**3GPP TSG-RAN WG4 Meeting # 107 R4-2310002**

**Incheon, KR, May 22nd – May 26th , 2023**

**Agenda item:** 7.33

**Source:** Moderator (Vodafone)

**Title:** Topic summary for [107][119] NR\_FDD\_ULn28\_DLn75\_n76

**Document for:** Information

# Introduction

*Briefly introduce background, the scope of this email discussion (e.g. list of treated agenda items) and provide some guidelines for email discussion if necessary.*

This email thread is focused on AI 7.33 FDD Bands using the uplink from n28 and the downlink of n75 and n76.

# Topic #1: General and work plan

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2307437 | Vodafone | Work plan for each meeting for the new FDD Bands using the uplink from n28 and the downlink of n75 and n76:RAN4#107 (0.5 TU)- Discussions on the system parameters for the new FDD Bands. - Discussions on the BS and UE core requirements for the new FDD.RAN4#108 (0.5 TU)- Continue discussions on the system parameters for the new FDD Bands.- Continue discussions on BS and UE requirements for the new FDD Bands.- Discussions on the conformance test requirements for the new FDD Bands.- Provide change requests on the system parameters for the new FDD Bands.- Provide change requests on the BS and UE core requirements for the new FDD Bands.RAN4#108bis (0.5 TU)- Approve change requests on the system parameters for the new FDD Bands.- Approve change requests on the BS and UE core requirements for the new FDD Bands.- Provide and approve change requests on the conformance test requirements for the new FDD Bands |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 1-1 Work plan

*Sub-topic description:*

*Open issues and candidate options before meeting:*

**Issue 1-1-1: Work plan**

*To discuss the following workplan for each meeting:*

* Proposals in R4-2307437
	+ RAN4#107 (0.5 TU)

- Discussions on the system parameters for the new FDD Bands.

- Discussions on the BS and UE core requirements for the new FDD.

* + RAN4#108 (0.5 TU)

- Continue discussions on the system parameters for the new FDD Bands.

- Continue discussions on BS and UE requirements for the new FDD Bands.

- Discussions on the conformance test requirements for the new FDD Bands.

- Provide change requests on the system parameters for the new FDD Bands.

- Provide change requests on the BS and UE core requirements for the new FDD Bands.

* + RAN4#108bis (0.5 TU)

- Approve change requests on the system parameters for the new FDD Bands.

- Approve change requests on the BS and UE core requirements for the new FDD Bands.

- Provide and approve change requests on the conformance test requirements for the new FDD Bands

# Topic #2: UE RF requirements

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2309092 | Apple | Proposal 1: Clarification is needed on whether CA\_n28-n76 should be introduced first before the normative work for the corresponding FDD band can be started.Proposal 2: Clarification is needed on whether the n28 UL should use the entire band range for the intended FDD bands or the restricted range as specified for CA\_n28-n75.Observation 1: For the FDD bands by combining n28 UL and n75/n76 DL, there is a high probability for n75 and n76 DL carrier REFSENS to be affected by n28 UL 2nd harmonic.Observation 2: For the FDD bands by combining n28 UL and n75/n76 DL, the REFSENS impact level could range from sub-1 dB to over 30 dB, depending on how much overlap of the UL 2nd harmonic (including the side-lobe) with the DL carrier.Observation 3: It would not be straightforward to specify the REFSENS requirements for the intended new FDD bands by combining n28 UL and n75/n76 DL.Proposal 3: For the intended new FDD bands by combining n28 UL and n75/n76 DL, how to handle the REFSENS impact caused by UL 2nd harmonic and specify the corresponding requirement needs to be addressed. |
| R4-2309623 | Skyworks Solutions, Inc | Proposal 1: on FDD with variable duplex operation bands REFSENS:* FDD with variable duplex operation bands REFSENS is moved from Table 7.3.2-1b to Table 7.3.2-1a
* Table 7.3.2-1a title is changed to: Two antenna port reference sensitivity QPSK PREFSENS for FDD bands with/without variable duplex operation
* Table 7.3.2-1a title is changed to: Two antenna port reference sensitivity QPSK PREFSENS for TDD and SDL bands
* The following rows are added to Table 7.3.2-1a
	+ FFS if a second RESENS should be specified for the case without H2 interference. An option is to measure the n76 5MHz CBW without H2 interference.

| Operating Band | SCS kHz | 5MHz(dBm) | 10MHz(dBm) | 15MHz(dBm) | 20MHz(dBm) | 25MHz(dBm) | 30 MHz (dBm) | 35 MHz (dBm) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n91 | 15 | -100.0 |  |  |  |  |  |  |
| n92 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |  |  |  |
| 30 |  | -97.2 | -94.0 | -93.2 |  |  |  |
| n93 | 15 | -100.0 |  |  |  |  |  |  |
| n94 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |  |  |  |
| 30 |  | -97.2 | -94.0 | -93.2 |  |  |  |
| n1XX(n28+n76) | 15 | -71.9X |  |  |  |  |  |  |
| n1XY(n28+n75) | 15 | -71.9 X | -71.9 X | -71.9 X | -71.9 X |  |  |  |
| 30 |  | -71.9 X | -71.9 X | -71.9 X |  |  |  |

 |
| R4-2307439 | Vodafone | Proposal 1: TX-RX frequency separation for the proposed bands is the following:

| NR Operating Band | TX – RX carrier centre frequencyseparation |
| --- | --- |
| nA | 689 MHz - 809 MHz (*μ* = 0)694 MHz - 804 MHz (*μ* = 1) |
| nB | 684 MHz – 724 MHz |

