**3GPP TSG-RAN WG4 Meeting #94-e R4-2002308**

**Electronic Meeting, Feb.24th – Mar.6th 2020**

**Agenda item:** 8.6.3

**Source:** Moderator (Nokia)

**Title:** Email discussion summary for RAN4#94e\_#54\_LTE\_NR\_DC\_CA\_RRM

**Document for:** Information

# Introduction

Summary document for the agenda item 8.6 Multi-RAT Dual-Connectivity and Carrier Aggregation enhancements [LTE\_NR\_DC\_CA\_enh]. Purpose of the document is to collect all RRM Core requirements related proposals from companies for each agenda item.

The Agenda for LTE\_NR\_DC\_CA\_enh includes 3 active discussion agendas:

1. Asynchronous and synchronous NR-NR Dual Connectivity
2. Early Measurement reporting
3. Efficient and low latency serving cell configuration, activation and setup

The Early Measurement reporting is split into two discussion topics:

2.1) NR measurements for EMR

2.2) LTE NR Inter-RAT EMR

The Efficient and low latency serving cell configuration, activation and setup is split into two topics:

3.1) Direct SCell activation

3.2) SCell dormancy

For each of the 5 discussion agendas and topics there is a list of company contributions as well as a copy of each observation and proposal from each company. Based on the proposals a number of Sub-topics have been identified.

For each sub-topic, the proposals from each company have been listed. Additionally, based on the proposals, a number of open issues have been identified (e.g. Issue 2-1) and for each open issue a recommended WF has been listed.

At the end of each topic there is a table with the identified open issues for companies are to give their views.

**Companies are encouraged to give their views on each listed Issue based on the recommended WF listed for the open issue. It is always possible to give additional input under ‘Other’.** Commenting based on the recommended WF will help focusing the discussion and facilitate progress.

**Please leave the original list of open Issues for Company XXX such that other companies can easily copy when they comment.**

## Email discussion guideline for Round 2

Please use R4-2002177 as baseline for the discussion. Use the ’recommendation for 2nd round’ as the baseline for the discussion in 2nd round.

In R4-2002177 a number of possible agreements have been listed (tentative agreements). Based in R4-2002177 discussion I have collected under ’Discussion on 2nd round’ aspect for input in 2nd round in this Revised\_R4-2002177. Companies should at least indicate if they cannot agree to the tentative agreement. If no objections are received the tentative agreement will be listed as agreed and captured in the WF as such. Otherwise, the tentative agreement will open for further discussion in next meeting.

Additionally, companies may add further comments to round open parts. These open aspects will be listed in the WF for further discussion.

After each Issue I have listed:

Comments: [Chronological order]

[Company A:]

Agreement:

Please fill in Company view under Company. Based on the input I will add Agreement. E.g.:

Nokia: Support the tentative agreement.

Once updated please upload to Draft folder (same location as in Round 1) adding company name at the end of the file name (same procedure as in round 1).

As for Dormancy SCell a WF will be created directly based on the round 1 discussion. Companies can comment the WF directly.

All submitted papers for 8.6.3:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8.6.3.1 | **R4-2001626** | CR on Interruptions at SCell activation/deactivation in async NR-DC | Huawei, HiSilicon | CR |
| 8.6.3.2 | **R4-2000988** | On MR-DC Early Measurement reporting | OPPO | discussion |
| 8.6.3.2 | **R4-2002056** | Further discussion on early measurement reporting in MR-DC | Qualcomm Incorporated | discussion |
| 8.6.3.2.1 | **R4-2001340** | Early measurements and reporting in NR | Nokia, Nokia Shanghai Bell | discussion |
| 8.6.3.2.1 | **R4-2001627** | Discussion on early measurement in NR | Huawei, HiSilicon | discussion |
| 8.6.3.2.1 | **R4-2001795** | Discussion on LTE CRS based and NR SSB based measurement in NR IDLE/INACTIVE mode | MediaTek inc. | discussion |
| 8.6.3.2.1 | **R4-2001927** | Further details on early measurement reporting requirements | Ericsson | discussion |
| 8.6.3.2.1 | **R4-2001928** | Early measurement reporting requirements structure | Ericsson | CR |
| 8.6.3.2.2 | **R4-2001341** | NR Inter-RAT measurements for early measurement reporting | Nokia, Nokia Shanghai Bell | discussion |
| 8.6.3.2.2 | **R4-2001628** | Discussion on LTE – NR inter-RAT EMR | Huawei, HiSilicon | discussion |
| 8.6.3.2.2 | **R4-2001796** | Discussion on NR SSB based measurement in LTE IDLE/INACTIVE mode | MediaTek inc. | discussion |
| 8.6.3.3.1 | **R4-2000059** | On delay requirements for direct SCell activation in resume | ZTE Corporation | discussion |
| 8.6.3.3.1 | R4-2000060 | [CR] Add delay requirements for direct SCell activation in resume | ZTE Corporation | CR |
| 8.6.3.3.1 | **R4-2000061** | [CR] Add delay requirements for direct SCell activation in resume | ZTE Corporation | CR |
| 8.6.3.3.1 | **R4-2000062** | [CR] Delay requirements for direct SCell activation | ZTE Corporation | CR |
| 8.6.3.3.1 | **R4-2001011** | Direct SCell activation interruption requirements | NEC | discussion |
| 8.6.3.3.1 | **R4-2001629** | Discussion on remaining issues for direct SCell activation | Huawei, HiSilicon | discussion |
| 8.6.3.3.1 | **R4-2001630** | CR on direct SCell activation delay | Huawei, HiSilicon | CR |
| 8.6.3.3.1 | **R4-2002084** | On direct SCell activation | Ericsson | discussion |
| 8.6.3.3.1 | **R4-2002085** | CR 38.133 (8.3.4-5) Corrections to Direct SCell activation | Ericsson | CR |
| 8.6.3.3.2 | **R4-2001342** | UE Requirements for Dormancy Scell | Nokia, Nokia Shanghai Bell | discussion |
| 8.6.3.3.2 | **R4-2002059** | Discussion on Scell BWP dormancy | Qualcomm Incorporated | discussion |
| 8.6.3.2.2 | **R4-2001631** | Discussion on RRM requirements for SCell dormancy | Huawei, HiSilicon | discussion |

# Topic #1: Asynchronous and synchronous NR-NR Dual Connectivity

Following contribution is submitted:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8.6.3.1 | **R4-2001626** | CR on Interruptions at SCell activation/deactivation in async NR-DC | Huawei, HiSilicon | CR |

## Companies’ contributions summary

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2001626 | Huawei | CR on Interruptions at SCell activation/deactivation in async NR-DC |

## Open issues summary

CR is 2nd priority.

Companies can comment directly on the CR content in the table below.

### CRs/TPs comments collection

Suggest to focus on open issues discussion on 1st round.

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2001626 | Nokia: Need further discussion |
| Huawei, HiSilicon: The CR is for interruption due to SCell activation in NR-DC, and the change is similar as in agreed CR R4-1914945 (which is for SCell addition/release in NR-DC). Could Nokia please clarify what the technical concern is?  Nokia: CR is agreeable |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Sub-topic#1** | *Tentative agreements:*  *Candidate options:*  *Recommendations for 2nd round:* |

*Recommendations on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provides recommendation on CRs/TPs Status update*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| R4-2001626 | Agreeable |

## Discussion on 2nd round (if applicable)

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

# Topic #2: Early Measurement reporting

Early measurement reporting is divided into two topics:

1. NR measurements for EMR (8.6.3.2 & 8.6.3.2.1). Covered in sections 2.2 – 2.6 both included
2. LTE NR Inter-RAT EMR (8.6.3.2.2). Covered in sections 2.7 – 2.12

## Companies’ contributions summary (NR measurements for EMR (8.6.3.2 & 8.6.3.2.1))

Following contributions are submitted for NR measurements for EMR (8.6.3.2 & 8.6.3.2.1):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8.6.3.2 | **R4-2000988** | On MR-DC Early Measurement reporting | OPPO | discussion |
| 8.6.3.2 | **R4-2002056** | Further discussion on early measurement reporting in MR-DC | Qualcomm Incorporated | discussion |
| 8.6.3.2.1 | **R4-2001340** | Early measurements and reporting in NR | Nokia, Nokia Shanghai Bell | discussion |
| 8.6.3.2.1 | **R4-2001627** | Discussion on early measurement in NR | Huawei, HiSilicon | discussion |
| 8.6.3.2.1 | **R4-2001795** | Discussion on LTE CRS based and NR SSB based measurement in NR IDLE/INACTIVE mode | MediaTek inc. | discussion |
| 8.6.3.2.1 | **R4-2001927** | Further details on early measurement reporting requirements | Ericsson | discussion |

Companies have proposed following:

