3GPP TSG RAN Meeting #103 RP-24xxxx

Maastricht, Netherlands, 18-22 March, 2024

**Agenda item: 9.7.2.7**

**Source:**  **Apple**

**Title:**  **Way Forward on 2Rx for XR**

**Document for: Approval**

# Introduction (for information)

## 1.1 Background

The discussion on 2Rx XR devices in RAN#102 led to the agreed way forward [RP-234015]:

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| --- |
| 1. **Task RAN2 and RAN3** to develop signaling support for ‘2Rx non-REDCAP XR devices’, send corresponding Release-18 draft CR(s) to RAN#103:
* A new dedicated UE capability indication per band and setting of corresponding existing UE capability(ies). [RAN2]*Note: no need is foreseen to add an indication to Msg1 or Msg3.*
* Indication in SIB, to be used to re-direct to another frequency layer, or to bar the device altogether. [RAN2]
* SPID indication from the Core Network to gNB. [RAN3]
* N2-NGAP indication for ‘2Rx non-REDCAP XR devices’ from gNB to Core Network to take action based on operator policy. [RAN3]
1. **Task RAN4** to develop Release-18 draft CR(s) to RAN#103 for ‘2Rx non-REDCAP XR devices’:
* Capture the definition of 2Rx non-REDCAP XR devices in [38.101-1] using the definition from RAN#101 (c.f. RP-232657)
* Determine the feasibility of tightened 2Rx REFSENS requirements (in relation to existing 2Rx and 4Rx REFSENS) for the bands where 4Rx is mandatory and provide the feasible REFSENS values. RAN4 shall consider both conducted requirements as well as OTA considerations.
1. **TSG-RAN#103 in March:**
2. Consider approving the draft CRs from RAN2, RAN3 and RAN4 for Release-18
3. Consider approving Release-19 work to be conducted on detailed OTA work for ‘2Rx non-REDCAP XR devices’.

Points 1) and 2) represent a package, each one is dependent on the other moving forward.  |

## 1.2 RAN2 Progress

Regarding the tasks from RAN #102:

* A new dedicated UE capability indication per band and setting of corresponding existing UE capability(ies). [RAN2]
* Indication in SIB, to be used to re-direct to another frequency layer, or to bar the device altogether. [RAN2]
* RAN2 had discussion at RAN2 #125 and fully accomplished them, and discussed and endorsed two sets of CRs:

|  |  |  |  |
| --- | --- | --- | --- |
|  | The first set of CRs | The second set of CRs | Notes |
| CR to TS 38.304 | R2-2402037 | R2-2401561 | Add UE behavior for 2Rx XR UEs after acquiring MIB and SIB1 |
| CR to TS 38.331 | R2-2401987 | R2-2401560 | Add clauses for 2Rx XR UE’s initial access behaviors. |
| CR to TS 38.306 | R2-2401988 | R2-2401563 | Add an exception in the field description of maxNumberMIMO-LayersPDSCH and introduce perband 2Rx XR capability |
| CR to TS 38.300 | R2-2401989 | R2-2401562 | Add behaviors in access and camping. |

## 1.3 RAN3 Progress

Regarding the tasks from RAN #102:

* SPID indication from the Core Network to gNB. [RAN3]
* N2-NGAP indication for ‘2Rx non-REDCAP XR devices’ from gNB to Core Network to take action based on operator policy. [RAN3]

RAN3 had discussion at RAN3 #123 and fully accomplished them.

* The CRs were endorsed/agreed:
* CR to TS 38.300
	+ R3-241069, Introduction of new SPID value for 2RX XR UE [2Rx\_XR\_Device]
	+ Introduces a new Reference SPID value for 2Rx XR UE.
	+ Note: this endorsed CR needs to be merged into RAN2 TS 38.300 CR
* CR to TS 38.413
	+ R3-241070, Introduction of 2Rx relaxation for XR devices [2Rx\_XR\_Device]
	+ To support N2 indication from gNB to CN for 2Rx XR devices, TS 38.413 should be enhanced. Currently, the UE Radio Capability Indication procedure is used to provide the AMF with UE radio capability-related information. It can be extended to indicate whether the UE is a 2Rx XR device or not.
	+ Adds a new IE to indicate 2Rx XR devices in the UE RADIO CAPABILITY INFO INDICATION message.

## 1.4 RAN4 Progress

As captured in the LS from RAN4 to RAN (R4-2403880, LS on 2Rx XR UE requirements, RAN4):

* The agreed CR is R4-2403890, CR 38.101-1 addition of 2Rx XR exception for REFSENS [2Rx\_XR\_UE], Nokia, Meta Ireland
	+ Two Rx antenna port XR UE is defined as “A non-(e)RedCap XR UE that is equipped with only two Rx antenna ports in frequency band(s) where 4 Rx antenna ports are required. The UE is intended to be worn on human head. When in use, is intended to be supported only by/behind the ears and by a nose-bridge resulting in a constrained form factor with limited volume available for Rx chains.”
* On conducted receiver sensitivity and OTA performance, the WF in R4-2403878 was agreed by RAN4:
	+ On conducted receiver sensitivity, consider two options
		- 0.5dB tightening compared to the existing 2Rx UE conducted REFSENS, which is considered feasible by some UE vendors
		- 2Rx XR UE meets the 4Rx handheld UE conducted REFSENS
	+ On OTA performance:
		- It is agreed to specify OTA TRS requirements per band for both 4Rx XR and 2Rx XR for the NR bands which are mandatorily to support 4Rx based on measurement campaign of 4Rx XR, considering the performance degradation value for 2Rx based on 4Rx measurement campaign.

During the RAN#103 discussions, companies have made an effort to converge on a resolution, as captured in this document.

# Way Forward (for approval)

**Issue 1: REFSENS**

Update the RAN4 CR in RP-240364 with the following:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| For two Rx antenna port XR UE(s) indicating UE capability [2Rx XR], reference sensitivity for two Rx antenna ports in Table 7.3.2-1a and in Table 7.3.2-1b shall be modified by the amount given in ΔRXR,2R in Table 7.3.2-3 for the applicable operating bands.Table 7.3.2-3: Two antenna port XR UE reference sensitivity allowance ΔRXR,2R

|  |  |
| --- | --- |
| Operating band | ΔRXR,2R (dB) |
| n7, n38, n41, n48, n77, n78, n79 |  [1.0]  |
| n104 | TBD |

 |

**Issue 2: OTA performance**

It is agreed to specify OTA TRS requirements per band for both 4Rx XR and 2Rx XR for the NR bands which are mandatorily to support 4Rx based on measurement campaign of 4Rx XR, considering the performance degradation value for 2Rx based on 4Rx measurement campaign.

**Issue 3: Signaling support**

Signaling and barring solution (default barring option) to be taken from to the following CR: RP-240706.