The range of TX-RX frequency separation given paired UL and DL channel bandwidths BWUL and BWDL is given by the respective lower and upper limit FDL\_low – FUL\_high + 0.5(BWDL + BWUL) and FDL\_high – FUL\_low – 0.5(BWDL + BWUL).Proposal 2: Asymmetric channel BW operation should be supported with below combinations:

|  |  |  |
| --- | --- | --- |
| **NR Operating Band** | **Channel BWs for UL (MHz)** | **Channel BWs for DL (MHz)** |
| **nA** | **5** | **10, 15, 20, 25, 30, 40, 50** |
| **10** | **5, 15, 20, 25, 30, 40, 50** |
| **15** | **5, 10, 20, 25, 30, 40, 50** |
| **20** | **5, 10, 15, 25, 30, 40, 50** |
| **25** | **5, 10, 15, 20, 30, 40, 50** |
| **30** | **5, 10, 15, 20, 25, 40, 50** |
| **nB** | **10** | **5** |
| **15** | **5** |
| **20** | **5** |

 |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 2-1 Second harmonic of band n28 overlaps with n75/n76

*Sub-topic description:*

*Open issues and candidate options before meeting:*

**Issue 2-1-1: n28 UL band range**

* Proposals
	+ Option 1: n28 UL should use the entire band range for the intended FDD bands
	+ Option 2: n28 UL should use restricted range as specified for CA\_n28-n75.
* Recommended WF
	+ Option 2

**Issue 2-1-2: n76 DL**

* Proposals
	+ Option 1: CA\_n28-n76 should be introduced first before starting the work on FDD band n28 UL/n76 DL.
	+ Option 2: There is no need to introduce CA\_n28-n76 before starting work on FDD band n28 UL/n76 DL.

**Issue 2-1-3 REFSENS:**

* Proposal:

o Option 1: On FDD with variable duplex operation bands REFSENS:

• FDD with variable duplex operation bands REFSENS is moved from Table 7.3.2-1b in 38.101-1 to Table 7.3.2-1a

• Table 7.3.2-1a in 38.101-1 title is changed to: Two antenna port reference sensitivity QPSK PREFSENS for FDD bands with/without variable duplex operation

• Table 7.3.2-1a in 38.101-1 title is changed to: Two antenna port reference sensitivity QPSK PREFSENS for TDD and SDL bands

• The following rows are added to Table 7.3.2-1a in 38.101-1

* FFS if a second RESENS should be specified for the case without H2 interference. An option is to measure the n76 5MHz CBW without H2 interference.

| Operating Band | SCS kHz | 5MHz(dBm) | 10MHz(dBm) | 15MHz(dBm) | 20MHz(dBm) | 25MHz(dBm) | 30 MHz (dBm) | 35 MHz (dBm) |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| n91 | 15 | -100.0 |  |  |  |  |  |  |
| n92 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |  |  |  |
| 30 |  | -97.2 | -94.0 | -93.2 |  |  |  |
| n93 | 15 | -100.0 |  |  |  |  |  |  |
| n94 | 15 | -100.0 | -96.8 | -95.0 | -93.7 |  |  |  |
| 30 |  | -97.2 | -94.0 | -93.2 |  |  |  |
| n1XX(n28+n76) | 15 | -71.9X |  |  |  |  |  |  |
| n1XY(n28+n75) | 15 | -71.9 X | -71.9 X | -71.9 X | -71.9 X |  |  |  |
| 30 |  | -71.9 X | -71.9 X | -71.9 X |  |  |  |

o Option 2: Other (Please specify)

* Recommended WF
	+ TBA

### Sub-topic 2-2 TX-RX frequency separation & Asymmetric channel BW

*Sub-topic description*

*Open issues and candidate options before meeting:*

**Issue 2-2-1 TX – RX carrier centre frequency separation:**

* Proposals
	+ Option 1: (UL band range is based on entire UL n28) The range of TX-RX frequency separation given paired UL and DL channel bandwidths BWUL and BWDL is given by the respective lower and upper limit FDL\_low – FUL\_high + 0.5(BWDL + BWUL) and FDL\_high – FUL\_low – 0.5(BWDL + BWUL).

| NR Operating Band | TX – RX carrier centre frequencyseparation |
| --- | --- |
| Band nA: 1432 – 1517 MHz DL / **703 – 748 MHz UL** | 689 MHz - 809 MHz (*μ* = 0)694 MHz - 804 MHz (*μ* = 1) |
| Band nB: 1427 – 1432 MHz DL / 703 – 748 MHz UL | 684 MHz – 724 MHz |

