**3GPP TSG RAN Meeting #104 RP-241360**

**Shanghai, China, June 17-20, 2024** (revision of RP-xxxxxx)

*NOTE: RAN specific additions are added in blue.*

**Source: MediaTek Inc.**

**Title: New SID:** **Study on NR FR1 Fragmented Carriers**

**Document for: Approval**

**Agenda Item: 9.1.4**

3GPP™ Work Item Description

Information on Work Items can be found at <http://www.3gpp.org/Work-Items>
See also the [3GPP Working Procedures](http://www.3gpp.org/specifications-groups/working-procedures), article 39 and the TSG Working Methods in [3GPP TR 21.900](http://www.3gpp.org/ftp/Specs/html-info/21900.htm)

Title: Study on NR FR1 Fragmented Carriers

Acronym: FS\_NR\_FR1\_Frag\_Carrier

Unique identifier:

NOTE: For new WIs/SIs leave the Unique identifier empty and make a proposal for an Acronym.

 For a revised WI/SI: Take Unique identifier and acronym as shown in 3GPP workplan.

 If this is a RAN WID including Core and Perf. part, then Title, Acronym and Unique identifier refer to the feature WI.

 Please tick (X) the applicable box(es) in the table below:

 Either:

|  |  |
| --- | --- |
| **This WID includes a Core part** |  |
| **This WID includes a Performance part** |  |

 or:

|  |  |
| --- | --- |
| **This WID includes a Testing part** |  |
| **and it addresses the following 3GPP work area:** | **Radio Access** |  |
| **Core Network** |  |
| **Services** |  |

Potential target Release: *Rel-19*

NOTE: In case of contradiction with the target dates of clause 5, clause 5 determines the target release.

# 1 Impacts

{For Normative work, identify the anticipated impacts. For a Study, identify the scope of the study}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Affects:** | UICC apps | ME | AN | CN | Others (specify) |
| **Yes** |  | X | X |  |  |
| **No** | X |  |  | X | X |
| **Don't know** |  |  |  |  |  |

# 2 Classification of the Work Item and linked work items

### 2.1 Primary classification

This description is either a …

|  |  |
| --- | --- |
| X | Study Item |

or a

|  |
| --- |
| Normative Work Item:*tick applicable boxes below* |
|  | Stage 1 |
|  | Stage 2 |
|  | Stage 3 |
|  | Other (e.g. testing) |

### 2.2 Parent Work Item

For a brand-new topic, use “N/A” in the table below. Otherwise indicate the parent Work Item.

|  |
| --- |
| Parent Work / Study Items  |
| Acronym | Working Group | Unique ID | Title (as in 3GPP Work Plan) |
| N/A | N/A | N/A | N/A |

NOTE: RAN agreed some time ago, that it describes the feature WI + Core/Perf. part WI or Testing part WI in one WID. Therefore the table above should include the feature WI data (In case the feature covers Core and Perf. part, please list under Working Group the leading WG of the Core part).

### 2.3 Other related Work Items and dependencies

|  |
| --- |
| Other related Work/Study Items (if any) |
| **Acronym** | Unique ID | Title | Nature of relationship |
|  |  |  |  |
|  |  |  |  |

NOTE: Also related or dependent WIs/SIs in other TSGs shall be indicated here.

# 3 Justification

RAN4 has introduced numerous NR Carrier Aggregation (CA) configurations in past releases. Fragmented carriers in the same band consuming multiple Rx chains may limit the UE CA capabilities as the maximum supported number of component carriers (CCs) in a CA combination is limited by the number and capabilities of the analog Rx chains as well as the baseband processor capabilities in the UEs. This limitation prevents operators from fully utilizing their fragmented spectrum holdings in a single CA combination. A multi-company proposal was submitted to RAN#102[[RP-233374](https://www.3gpp.org/ftp/TSG_RAN/TSG_RAN/TSGR_102/Docs/RP-233374.zip)] and RAN4#110[[R4-2402309](https://www.3gpp.org/ftp/TSG_RAN/WG4_Radio/TSGR4_110/Docs/R4-2402309.zip)] indicating a potential solution that could have global impact.

This study will investigate solutions to address the aforementioned issue, focusing on the use of fewer (shared) Rx chains than the number of carrier fragments in a band.