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000988 | OPPO | **Proposal 1: Define that an overlapping carrier is a carrier which the UE is actively measuring for mobility and EMR, and a non-overlapping carrier is a carrier which the UE is actively measuring for EMR only.**  **Observation 1: Number of carriers configured for EMR should not exceed UE measurement capability.**  **Proposal 2: RAN4 to define the maximum number of non-overlapping carriers only, with the value by 3 for NR inter-frequency and 3 for inter-RAT NR early measurement, respectively.**  **Proposal 3: Do not introduce any threshold on serving cell condition for EMR, otherwise RAN4 can wait and follow RAN2’s conclusion.**  **Proposal 4: UE is not expected to report the results of EMR after the expiry of T331.** |
| R4-2002056 | Qualcomm | **Proposal 1a**: An overlapping carrier is defined as a carrier that UE is actively measuring for both mobility and EMR  **Proposal 1b**: A non-overlapping carrier is defined as a carrier that the UE is actively measuring for EMR only.  **Proposal 2a**: EMR requirements for NR carriers while camped on NR only apply if EMR carriers are in CA combination supported by UE  **Proposal 2b**: EMR requirements for NR carriers while camped on LTE only apply if UE supports EN-DC and NR EMR carriers are in the ENDC band combination supported by UE.  **Proposal 3**: The total number of carriers that the UE must measure, overlapping and non-overlapping, should not exceed UE’s idle mode measurement capability.  **Proposal 4**: RAN4 to not define any procedures for UE at cell change.  **Proposal 5**: New capability bit to be introduced to indicate if a UE support NR EMR in LTE idle.  **Proposal 6a**: The number of LTE carriers UE needs to measure for EMR in LTE idle should be the same as in euCA.  **Proposal 6b**: For a UE the supports measurement of NR carriers in LTE idle, the total number of carriers that the UE must measure, overlapping and non-overlapping, LTE and NR, should not exceed UE’s measurement capability. |
| R4-2001340 | Nokia | 1. Adopt the LTE definition of overlapping and non-overlapping EMR carriers 2. An overlapping carrier is defined as a carrier configured by higher layer for early measurement reporting and inter-frequency mobility measurements. 3. A non-overlapping carrier is defined as a carrier configured by higher layer for early measurement reporting while not configured for inter-frequency mobility measurements. 4. N: The total number EMR carriers, N ≤ 7; N = A + B. 5. A: The number of overlapping carriers, A = [0;x] 6. B: The number of non-overlapping carriers, B = [0;y] 7. While T331 is running, the UE shall perform measurements and fulfil the ‘inter-frequency’ measurement requirements on the configured overlapping EMR carriers. 8. Discuss tightening of the EMR measurements and accuracy for NR EMR carriers 9. Introduce cell edge search threshold for NR EMR carriers. 10. At cell change - follow the RAN2 agreements. 11. RAN2 has defined rules for EMR at cell changes and RAN4 should align the necessary accordingly. 12. There is no need to introduce the concept of known and unknown cells for EMR. 13. Upon the expiry of T331 while in IDLE or INACTIVE mode, the UE deletes the dedicated idle mode measurement configuration. 14. RAN4 defines conditions for detected cell state during UE state transitions. |
| R4-2001627 | Huawei | **Proposal 1: UE shall be able to measure any number of overlapping carriers, provided that the number of overlapping carriers does not exceed the UE capability defined in Rel-15.**  **Proposal 2: UE shall be able to measure any number of non-overlapping carriers, provided that the total number of non-overlapping carriers and the carriers UE measures for reselection does not exceed the UE capability defined in Rel-15.**  **Proposal 3:** **Measurement of overlapping carriers is not impacted by serving cell condition.**  **Proposal 4:** **When serving cell is below SnonIntraSearch, UE measures a limited number of non-overlapping carriers, or measures non-overlapping carriers with relaxed performance.**  **Proposal 5:** **Do not introduce the concept of known/unknown cell for EMR measurement requirements.**  **Proposal 6:** **UE performs cell detection for NR EMR measurement.**  **Proposal 7: Re-use the same concept of detected cell status from LTE for NR EMR measurement.**  **Proposal 8: RAN4 not to define different or additional UE behaviour than what RAN2 has defined related to EMR measurement at cell change.**  **Proposal 9:** **RAN4 considers to define transition requirements for EMR measurement at cell change.**  **Proposal 10: RAN4 not to define EMR measurement requirements or reporting behaviour for UE after T331 expiry.** |
| R4-2001795 | MediaTek | ***Proposal 1: RAN4 to study whether there is any issue if adopting different overlapping definitions between LTE IDLE/INACTIVE mode DC and CA measurement and NR IDLE/INACTIVE mode DC and CA*** *measurement.*  ***Proposal 2: In NR IDLE/INACTIVE mode DC and CA measurement, RAN4 to only specify the total number of overlapping/non-overlapping carriers that UE should be able to report for early measurement reporting.***  ***Proposal 3: In NR IDLE/INACTIVE mode DC and CA measurement, UE monitors less carriers when one of the serving cell signal quality is no larger than a certain threshold and measures more carriers for DC and CA measurement otherwise.***  ***Proposal 4: UE should measure the RRCRelease configured EMR carriers if they are configured; otherwise, UE should measure the SIB configured ERM carriers.***  ***Proposal 5: RAN4 to reuse the concept of known cell and unknown cell in Rel-15 re-selection requirement to specify the Rel-16 EMR measurement delay.***  ***Proposal 6: Ran4 to specify the measurement accuracy for the overlapping and non-overlapping EMR carriers for the UE would like to report EMR after T331 timer expires.***  *Proposal 8: RAN4 to adopt the CRS based and SSB Based EMR requirement framework shown in following table as a baseline to further discuss the corresponding measurement delay and accuracy requirements*  Table 3: CRS based and SSB Based EMR requirement framework in NR IDLE/INACTIVE mode   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Serving cell signal quality | Srxlev ≤ Threshold | | Srxlev > Threshold | | | Overlapping with carriers for  re-selection | Overlapping | Non-overlapping | Overlapping | Non-overlapping | | # of early measurement reporting carriers | At least [X] inter-freq. carriers | | At least [X+Y] inter-freq. carriers,  where Y>0 | | | CRS based Measurement delay | FFS | FFS | FFS | FFS | | CRS based Measurement accuracy | FFS | FFS | FFS | FFS | | SSB based Measurement delay | FFS | FFS | FFS | FFS | | SSB based Measurement accuracy | FFS | FFS | FFS | FFS | |
| R4-2001927 | Ericsson | ***Proposal 1****: RAN4 specifies the applicable requirements in the above cases.*  ***Proposal 2****:* *RAN4 defines reporting rules at cell change, particularly when the carrier status changes.*  ***Proposal 3****:* *UE shall stop and start a new EMR measurement if the cell change results in changing the carrier relation or the measurement type (e.g., from overlapping carriers to non-overlapping carriers or from intra-frequency to inter-frequency). UE shall continue the EMR measurement if the carrier relation or measurement type do not change.*  ***Proposal 4****:* *The stopped (due to cell change) measurement based on old samples (before the cell change) may still be reported to the network, at least when the remaining time to the expiry of the T331 timer is short or not sufficient for the new measurement (after the cell change).*  ***Proposal 5****: The early measurement, which was continued over a time period with one or more cell changes shall meet the most relaxed required applicable during the measurement period.*  *A measurement performed on a carrier which was a non-overlapping carrier with the serving carrier before and/or after the cell change, shall meet the requirement corresponding to that for the non-overlapping carrier.*  ***Proposal 6****:* *RAN4 specifies applicable requirements for the early measurements performed and used for EMR after the expiry of the T331 timer, for UE performing such measurements*  *At least the UE can continue the measurements on the overlapping carriers and report them for EMR purpose*  *The UE shall be capable of reporting the results of the early measurements at least up to T0 after the expiry of T331; where T0 is TBD.* |

## Open issues summary

Based on the contributions, observations and proposals following list of sub-topics for further discussion and agreement have been identified:

* definition of EMR carriers
* number of carriers to measure
* detected cell state during state transition
* EMR measurement accuracy
* search threshold for EMR carriers
* EMR and cell change

Below a section is allocated for each sub-topic listing one or more Issues for discussion. A recommended WF has been provided for each issue.

### Sub-topic 2-1 Definition of EMR carriers

Sub-topic description:

RAN4 need to decide how to define overlapping and non-overlapping EMR carriers. The discussion is about the conditions for when a given EMR carrier is defined as overlapping or non-overlapping carrier: Two options are listed:

Proposals:

1. Configured:
   * An EMR carrier is an overlapping EMR carrier if configured to be measured for mobility and EMR
   * An EMR carrier is a non-overlapping EMR carrier if configured to be measured for EMR only
2. Actively measured:
   * An EMR carrier is an overlapping EMR carrier if configured and actively measured for mobility and EMR
   * An EMR carrier is a non-overlapping EMR carrier if configured and actively measured for EMR only

Hence, difference is in the ‘actively measured’.