* + Option 2: (UL band range is based on UL CA\_n28-n75) The range of TX-RX frequency separation given paired UL and DL channel bandwidths BWUL and BWDL is given by the respective lower and upper limit FDL\_low – FUL\_high + 0.5(BWDL + BWUL) and FDL\_high – FUL\_low – 0.5(BWDL + BWUL).

| NR Operating Band | TX – RX carrier centre frequencyseparation |
| --- | --- |
| Band nA: 1432 – 1517 MHz DL / **703 – 733 MHz UL** | 704 MHz - 809 MHz (*μ* = 0)709 MHz - 804 MHz (*μ* = 1) |
| Band nB: 1427 – 1432 MHz DL / 703 – 733 MHz UL | 699 MHz – 724 MHz |

* + Option 3: Other (Please Specify)
* Recommended WF
	+ TBA

**Issue 2-2-2 Asymmetric channel BW:**

* Proposals
	+ Option 1: Asymmetric channel BW operation should be supported with below combinations:

|  |  |  |
| --- | --- | --- |
| **NR Operating Band** | **Channel BWs for UL (MHz)** | **Channel BWs for DL (MHz)** |
| **nA** | **5** | **10, 15, 20, 25, 30, 40, 50** |
| **10** | **5, 15, 20, 25, 30, 40, 50** |
| **15** | **5, 10, 20, 25, 30, 40, 50** |
| **20** | **5, 10, 15, 25, 30, 40, 50** |
| **25** | **5, 10, 15, 20, 30, 40, 50** |
| **30** | **5, 10, 15, 20, 25, 40, 50** |
| **nB** | **10** | **5** |
| **15** | **5** |
| **20** | **5** |

* + Option 2: Other (Please specify)
* Recommended WF
	+ TBA

# Topic #3: Band definition and system parameters

*Main technical topic overview. The structure can be done based on sub-agenda basis.*

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2307438 | Vodafone | Proposal 1: a) Confirm CBW and SCSs marked with ‘YES’ for the new FDD bands based on the Table 3.b) Decide if UL and DL CBW options in Table 3 should all be supported for the new FDD bands.Table 3: CBWs and SCSs for the new FDD bands

|  | NR band / SCS / UE CBW |
| --- | --- |
| NR Band | SCSkHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz |
| Band nA: 1432 – 1517 MHz DL / 703 – 748 MHz UL | 15 | Yes | Yes | Yes | Yes | Yes | Yes | DL | DL |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | DL | DL |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| Band nB: 1427 – 1432 MHz DL / 703 – 748 MHz UL | 15 | Yes | UL | UL | UL | UL | UL |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |

 |

## Open issues summary

*Before Meeting, moderators shall summarize list of open issues, candidate options and possible WF (if applicable) based on companies’ contributions.*

### Sub-topic 3-1 Channel bandwidth

*Sub-topic description:*

*Open issues and candidate options before meeting:*

**Issue 3-1-1: CBW**

* Proposals
	+ Option 1: Confirm CBW and SCSs marked with ‘YES’ for the new FDD bands based on the following table (UL band range is based on entire UL n28 band):

Table 3\_1: CBWs and SCSs for the new FDD bands

|  | NR band / SCS / UE CBW |
| --- | --- |
| NR Band | SCSkHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz |
| Band nA: 1432 – 1517 MHz DL / 703 – 748 MHz UL | 15 | Yes | Yes | Yes | Yes | Yes | Yes | DL | DL |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | DL | DL |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| Band nB: 1427 – 1432 MHz DL / 703 – 748 MHz UL | 15 | Yes | UL | UL | UL | UL | UL |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |

* + Option 2: Confirm CBW and SCSs marked with ‘YES’ for the new FDD bands based on the following table (UL band range is based on UL CA\_n28-n75):

Table 3\_2: CBWs and SCSs for the new FDD bands

|  | NR band / SCS / UE CBW |
| --- | --- |
| NR Band | SCSkHz | 5 MHz | 10 MHz | 15 MHz | 20 MHz | 25 MHz | 30 MHz | 40 MHz | 50 MHz | 60 MHz | 80 MHz | 90 MHz | 100 MHz |
| Band nA: 1432 – 1517 MHz DL / 703 – 733 MHz UL | 15 | Yes | Yes | Yes | Yes | Yes | Yes | DL | DL |  |  |  |  |
| 30 |  | Yes | Yes | Yes | Yes | Yes | DL | DL |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |
| Band nB: 1427 – 1432 MHz DL / 703 – 733 MHz UL | 15 | Yes | UL | UL | UL | UL | UL |  |  |  |  |  |  |
| 30 |  |  |  |  |  |  |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |  |  |  |  |  |  |

* + Option 3: Other (Please specify)
* Recommended WF
	+ TBA

**Issue 3-1-2: UL & DL CBW**

* Proposals
* Option 1: Decide if UL and DL CBW options in Table 3\_1/Table3\_2 should all be supported for the new FDD bands.
* Option 2: Other (Please specify)