# 4 Objective

### 4.1 Objective of SI or Core part WI or Testing part WI

The objective of this study is as follows:

- Identify methods for reducing the number of UE Rx chains (e.g. from separate RF chains per CC to shared RF chains ) needed for single DL band with frequency span ≤ 100 MHz, containing two non-contiguous CCs within a CA combination for the inter-operator co-located scenario, considering:

- Which RF requirements could be adjusted for the inter-operator co-located BS scenario, e.g. existing UE RF requirements such as ΔRIBNC, ACS and in-band blocking [RAN4];

- The ability to semi-statically switch hardware resources (i.e. Rx chains) [RAN4, RAN2 – See note 2];

- Up to 6 dB DL received power imbalance between the two non-contiguous CCs [RAN4];

- Study whether to consider maximum power imbalance among inter-operator carriers

- Impacts on DL performance [RAN4] ;

* E.g. REFSENS degradation due to shared Rx chain

- Means for a UE to inform the network of new CA configuration it can support with adjusted RF requirements [RAN4, RAN2 – See note 2].

NOTE 1: No RAN1 impact is foreseen

NOTE 2: RAN2 work, if necessary, will be triggered by RAN4 LSNOTE 3: This study starts from single DL band. Sharing RF chain is not considered among inter-band DL carriers. [Higher order band combinations can be considered after RAN#106.]

### 4.2 Objective of Performance part WI

NOTE: Leave empty if the WI proposal does not contain a RAN performance part.

### 4.3 RAN time budget request (not applicable to RAN5 WIs/SIs)

NOTE: For all new RAN related WIs/SIs which are not led by RAN WG5 the WI/SI rapporteur has to fill out the attached Excel table to request time budgets for corresponding RAN WG meetings.
The Excel table has to be filled out for all affected RAN WGs and up to the target date of the WI/SI.
One time unit (TU) corresponds to ~ 2 hours in the meeting.
If no TU is needed, then leave the field empty otherwise enter a number >0 in the field.

 For revisions of already approved WI/SI descriptions: Please remove the Excel table from the WID/SID's zip file. The time budgets are already recorded. If you want to modify them, then this has to be done via the status report and not via a revised WID/SID.

 If this WID is covering Core and Performance part, then please fill out one line for each part in the attached Excel table.

**additional comments to the time budget request in the attached Excel table:**

# 5 Expected Output and Time scale

|  |
| --- |
| **New specifications** *{One line per specification. Create/delete lines as needed}* |
| Type  | TS/TR number | Title | For info at TSG#  | For approval at TSG# | Remarks |
| Internal TR | TR 38.xyz | *Study on NR FR1 Fragmented Carriers* | *N/A* | *TSG #108 / Jun 2025* | *One-step approval expected* |
|  |  |  |  |  |  |

*{Note 1: Only TSs may contain normative provisions. Study Items shall create or impact only TRs.
"Internal TR" is intended for 3GPP internal use only whereas "External TR" may be transposed by OPs.}*

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
By default a new specs can only be new for one of both parts.

|  |
| --- |
| **Impacted existing TS/TR** *{One line per specification. Create/delete lines as needed}* |
| TS/TR No. | Description of change  | Target completion plenary# | Remarks |
| *{E.g. "22.281"}* | *{Possible values:* *- either free text (e.g. “CS aspects to be removed") - or “Specification to be withdrawn”}* | *{E.g. "TSG#89"}* | *{Free text, e.g. "This TS covers Stage 2" or "This TS covers Stage 3" or "This TS covers both stages 2 and 3"}* |
|  |  |  |  |

NOTE: If this is a RAN WI including Core and Perf. part, then all new Core part specs have to be listed first and then all new Perf. part specs. Indicate "Core part" or "Perf. part" under Remarks for each spec.
If an existing spec is affected by both (Core part and Perf. part), then it has to be listed twice with appropriate approval dates.

# 6 Work item Rapporteur(s)

Huanren (Henry) Fu, MediaTek Inc., huanren.fu@mediatek.com

NOTE: The first listed Rapporteur has the overall responsibility for this WI (incl all secondary tasks).

# 7 Work item leadership

RAN WG4

# 8 Aspects that involve other WGs

None

NOTE: For RAN WIs: Section 8 applies only toWGs outside of TSG RAN because all RAN WG aspects have to be covered in section 4.

# 9 Supporting Individual Members

*{At least 4 supporting Individual Members are needed. There is an expectation that these companies will provide resources to progress the work. Note that having 4 supporting companies is a necessary but not sufficient condition: the usual TSG approval process by consensus is needed for the WID approval.}*

|  |
| --- |
| Supporting IM name |
| MediaTek Inc. |
| TELUS |
| Bell Mobility |
| Nokia |
| Telstra |
| T-Mobile USA |
| [US Cellular] |
| Spark NZ Ltd |
| [Southern Linc] |
| AT&T |
| Verizon Wireless |
| [CableLabs] |
| Samsung |
| Ericsson |
| [Apple] |
| CHTTL |
| Intel Corporation |
| ZTE |
| New H3C |