**Issue 2-1: Definition of overlapping and non-overlapping carriers**

* Proposals
  + Option 1: Use LTE and ‘configured’ carriers
  + Option 2: Use ‘actively measured’ carriers
  + Option 3: Use ‘actively measured’ carriers with conditions for what is an ‘actively measured’ carrier (added by Moderator (Nokia)).

Recommended WF:

1. Use option 3 and define the conditions for ‘actively measured’ and account the ‘actively measured in the definition.
2. Actively measured EMR carrier conditions (added by Moderator (Nokia)):
   1. T331 timer is running
   2. Serving cell is in the validity area
   3. Serving cell support EMR.
3. Text Proposal (added by Moderator (Nokia)):
   1. Provided that a carrier is actively measured carrier for early measurement reporting, an overlapping carrier is defined as a carrier configured by higher layer for early measurement reporting and inter-frequency mobility measurements. A non-overlapping carrier is defined as a carrier configured by higher layer for early measurement reporting while not configured for inter-frequency mobility measurements.

### Sub-topic 2-2 Number of carriers to measure

RAN4 agreed to progress the requirements for number of EMR carriers to measure while in NR SA (LTE is discussed in section 2.8.2).

RAN4#93 agreed following baseline for the discussion:

* *Number of carriers to measure for EMR considering the use of overlapping and non-overlapping carriers:*
  + *Option 1: Re-use the LTE euCA requirements for number of carriers to be reported for early measurements (Qualcomm)*
    1. *Limit the number of overlapping and number of non-overlapping carriers (i.e. LTE EMR approach)*
  + *Option 2: Specify the total number of carriers (MediaTek)*
    1. *Limit the number of overlapping + non-overlapping carriers (i.e. total number of carriers for EMR)*
  + *Option 3: No limit on carriers that can be configured for EMR (as long as it does not exceed UE measurement capability) (Nokia, Huawei)*
  + *Option 4: Limit the number of non-overlapping carriers only (New, option 3 + limit on number of non-overlapping carriers)*
* *FFS: UE behavior when the above limits are exceeded*

RAN4 need to discuss 2 aspects related to EMR carriers:

* Which carriers are to be considered for EMR measurements?
* How many carriers is the UE required to be able to measure for EMR?

**Issue 2-2: EMR carrier candidates**

RAN4 need to agree which carriers are required to be measured for EMR:

* Proposals
  + Option 1: RAN4 follow RAN2 and captures that the UE performs the idle measurement for the frequencies in configured frequency list only when the UE support CA or MR-DC between the frequency and the serving frequency
  + Option 2: Other
* Recommended WF
  + Follow RAN2 agreement and agree on option 1.

**Issue 2-3:** **Number of EMR carriers to measure**

RAN4 need to decide on the number of carrier that the UE at least should be able to measure for EMR. Here only NR SA is discussed (LTE SA is discussed later).

Two aspects to address:

1. UE requirements related to the total number of carriers to measure in NR SA idle mode
2. UE requirements related to number of overlapping and non-overlapping carriers for EMR in NR SA idle mode

* Proposals (UE requirements related to the total number of carriers to measure in NR SA idle mode)
  + Option 1: The total number of carriers that the UE must measure, overlapping and non-overlapping, should not exceed UE’s NR idle mode measurement capability
  + Option 2: Other
* Recommended WF
  + Agree on option 1.
* Proposals (UE requirements related to number of overlapping and non-overlapping carriers for EMR in NR SA idle mode)
  + Option 1: RAN4 to define the maximum number of non-overlapping carriers only, with the value by 3 for NR inter-frequency and 3 for inter-RAT NR early measurement, respectively
  + Option 2: The total number EMR carriers, N ≤ 7; N = A + B; A: The number of overlapping carriers, A = [0;x]; B: The number of non-overlapping carriers, B = [0;y]
  + Option 3: UE shall be able to measure any number of overlapping carriers, provided that the number of overlapping carriers does not exceed the UE capability defined in Rel-15. UE shall be able to measure any number of non-overlapping carriers, provided that the total number of non-overlapping carriers and the carriers UE measures for reselection does not exceed the UE capability defined in Rel-15.
  + Option 4: In NR IDLE/INACTIVE mode DC and CA measurement, RAN4 to only specify the total number of overlapping/non-overlapping carriers that UE should be able to report for early measurement reporting.
  + Option 5: Other
* Recommended WF
  + Discuss among the following options:
  1. Specify the total number of EMR carriers (sum of overlapping and non-overlapping carriers) that the UE at least should be able to measure.
  2. The total number carriers the UE at least shall be able to measure for EMR, N ≤ 14;
     + N = A + B;
     + A: The number of overlapping carriers, A = [0;x];
     + B: The number of non-overlapping carriers, B = [0;y]
  3. Overlapping EMR carriers:
     + RAN4 does not specify any maximum number of EMR overlapping carriers. The number is limited by the current UE measurement capability related to total number inter-frequency and Inter-RAT carriers in section 4.2.2.1). Hence, A = [0; 14].
  4. Non-overlapping EMR carriers:
     + RAN4 does not specify any maximum number of EMR non-overlapping carriers. The number is limited by the current UE measurement capability related to total number inter-frequency and Inter-RAT carriers in section 4.2.2.1). Hence, B = [0; 14]
     + The maximum number of EMR non-overlapping carriers: B ≤ [6] with up to 3 NR inter-frequency carriers and up to 3 NR inter-RAT carriers.

### Sub-topic 2-3 Detected cell state during UE state transitions

RAN4 should discuss defining requirements for the detected cell status for the EMR measurement when UE transitions from RRC Connected mode to Idle or Inactive mode and after UE has entered Idle or Inactive mode

**Issue 2-4: detected cell state during UE state transitions**

* Proposals
  + Option 1: RAN4 defines conditions for detected cell state during UE state transitions
  + Option 2: Other
* Recommended WF
  + RAN4 defines requirements for the detected cell status for the EMR measurement when UE transitions from RRC Connected mode to Idle or Inactive mode and after UE has entered Idle or Inactive mode.

### Sub-topic 2-4 EMR measurement accuracy

RAN4 will need to define UE measurement requirements for EMR. Requirements would need to be defined for both overlapping and non-overlapping EMR carriers. Additionally, RAN4 also need to discuss the measurement accuracy of the measurements used for EMR

**Issue 2-5: Measurement requirements**

* Proposals
  + Option 1: While T331 is running, the UE shall perform measurements and fulfil the ‘inter-frequency’ measurement requirements on the configured overlapping EMR carriers. Upon the expiry of T331 while in IDLE or INACTIVE mode, the UE deletes the dedicated idle mode measurement configuration and no UE requirements apply.
  + Option 2: UE performs cell detection for NR EMR measurement. RAN4 not to define EMR measurement requirements or reporting behaviour for UE after T331 expiry.
  + Option 3: Ran4 to specify the measurement accuracy for the overlapping and non-overlapping EMR carriers for the UE would like to report EMR after T331 timer expires.
  + Option 4: RAN4 to discuss the measurement delay and accuracy requirements.
    - RAN4 to adopt the CRS based and SSB Based EMR requirement framework shown in the table in R4-2001795.
  + Option 5: UE is not expected to report the results of EMR after the expiry of T331
* Recommended WF
  + Define UE measurement requirements for EMR for overlapping EMR carriers.
  + Define UE measurement requirements for EMR for non-overlapping EMR carriers.
  + UE measurement requirements applicable for EMR carriers apply while T331 timer is active, provided the serving cell support EMR.
  + Measurement requirements needs further discussion.

**Issue 2-6: Measurement accuracy requirements**

* Proposals
  + Option 1: Discuss tightening of the EMR measurements and accuracy for NR EMR carriers
  + Option 2: Other
* Recommended WF
  + Discuss further

### Sub-topic 2-5 search threshold for NR EMR carriers

RAN4 to discuss whether to apply threshold on serving cell condition for EMR

**Issue 2-7: Apply a serving cell-based threshold condition for EMR carrier measurements**

* Proposals
  + Option 1: Do not introduce any threshold on serving cell condition for EMR, otherwise RAN4 can wait and follow RAN2’s conclusion
  + Option 2: Introduce cell edge search threshold for NR EMR carriers
  + Option 3: Measurement of overlapping carriers is not impacted by serving cell condition. When serving cell is below SnonIntraSearch, UE measures a limited number of non-overlapping carriers, or measures non-overlapping carriers with relaxed performance.
  + Option 4: In NR IDLE/INACTIVE mode DC and CA measurement, UE monitors less carriers when one of the serving cell signal quality is no larger than a certain threshold and measures more carriers for DC and CA measurement otherwise
* Recommended WF
  + Discuss reduction of EMR measurement at cell edge.
    - introduce means for limiting cell edge EMR measurements
    - Do not introduce anything
  + Discuss further how to introduce serving cell-based thresholds for reducing the UE EMR measurements at cell edge.
  + Following options are currently proposed:
    - An EMR carrier threshold indicating when the EMR carrier is to be measured.
    - Limitation of the number of non-overlapping EMR carriers based on the SnonIntraSearch threshold.
    - EMR carrier measurements is performed for the EMR carrier based on the SnonIntraSearch threshold.

