200ms, ceil(MSSB\_index\_intra × Kp) × SMTC period) × CSSFintra | Max(200ms, ceil(MSSB\_index\_intra × Kp) × Max(MGRP, SMTC period)) × CSSFintra |
| DRX cycle≤ 320ms | Max(200ms, ceil(1.5 × MSSB\_index\_intra s × Kp) × Max(SMTC period, DRX cycle)) × CSSFintra | Max(200ms, ceil(1.5 × MSSB\_index\_intra × Kp) × Max(MGRP, SMTC period, DRX cycle)) × CSSFintra |
| DRX cycle>320ms | ceil(MSSB\_index\_intra × Kp) × DRX cycle × CSSFintra | ceil(MSSB\_index\_intra × Kp) × DRX cycle × CSSFintra |
| MSSB\_index\_intra will depend on the outcome of the PBCH index detection discussion and RF decision on supported power classes for FR2-2. |

* + FFS: MSSB\_index\_intra

# References

1. R4-2207065, Email discussion summary for [102-e][224] NR\_ext\_to\_71GHz\_RRM\_1, Qualcomm, RAN4 #102-e, February 21 – March 3, 2022