### Sub-topic 2-6 EMR and Cell change

Concerning Early measurement and cell change, RAN4 have a number of open aspects to discuss:

1. FFS whether the above also applies when the carrier changes from overlapping to non-overlapping or from non-overlapping to overlapping after the cell change
2. At cell change, what is the UE behaviour related to reporting of EMR
3. RAN4 to discuss introduction of the concept of unknown cells considering early measurement reporting
4. Impact on early measurements after T331 stops and before reporting EMR

**Issue 2-8: UE requirements if carrier changes from overlapping to non-overlapping or from non-overlapping to overlapping after the cell change:**

* Proposals
  + Option 1: RAN4 to not define any procedures for UE at cell change.
  + Option 2: RAN4 considers to define transition requirements for EMR measurement at cell change.
  + Option 3: UE shall stop and start a new EMR measurement if the cell change results in changing the carrier relation or the measurement type (e.g., from overlapping carriers to non-overlapping carriers or from intra-frequency to inter-frequency). UE shall continue the EMR measurement if the carrier relation or measurement type do not change.
    - The early measurement, which was continued over a time period with one or more cell changes shall meet the most relaxed required applicable during the measurement period
* Recommended WF
  + Needs further discussion

**Issue 2-9: At cell change, what is the UE behaviour related to reporting of EMR**

* Proposals
  + Option 1: RAN4 to not define any procedures for UE at cell change.
  + Option 2: At cell change - follow the RAN2 agreements. RAN2 has defined rules for EMR at cell changes and RAN4 should align the necessary accordingly
  + Option 3: RAN4 not to define different or additional UE behaviour than what RAN2 has defined related to EMR measurement at cell change
  + Option 4: RAN4 defines reporting rules at cell change, particularly when the carrier status changes
* Recommended WF
  + Needs further discussion.

**Issue 2-10: RAN4 to discuss introduction of the concept of unknown cells considering early measurement reporting**

* Proposals
  + Option 1: There is no need to introduce the concept of known and unknown cells for EMR
  + Option 2: Do not introduce the concept of known/unknown cell for EMR measurement requirements
  + Option 3: RAN4 to reuse the concept of known cell and unknown cell in Rel-15 re-selection requirement to specify the Rel-16 EMR measurement delay
* Recommended WF
  + Needs further discussion

**Issue 2-11: Impact on early measurements after T331 stops and before reporting EMR**

* Proposals
  + Option 1: UE is not expected to report the results of EMR after the expiry of T331
  + Option 2: The stopped (due to cell change) measurement based on old samples (before the cell change) may still be reported to the network, at least when the remaining time to the expiry of the T331 timer is short or not sufficient for the new measurement (after the cell change)
  + Option 3: RAN4 specifies applicable requirements for the early measurements performed and used for EMR after the expiry of the T331 timer, for UE performing such measurements
  + Option 4: Upon the expiry of T331 while in IDLE or INACTIVE mode, the UE deletes the dedicated idle mode measurement configuration
* Recommended WF
  + Needs further discussion

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 2-1: Definition of overlapping and non-overlapping carriers:** Agree that we need to define the “actively measured”, if that is not possible, then perhaps Option 1 can be used instead.  **Issue 2-2: EMR carrier candidates:** What if the serving cell changes, all measurements become useless with option 1?  **Issue 2-3: Number of EMR carriers to measure:** Option 1, i.e. no additional capabilities.  **Issue 2-4: detected cell state during UE state transitions**: Option 1  **Issue 2-5: Measurement requirements:** Do not agree with “UE measurement requirements applicable for EMR carriers apply while T331 timer is active, provided the serving cellsupport EMR.” in the recommended WF. Requirements for overlapping and non-overlapping carriers are needed, also applicable requirements after the timer stops are needed at least for overlapping carriers since otherwise the NW cannot rely on those measurements. Applicable requirements related to the cell change are also needed.  **Issue 2-6: Measurement accuracy requirements**  **Issue 2-7: Apply a serving cell-based threshold condition for EMR carrier measurements:** No additional thresholds are needed for EMR.  **Issue 2-8: UE requirements if carrier changes from overlapping to non-overlapping or from non-overlapping to overlapping after the cell change:** Support Option 3 or Option 2  **Issue 2-9: At cell change, what is the UE behaviour related to reporting of EMR:** Option 4 and Option 2 together, RAN4 should define what is not covered by RAN2.  **Issue 2-10: RAN4 to discuss introduction of the concept of unknown cells considering early measurement reporting:** If the UE loses a measured cell, then it needs to detect it again prior to performing the EMR measurements.  **Issue 2-11: Impact on early measurements after T331 stops and before reporting EMR:** Option 2 and Option 3 (at least for the overlapping carriers the reported measurements after the timer expires have to meet some requirements); RAN2 allows the UE to report, in which case the reported measurements cannot be just anything but have to be still reliable for being useful for the network.  **Others:** |
| QC | Issue 2-1: Definition of overlapping and non-overlapping carriers:  We would be ok with using the term actively measured in the definition of overlapping. For inter-frequency carriers the defection of actively measured should also include the scenarios where the UE is doing these measurements for mobility, e.g.: if Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ then UE measures inter-frequency layers of higher priority  Issue 2-2: EMR carrier candidates:  Agree with option 1. EMR feature is only to be used for enabling fast activation of Scells. For this, the Scells should obviously within the UE’s supported CA/EN-DC combination.  Issue 2-3: Number of EMR carriers to measure:  Once the definitions of overlapped vs non-overlapped are more settled, we can further discuss this. If the UE is not expected to be waking up more frequently to do EMR measurements we should be fine with putting in further limits on the number of carriers. However, this depends on how we end up defining overlapping carriers.  Issue 2-4: detected cell state during UE state transitions  Need further clarity on what this means. Does this only mean that detected cells in connected state are assumed to remain detected in idle/inactive or is there something more? Can the proponents or moderator clarify.  Issue 2-5: Measurement requirements  There should be no requirements on the UE after the expiry of T331 timer. The UE can still report the measurements if it gets activated after the T331 expiry with the understanding on the network side that these are stale measurements.  Issue 2-6: Measurement accuracy requirements  We see no reason to tighten requirements.  Issue 2-7: Apply a serving cell-based threshold condition for EMR carrier measurements  The procedure should be discussed in RAN2. RAN4 can follow whatever RAN2 agrees to for this.  Issue 2-8: UE requirements if carrier changes from overlapping to non-overlapping or from non-overlapping to overlapping after the cell change:  No additional requirements compared to what is needed to align to RAN2 to be defined at cell change.  Issue 2-9: At cell change, what is the UE behaviour related to reporting of EMR  Issue 2-10: RAN4 to discuss introduction of the concept of unknown cells considering early measurement reporting  No need to define the concept of known/unknown for EMR. The only thing matters for EMR is the status of cell in that has it already been detected or not.  Issue 2-11: Impact on early measurements after T331 stops and before reporting EMR  UE is not expected to report the measurements after T331 stops. However, the UE may still report those and the network can take them into account for cell activation. |
| Nokia | **Issue 2-1: Definition of overlapping and non-overlapping carriers:**  Agree with recommended WF. Using option 3 where an overlapping carrier is an actively measured carrier, where the conditions for actively measured are clearly defined.  **Issue 2-2: EMR carrier candidates:**  RAN4 is expected to follow the RAN2 agreement and we support the recommended WF.  **Issue 2-3: Number of EMR carriers to measure:**  We support that the total number of carriers that the UE must measure, overlapping and non-overlapping, should not exceed UE’s NR idle mode measurement capability  Although the proposals are slightly different proposals, they all at least support option 3 such that RAN4 can progress the further work while continuing discussing the final numbers. We propose to go forward with option 3. And then further discussions would be needed on the final numbers.  **Issue 2-4: detected cell state during UE state transitions**  Support recommended WF.  **Issue 2-5: Measurement requirements**  Support the recommended WF. Additional discussion is then to follow on the actual requirements.  **Issue 2-6: Measurement accuracy requirements**  More discussion is needed  **Issue 2-7: Apply a serving cell-based threshold condition for EMR carrier measurements**  Most companies see some have proposals which in different ways addresses the cell edge inter-frequency measurements. We support going forward with the topics listed in the recommended WF and hence continue the discussion and work towards a potential solution.  **Issue 2-8: UE requirements if carrier changes from overlapping to non-overlapping or from non-overlapping to overlapping after the cell change:**  Further discussion is needed.  **Issue 2-9: At cell change, what is the UE behaviour related to reporting of EMR**  We suggest that RAN4 follow the RAN2 agreements which already addresses this.  **Issue 2-10: RAN4 to discuss introduction of the concept of unknown cells considering early measurement reporting**  Our view is that it is unclear what an unknown cell would be and what would be the benefit of introducing the concept in idle mode. Purpose of EMR is to report a detected and measured cell. It is already clear when a cell is detected and measured as it can then be used for reselection.  **Issue 2-11: Impact on early measurements after T331 stops and before reporting EMR**  Our understanding is that when T331 expires the UE shall delete the EMR configuration.  **Others:** |
| Huawei, HiSilicon | **Issue 2-1: Definition of overlapping and non-overlapping carriers:**  We support option 2. We have similar understanding as QC that ‘Actively measure’ is for mobility measurement, i.e. a high priority carrier is always actively measured while an equal priority carrier is actively measured when Srxlev <= SnonIntraSearchP and Squal <= SnonIntraSearchQ. Option 2 means if a carrier configured for EMR is also actively measured for mobility it is an overlapping carrier; if it is not actively measured for mobility it is a non-overlapping carrier.  **Issue 2-2: EMR carrier candidates:**  Support the recommended WF.  **Issue 2-3: Number of EMR carriers to measure:**  For the first aspect, we support the recommended WF.  For the second aspect, it depends on the outcome of Issue 2-1. In principle, we do not see a need to define limit on the number of EMR carriers, either overlapping or non-overlapping, as long as the capability to do mobility measurement is not compromised. We are also open to other opinions.  **Issue 2-4: detected cell state during UE state transitions**  Support the recommend WF in principle, but the detailed conditions need to be further discussed.  **Issue 2-5: Measurement requirements**  Support the recommend WF.  **Issue 2-6: Measurement accuracy requirements**  It may be better to clarify more details what ‘tightening’ means here. At least we suggest to define ‘tighter’ requirements for non-overlapping carriers than in LTE in that UE is supposed to do cell detection and periodic measurement.  **Issue 2-7: Apply a serving cell-based threshold condition for EMR carrier measurements**  We support to reduce EMR carrier at cell edge to minimize the impact on mobility measurement. With this motivation, we somehow prefer to reuse SnonIntraSearch as the threshold to control EMR measurement. Otherwise the UE behaviour could be rather complex. We are also open to discuss other options.  **Issue 2-8: UE requirements if carrier changes from overlapping to non-overlapping or from non-overlapping to overlapping after the cell change:**  We support option 1, but we are also fine with option 2.  **Issue 2-9: At cell change, what is the UE behaviour related to reporting of EMR**  We understand option 1, 2 and 3 are similar to each other, and we are fine with either option 1 or 3.  **Issue 2-10: RAN4 to discuss introduction of the concept of unknown cells considering early measurement reporting**  We support option 1 and 2. The concept of detected cell status should apply. The concept of known/unknown cell is used in RRM requirements like HO and SCell activation but not for measurement requirement itself.  **Issue 2-11: Impact on early measurements after T331 stops and before reporting EMR**  We understand it is up to UE implementation whether and how to perform EMR measurement after T331 expiry. RAN4 does not need to define requirements for EMR measurement after T331 expires. |
| MediaTek | **Issue 2-1: Definition of overlapping and non-overlapping carriers:**  Recommended WF:   1. Use option 3 and define the conditions for ‘actively measured’ and account the ‘actively measured in the definition.   [MTK]: We are fine with the option 3.   1. Actively measured EMR carrier conditions (added by Moderator (Nokia)):    1. T331 timer is running    2. Serving cell is in the validity area    3. Serving cell support EMR.   [MTK]: The conditions should also consider measurement capability. For example, the  configured EMR carriers and UE is able to measure (if the number of configured EMR  carriers exceed the measurement capability, then UE might not be able to conduct the EMR  measurement on each configured carrier)   1. Text Proposal (added by Moderator (Nokia)):    1. Provided that a carrier is actively measured carrier for early measurement reporting, an overlapping carrier is defined as a carrier configured by higher layer for early measurement reporting and inter-frequency mobility measurements. A non-overlapping carrier is defined as a carrier configured by higher layer for early measurement reporting while not configured for inter-frequency mobility measurements.   [MTK]: FFS. Prefer to make decision after companies reach consensus on the definitions.  **Issue 2-2: EMR carrier candidates:**  <Comment on recommended WF >  RAN4 need to discuss 2 aspects related to EMR carriers:   * Which carriers are to be considered for EMR measurements?   [MTK]: The RRCRelease configured EMR carriers or the SIB configured EMR carriers in NR IDLE/INACTIVE mode.   * + If it is for DC purpose (to enter the NE-DC mode), then target carriers will be LTE EMR carriers.   + If it is for DC purpose (to enter the NR-DC mode), then target carriers will be NR EMR carriers.   + If it is for CA purpose (to enter the NR CA mode), then target carriers will be NR EMR carriers.   Our understanding is that Network might configure both LTE and NR EMR carriers at the same time. Besides, UE doesn’t know the configured EMR carriers are for DC purpose or for CA purpose. RAN2 is now discussing whether to creating different UE capabilities for different cases, such that UE can feedback to Network which case is supported by UE.   * How many carriers is the UE required to be able to measure for EMR?   [MTK]: There is an agreement agreed RAN #92 meeting:  “In NR, supporting IDLE/INACTIVE mode CA measurement should not extend the measurement capability defined in Rel-15.” We prefer to further extend the agreement to cover the IDLE/INACTIVE mode DC measurement.  **RAN4 to agree that “In NR, supporting IDLE/INACTIVE mode CA and/or DC measurement should not extend the measurement capability defined in Rel-15**  If above proposal is agreeable. As specified in 4.2.2.1 UE measurement capability in TS38.133:  For idle mode cell re-selection purposes, the UE shall be capable of monitoring at least:  - Intra-frequency carrier, and  - Depending on UE capability, 7 NR inter-frequency carriers, and  - Depending on UE capability, 7 FDD E-UTRA inter-RAT carriers, and  - Depending on UE capability, 7 TDD E-UTRA inter-RAT carriers.  In addition to the requirements defined above, a UE supporting E-UTRA measurements in RRC\_IDLE state shall be capable of monitoring a total of at least 14 carrier frequency layers, which includes serving layer, comprising of any above defined combination of E-UTRA FDD, E-UTRA TDD and NR layers.  It means that UE should be capable of monitoring a total of at least 14 carrier frequency  layers, which includes serving layer, comprising of any defined combination of E-UTRA  FDD, E-UTRA TDD and NR layers. For IDLE/INACTIVE mode **cell re-selection** and **EMR**  **purposes**, the UE shall be capable of monitoring at least:  - Intra-frequency carrier, and  - Depending on UE capability, 7 NR inter-frequency carriers, and  - Depending on UE capability, 7 FDD E-UTRA inter-RAT carriers, and  - Depending on UE capability, 7 TDD E-UTRA inter-RAT carriers.   * Recommended WF   + Follow RAN2 agreement and agree on option 1.   [MTK]: It is agreeable  **Issue 2-3: Number of EMR carriers to measure:**  <Comment on recommended WF >   * Recommended WF   + Agree on option 1.   [MTK]: Agree option 1. The total number of carriers that the UE must measure, overlapping and non-overlapping, should not exceed UE’s NR idle mode measurement capability.   * Recommended WF   + Discuss among the following options: * Specify the total number of EMR carriers (sum of overlapping and non-overlapping carriers) that the UE at least should be able to measure.   [MTK]: Agree.   * The total number carriers the UE at least shall be able to measure for EMR, N ≤ 14;   + - N = A + B;     - A: The number of overlapping carriers, A = [0;x];     - B: The number of non-overlapping carriers, B = [0;y]   [MTK]: Agree on N = A + B; however, so far we are not clear the benefit of   limiting the values of x and y. FFS the value of [N].   * Overlapping EMR carriers:   + - RAN4 does not specify any maximum number of EMR overlapping carriers. The number is limited by the current UE measurement capability related to total number inter-frequency and Inter-RAT carriers in section 4.2.2.1). Hence, A = [0; 14].   [MTK]: So far we are not clear the benefit of limiting the values of x.   * Non-overlapping EMR carriers:   + - RAN4 does not specify any maximum number of EMR non-overlapping carriers. The number is limited by the current UE measurement capability related to total number inter-frequency and Inter-RAT carriers in section 4.2.2.1). Hence, B = [0; 14]     - The maximum number of EMR non-overlapping carriers: B ≤ [6] with up to 3 NR inter-frequency carriers and up to 3 NR inter-RAT carriers.   [MTK]: So far we are not clear the benefit of limiting the values of y.  **Issue 2-4: detected cell state during UE state transitions**   * Recommended WF   + RAN4 defines requirements for the detected cell status for the EMR measurement when UE transitions from RRC Connected mode to Idle or Inactive mode and after UE has entered Idle or Inactive mode.   [MTK]: We prefer to discuss the necessary conditions first. For example, inter-frequency  layer should also be configured as the EMR measurement object, otherwise UE might delete  the cell ID and corresponding measurement results from the RRC when UE enters the idle  mode.  **Issue 2-5: Measurement requirements**   * Recommended WF   + Define UE measurement requirements for EMR for overlapping EMR carriers.   [MTK]: Agree. While T331 is running, both measurement delay and accuracy should be specified. After the expiry of T331, only measurement accuracy should be specified. The measurement delay and accuracy of cell re-selection can be the baseline.   * + Define UE measurement requirements for EMR for non-overlapping EMR carriers.   [MTK]: FFS. RAN4 does not specify both measurement delay and accuracy for non-overlapping EMR carriers in euCA.   * + UE measurement requirements applicable for EMR carriers apply while T331 timer is active, provided the serving cell support EMR.   [MTK]: FFS.   * + Measurement requirements needs further discussion.   [MTK]: FFS.  **Issue 2-6: Measurement accuracy requirements**   * Recommended WF   + Discuss further   [MTK]: We don’t see the benefit of tightening of the EMR measurements and accuracy for NR EMR carriers  **Issue 2-7: Apply a serving cell-based threshold condition for EMR carrier measurements**   * Recommended WF   + Discuss reduction of EMR measurement at cell edge.     - introduce means for limiting cell edge EMR measurements     - Do not introduce anything   [MTK]: We prefer to apply different N value (N= A+B), when UE is at cell edge.  It means that Ncell center > Ncell edge, where   * + - Ncell center is the total number carriers the UE at least shall be able to measure for EMR when UE is at cell center.     - Ncell edge is the total number carriers the UE at least shall be able to measure for EMR when UE is at cell edge.   FFS the value of [Ncell center] and [Ncell edge].   * + Discuss further how to introduce serving cell-based thresholds for reducing the UE EMR measurements at cell edge.   [MTK]: We prefer to introduce a serving cell-based thresholds. FFS the threshold value.   * + Following options are currently proposed:     - An EMR carrier threshold indicating when the EMR carrier is to be measured.     - Limitation of the number of non-overlapping EMR carriers based on the SnonIntraSearch threshold.     - EMR carrier measurements is performed for the EMR carrier based on the SnonIntraSearch threshold.   [MTK]: We prefer to limit the total number of overlapping (A) and non-overlapping  (B) EMR carriers and apply different N value (N= A+B) when UE is at cell edge  and at cell center. It means that Ncell center > Ncell edge, where   * + - Ncell center = A+B is the total number carriers the UE at least shall be able to measure for EMR when UE is at cell center.     - Ncell edge = A+B is the total number carriers the UE at least shall be able to measure for EMR when UE is at cell edge.   FFS the value of [Ncell center] and [Ncell edge].  **Issue 2-8: UE requirements if carrier changes from overlapping to non-overlapping or from non-overlapping to overlapping after the cell change:**   * Recommended WF   + Needs further discussion   [MTK]: Agree on option 3.  **Issue 2-9: At cell change, what is the UE behaviour related to reporting of EMR**   * Recommended WF   + Needs further discussion   [MTK]: When PCell change:  • RRCRelease configured EMR: always continue the measurement of EMR  • SIB configured EMR:  i. EMR carriers are listed in the old cell, but not listed in the new cell: UE stop  ii. EMR carriers are listed in the old cell, and also listed in the new cell: UE continue  iii. EMR carriers aren’t listed in the old cell, but listed in the new cell: UE start  **Issue 2-10: RAN4 to discuss introduction of the concept of unknown cells considering early measurement reporting**   * Recommended WF   + Needs further discussion   [MTK]: Agree option 3. RAN4 to reuse the concept of known cell and unknown cell in Rel-15 re-selection requirement to specify the measurement delay of overlapping EMR carriers.  **Issue 2-11: Impact on early measurements after T331 stops and before reporting EMR**  **Others:**   * Recommended WF   + Needs further discussion   [MTK]: RAN4 to specify the measurement accuracy (no measurement delay) for EMR  after the expiry of the T331 timer.   * Whether to report EMR after T331 stop is up to UE implementation.   The reporting delay is up to UE implementation. |

### CRs/TPs comments collection

CR is 2nd priority.

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| **CR/TP number** | **Comments collection** |
| R4-2001928, Early measurement reporting requirements structure, Ericsson | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

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| --- | --- |
|  | **Status summary** |
| **Issue 2-1: Definition of overlapping and non-overlapping carriers** | *Tentative agreements:*  Based on the company views and considering the discussion it seems that a compromise, where RAN4 use ‘actively measured’ in the definition of overlapping and non-overlapping carriers, is agreeable conditioned that RAN4 also defines the conditions for ‘actively measured’.  If this is an agreeable approach to companies as baseline, Moderator suggest using this as baseline and suggest next that RAN4 will then need to define the conditions for ‘actively measured’ carrier. *Candidate options:*  Companies are welcome to give input on these conditions for the definition of an ‘actively measured’ carrier.  From discussion RAN4 need to consider following:   * Mobility measurements are measured continuously conditioned any configured search thresholds SIntraSearchX and SnonIntraSearchX. * Higher priority carriers are continuously searched (conditioned serving carrier priority) * RAN2 agreements concerning EMR and measurements   + EMR and Search thresholds   + Other * T331 timer * Serving cell is and validity area * Serving cell support of EMR * Other   *Recommendations for 2nd round:*  RAN4 to discuss:   1. Is the tentative agreement agreeable as a compromise? 2. Discuss the conditions for the definition of an ‘actively measured’ carrier according to what is listed under candidate options. |
| **Issue 2-2:** **EMR carrier candidates** | *Tentative agreements:*  All companies support the recommended WF and hence option 1:  Option 1: RAN4 follow RAN2 and captures that the UE performs the idle measurement for the frequencies in configured frequency list only when the UE support CA or MR-DC between the frequency and the serving frequency  *Candidate options:*  Following the RAN2 agreement, a number of open aspects have been raised by companies which RAN4 would need to discuss further. At least:   * EMR measurements and cell changes during EMR measurements. * Which carriers to measure according to RAN2. * Clarify the carriers the UE at least shall be able to measure to consider also DC. This open aspect is moved to be discussed under Issue 1-3   *Recommendations for 2nd round:*  Confirm the tentative agreement.  Companies to check the RAN2 agreements and at least give their input to the following open aspects:   * EMR measurements and cell changes during EMR measurements. * Which carriers to measure according to RAN2. |
| **Issue 2-3: Number of EMR carriers to measure** | *Tentative agreements:*  The total number of carriers that the UE must measure, overlapping and non-overlapping, should not exceed UE’s NR idle mode mobility measurement capability (section 4.2.2.1 in 38.133).  RAN4 need to discuss further the definition of ‘measure’.  *Candidate options:*  Next to address in the discussion is:   1. Confirm the tentative agreement. 2. The definition of ‘measure’. This is closely related to 2-1 and will follow what is agreed in 2-1. 3. UE requirements related to number of overlapping and non-overlapping carriers for EMR in NR SA idle mode, use following in order to enable further discussions in RAN4 while leaving all numbers FFS:    1. The total number carriers the UE at least shall be able to measure for EMR, N ≤ 14;       1. N = A + B;       2. A: The number of overlapping carriers, A = [0;x];       3. B: The number of non-overlapping carriers, B = [0;y]    2. A, B, x and y are all FFS.   *Recommendations for 2nd round:*   1. Discuss the two options listed under candidate options. 2. Clarify that carriers the UE at least shall be able to measure also considers DC (not only CA). |
| **Issue 2-4: detected cell state during UE state transitions** | *Tentative agreements:*  RAN4 agree to option 1 and defines requirements for the detected cell status for the EMR measurement when UE transitions from RRC Connected mode to Idle or Inactive mode and after UE has entered Idle or Inactive mode  Note: further clarification as to the conditions needs to be discussed  *Candidate options:*  RAN4 to discuss and agree on at least following:   1. Detected cell requirement during state transition from connected mode to Idle/Inactive mode. 2. Requirements for detected cell after UE has entered Idle mode or Inactive mode.   *Recommendations for 2nd round:*   1. Confirm the tentative agreement. 2. Discuss the two options listed under candidate options:    1. Detected cell requirement during state transition from connected mode to Idle/Inactive mode    2. UE requirements for detected cell after UE has entered Idle mode or Inactive mode |
| **Issue 2-5: Measurement requirements** | *Tentative agreements:*  There seems to be some confusion on this topic. However, it seems that at least following agreement is supported by companies:   1. RAN4 will define UE EMR requirements for EMR carriers while T331 timer is active?   *Candidate options:*  Based on the company feedback RAN4 should further discuss following issues:   1. Will RAN4 need to define UE EMR requirements for EMR carriers when T331 timer has expired? 2. Shall RAN4 define UE EMR measurement requirements for EMR for overlapping EMR carriers? 3. Shall RAN4 define UE EMR measurement requirements for EMR for non-overlapping EMR carriers? 4. EMR Measurement requirements details    1. details are FFS.   *Recommendations for 2nd round:*   1. Confirm the tentative agreement 2. Discuss the and agree on at least following 3 aspects:    1. Will RAN4 need to define UE EMR requirements for EMR carriers when T331 timer has expired?    2. Shall RAN4 define UE EMR measurement requirements for EMR for overlapping EMR carriers?    3. Shall RAN4 define UE EMR measurement requirements for EMR for non-overlapping EMR carriers? 3. Baseline for NR EMR measurement requirements:    1. overlapping EMR carrier    2. non-overlapping EMR carrier |
| **Issue 2-6: Measurement accuracy requirements** | *Tentative agreements:*  No tentative agreement  *Candidate options:*  RAN4 needs to further discuss the UE measurement requirements details at least including:   1. Cell detection requirements for overlapping and non-overlapping carriers. 2. Measurement requirements for overlapping and non-overlapping carriers.   Discuss whether NR EMR requirements should include e.g.:   * cell detection on non-overlapping carrier * more accurate measurements on EMR carriers   *Recommendations for 2nd round:*  Continue the discussion related to cell detection and measurement requirements on EMR carrier, addressing the topics listed under candidate options. |
| **Issue 2-7: Apply a serving cell-based threshold condition for EMR carrier measurements** | *Tentative agreements:*  No clear conclusion although there is support enable reduction of the number of carriers the measures at cell edge when performing EMR measurements.  *Candidate options:*  From the different company options:   1. No additional thresholds are needed for EMR 2. Let RAN2 decide 3. Use existing search thresholds 4. Weighted number of EMR carriers based on cell center or cell edge based on serving cell threshold.   *Recommendations for 2nd round:*  Discuss further. Options 3 and 4 are seemingly very similar and RAN4 could continue discussion based on those as baseline. These can also be realized without introducing any new thresholds for EMR. |
| **Issue 2-8: UE requirements if carrier changes from overlapping to non-overlapping or from non-overlapping to overlapping after the cell change** | *Tentative agreements:*  No clear candidate.  *Candidate options:*  Needs more discussion. Initially, the RAN2 agreements needs to be clarified although it may not specifically address the details considering the UE measurements.  Option 1: 1 supporter  Option 2: 2 supporters  Option 3: 2 supporters  Option 4: Follow RAN2  *Recommendations for 2nd round:*  Continue the discussion if or how to capture the measurement assumptions for EMR carrier when cell type changes due to cell change. |
| **Issue 2-9: At cell change, what is the UE behaviour related to reporting of EMR** | *Tentative agreements:*  No clear agreement or candidate.  *Candidate options:*  Option 1 1 supporter  Option 2 3 supporters (assuming MediaTek also support follow RAN2 according to the reply?)  Option 3 1 supporter  Option 4 1 supporter  *Recommendations for 2nd round:*  RAN4 to discuss what is potentially not covered by RAN2 agreements and if this leads to a need for RAN4 requirements. |
| **Issue 2-10: RAN4 to discuss introduction of the concept of unknown cells considering early measurement reporting** | *Tentative agreements:*  No clear candidate but a slight preference to define some rule concerning detected cell and delay.  *Candidate options:*  option 1/2: 2 supporters  option 3: 3 supporters  *Recommendations for 2nd round:*  RAN4 to discuss further the expected UE behaviour related to detected and measured cell needs to be captured for EMR specifically. This can be part of the discussion considering measurement requirement. |
| **Issue 2-11: Impact on early measurements after T331 stops and before reporting EMR** | *Tentative agreements:*  No clear candidate although more companies support option1 which states that UE is not required to report of EMR after the expiry of timer T331.  *Candidate options:*  Option 1: 3 supporters  Option 2: 1 supporter  Option 3: 1 supporter  Option 4: 1 supporter  *Recommendations for 2nd round:*  RAN4 continues the discussion and accounts the RAN2 agreements. |

*Suggestion on WF/LS assignment*

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|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| R4-2002234 | WF on RRM Requirements for MR-DC | Nokia, Nokia Shanghai Bell |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| R4-2002265 | Running CR to 38.133 for Multi-RAT Dual-Connectivity and Carrier Aggregation enhancements |

## Discussion on 2nd round (if applicable)

Issue 2-5-1: Discuss the conditions for the definition of an ‘actively measured’ carrier according to what is listed under candidate options:

1. Is the tentative agreement agreeable as a compromise?
2. The following criteria are FFS:

* Mobility measurements are measured continuously conditioned any configured search thresholds SIntraSearchX and SnonIntraSearchX.
* Higher priority carriers are continuously searched (conditioned serving carrier priority)
* RAN2 agreements concerning EMR and measurements
  + EMR and Search thresholds
  + Other
* T331 timer
* Serving cell is and validity area
* Serving cell support of EMR
* Other

Comments: [Chronological order]

[QC] Just to be clear, in the definition of overlapping carrier we will use ‘actively measured’ where actively measured would have some conditions associated with it, e.g.: T331 timer is running and Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ etc. So in the above example if T331 timer is expired the carrier no longer qualifies as overlapping. If that is the common understanding then the above is agreeable.

[Huawei, HiSilicon] we are fine with the tentative agreements. Conditions for ‘actively measured’ needs to be discussed from both mobility and EMR point of view. We suggest to agree on the exact conditions in RAN4#94bis.

[Nokia] We are fine to proceed as proposed and use ‘actively measured’. The conditions for when EMR carriers are ‘actively measured’ is then discussed next. Our understanding is ‘actively measured’ applies for EMR carrier measurements only. Hence, it applies to EMR carrier, overlapping and non-overlapping. Additionally, our understanding is that, as in LTE EMR, the search thresholds (Srxlev > SnonIntraSearchP and Squal > SnonIntraSearchQ) do not applicable to EMR carriers. I.e. a carrier configured for mobility and EMR will be overlapping and actively measured while T331 is running independently from any search thresholds. The search thresholds still apply to a carrier configured for mobility and not EMR.

[Ericsson] We are fine with the tentative agreement, i.e., that RAN4 uses ‘actively measured’ in the definition of overlapping and non-overlapping carriers, and that we further work on defining the conditions for ‘actively measured’ in a future meeting. The whole list of criteria for “actively measured” should be FFS for now.

[MTK]: We are fine with the tentative agreements. RAN4 can discuss the definition of “actively measured” in next meeting.

[Moderator]: Criteria will be captured as FFS

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

Issue 2-5-2: EMR carrier candidates:

1. Confirm the tentative agreement.
2. View on if RAN4 follow RAN2 considering:

* EMR measurements and cell changes during EMR measurements.
* Which carriers to measure according to RAN2.

Comments: [Chronological order]

[QC:] The tentative agreement is acceptable. I would need more information on the point 2) here. To me if there is a RAN2 procedure defined at cell change during EMR measurement then UE follows that and RAN4 defines corresponding requirements. Else, there are no requirements at cell change and it is up to UE if it reports anything.

[Huawei, HiSilicon] we are fine with the tentative agreements. On 2), maybe the proponent or the moderator can give more specific proposal what needs to be captured in RAN4 spec.

[Nokia] RAN2 has already made a number of agreements related to carriers to measure and behavior at cell change:

1) When UE reselects to a cell that is not part of the validity area, the UE stops the validity timer and also clears the entire early measurement configuration,

2) If UE reselects to a cell that does not support early measurements (as indicated by absence of an indicator in SI), the validity timer keeps running, but the UE is not required to performs measurements while camped on that cell (same as LTE euCA),

3) The UE performs the idle measurement for the frequencies in configured frequency list only when the UE support CA or MR-DC between the frequency and the serving frequency

Our view is that RAN4 follow these (and other) RAN2 agreements in general. Additionally, RAN2 has already decided in 3) concerning carriers to measure for EMR. 3) would also address MediaTek discussion concerning EMR is for CA and DC.

Ericsson: the tentative agreement is Ok, the details need to be further discussed in the next meeting.

[MTK]: tentative agreement is fine.

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

Issue 2-5-3: Number of EMR carriers to measure:

1. confirm the tentative agreement
2. Discuss the two options listed under candidate options:
   1. The definition of ‘measure’. This is closely related to 2-5-1 and will follow what is agreed in 2-5-1.
   2. UE requirements related to number of overlapping and non-overlapping carriers for EMR in NR SA idle mode, use following in order to enable further discussions in RAN4 while leaving all numbers FFS:
      1. The total number carriers the UE at least shall be able to measure for EMR, N ≤ 14;
         1. N = A + B;
         2. A: The number of overlapping carriers, A = [0;x];
         3. B: The number of non-overlapping carriers, B = [0;y]
      2. A, B, x and y are all FFS.

Comments: [Chronological order]

[QC:] How does the above account for LTE carriers in NR idle. Since we don’t want to exceed UE’s measurement capability LTE carriers would need to be somehow accounted for in the above too.

[Huawei, HiSilicon] We have a question for clarification. In RAN4#92 (R4-1909997) the following was agreed. Is it same as the tentative agreement?

“In NR, supporting IDLE/INACTIVE mode CA measurement should not extend the measurement capability defined in Rel-15”On 2) we understand the intention is to have a common framework to facilitate further discussion, but we need some clarification from the moderator. E.g. Among A, B, N, x and y, which are variable number based on configuration and which are fixed number to be specified in spec? Are we going to use all of them, or depending on discussion some may not be specified or used?

[Nokia] For Qualcomm: the proposal solely addresses overlapping and non-overlapping carriers. An LTE Inter-RAT carrier can be overlapping or non-overlapping. The proposal is simply that what we have currently defined in 38.133 as UE minimum requirement will stay unchanged also for a UE supporting EMR. E.g. currently the UE shall support at least 7 NR inter-f carriers. This will not increase for a UE supporting EMR. Out of those 7 carriers none, 1 or more inter-f carriers may be configured for EMR. Additionally, the UE total number of carrier (14) will stay unchanged. A carrier may be configured solely for EMR or for both EMR and mobility (the overlapping and non-overlapping discussion). Is there a need to further study if there is need to limit NR inter-frequency EMR carriers and LTE Inter-RAT EMR carriers?

For Huawei: yes. By confirming this we can start capture agreements into the Big CR. As for the numbers N, A, B, x and y – all number are open for discussion. This is to get some framework in place. However, N cannot be larger than 14. Currently the number x and y cannot exceed 7. These restrictions come from section 4.2.2.1 in 38.133. These numbers are FFS.

[Ericsson] No need to explicitly define x and y.

[MTK] It should be N, x, and y are all FFS. Because of that A and B should be the definitions of number of overlapping carriers and non-overlapping carriers, not values to be determined. Besides, we agree with Ericsson that there is no need to define x and y.

[QC] We agree with Nokia that the above only covers the number of overlapping and non-overlapping carriers. What we are saying is that we would also want to retain a limitation on the number of interRAT LTE carriers that can be configured for EMR. Not sure how that would fit under this framework.

[Moderator]: further discussion on the details seems necessary

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

Issue 2-5-4 detected cell state during UE state transitions:

1. Confirm the tentative agreement.
2. Discuss the two options listed under candidate options:
   1. Detected cell requirement during state transition from connected mode to Idle/Inactive mode
   2. UE requirements for detected cell after UE has entered Idle mode or Inactive mode

Comments: [Chronological order]

[Company A:]

[Huawei, HiSilicon] we are fine with the tentative agreements.

On 2), if the tentative agreement is confirmed, do we still need to discuss a and b? We understand they are already included. Separately, the exact conditions for detected cell status need to be further discussed, and we think this can be captured in the WF.

[Nokia] We are fine to settle an agreement related to the cell detected status during state transitions for now. We expect that we need to continue discussing the detailed conditions when a detected cell in connected mode can be assumed to stay detected during the state transition. a and b need further discussion and can be captured in the WF.

[Ericsson]: tentative agreement is Ok

[MTK] Tentative agreement is o.k. We would like to also discuss the necessary conditions. For example, inter-frequency layer should also be configured as the EMR measurement object, otherwise UE might delete the cell ID and corresponding measurement results from the RRC when UE enters the idle mode.

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

Issue 2-5-5 Measurement requirements:

1. Confirm the tentative agreement
2. Discuss the and agree on at least following 3 aspects:
   1. Will RAN4 need to define UE EMR requirements for EMR carriers when T331 timer has expired?
   2. Shall RAN4 define UE EMR measurement requirements for EMR for overlapping EMR carriers?
   3. Shall RAN4 define UE EMR measurement requirements for EMR for non-overlapping EMR carriers?
3. Baseline for NR EMR measurement requirements:
   1. overlapping EMR carrier
   2. non-overlapping EMR carrier

Comments: [Chronological order]

[QC:] The tentative agreement looks ok. For 2a) our view is that it should be best effort from the UE, maybe whatever the UE has stored at the expiry of T331 the UE can report, but will need to confirm if that is useful. For 2b) and 2c), I need more clarification, as to what requirements are we even talking about here?

[Huawei, HiSilicon] we are fine with the tentative agreements.

For 2a, we see no need for RAN4 to define requirement. For 2b and 2c, our answer would be yes, while the exact requirements needs to be further discussed.

[Nokia] We agree that for the 2a no UE requirements are needed. We agree that RAN4 would need to define some UE requirements for those cases. RAN4 would of course need more discussions on the detailed requirements.

For Qualcomm: It would need to be defined which measurements the UE shall perform and possible accuracy. Hence, some minimum measurement requirements. Using the LTE EMR as example: measurement requirements for an overlapping EMR carrier follow those of an inter-frequency carrier.

[Ericsson]: disagree with the tentative agreement, it is misleading, the whole question is about what is ahapenning after the timer expires, not before. 2a: if the UE reports measurements performed after the expiry of the timer (supported by RAN2), then we need to define applicable requirements. We think at least applicable requirements for overlapping carriers should be specified. On 3: is it related to the timer or what is it?

[MTK] Tentative agreement is o.k. For 2a, we suggest to specify the measurement accuracy (but not need to specify the measurement delay) in case that UE would like to report the EMR measurement after T331 timer expires. For 2b it definitely needs RAN4 requirement. For 2c, it needs more discussion on whether requirement of overlapping EMR carriers can be used as a baseline and to further extended. For 3, we don’t understand the moderator’s meaning.

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

Issue 2-5-6 Measurement accuracy requirements:

Continue the discussion related to cell detection and measurement requirements on EMR carrier, addressing the topics listed under candidate options.

Comments: [Chronological order]

[Moderator] Capture in WF for further discussion in coming meeting.

[Ericsson]: more accurate measurements compared to what? Yes, cell detection on non-overlapping carrier needs to be included.

[MTK] we don’t capture the moderator’s meaning.

[Moderator]: clarification: RAN4 would need to discuss which kind of measurement requirements and accuracy requirements would need to be defined for EMR.

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

Issue 2-5-7 Apply a serving cell-based threshold condition for EMR carrier measurements

Discuss further. Options 3 and 4 are seemingly very similar and RAN4 could continue discussion based on those as baseline. These can also be realized without introducing any new thresholds for EMR.

Comments: [Chronological order]

[Moderator] Capture in WF for further discussion in coming meeting.

[Ericsson]: no need in new/different thresholds for EMR, so we support option 1.

[MTK] Option 1 and option 3 are applicable. I think the main question is whether we can reduce the monitor number of EMR when UE at cell edge.

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

Issue 2-5-8 UE requirements if carrier changes from overlapping to non-overlapping or from non-overlapping to overlapping after the cell change

Continue the discussion if or how to capture the measurement assumptions for EMR carrier when cell type changes due to cell change.

Comments: [Chronological order]

[Moderator] Capture in WF for further discussion in coming meeting.

Ericsson: the requirements can be imposed, e.g., by applicability rules.

[MTK] Agree with Ericsson. The main question is whether RAN4 should define the principles?

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

Issue 2-5-9: At cell change, what is the UE behaviour related to reporting of EMR

RAN4 to discuss what is potentially not covered by RAN2 agreements and if this leads to a need for RAN4 requirements

Comments: [Chronological order]

[Moderator] Capture in WF for further discussion in coming meeting.

Ericsson: Need to check e.g. will the UE continue the measurement *same way* if the carrier status has changed (a) from overlapping to non-overlapping, or (b) from non-overlapping to overlapping?

[MTK] Agree with Ericsson. For dedicated EMR, we don’t see the issues if RAN2 agreements are followed. For SIB configured EMR, the main question is whether RAN4 should define the principles?

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

Issue 2-10: RAN4 to discuss introduction of the concept of unknown cells considering early measurement reporting

RAN4 continues the discussion and accounts the RAN2 agreements.

Comments: [Chronological order]

[QC:] Need clarification here. What is the benefit of defining a known cell for EMR. Doesn’t it only matter if the cell was detected or not?

[Moderator] From the discussion it seemed to try to address the case where a cell which has been detected and measured, drops in quality and is ‘not detectable’ when the network requests the EMR.

[Ericsson] the UE may need to detect the cell if it has lost it for a while.

[MTK]: To our understanding, for overlapping EMR carriers, the requirement has no different with cell-reselection. So the problem might occur only for non-overlapping EMR carriers, right?

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

ADDED BY MODERATOR (March 3rd)

Issue 2-11: Impact on early measurements after T331 stops and before reporting EMR:

Comments: [Chronological order]

[Nokia] Our view is that RAN4 follow the RAN2 agreement from RAN2#107: Upon the expiry of T331 while in IDLE or INACTIVE mode, the UE deletes the dedicated idle mode measurement configuration, if any.

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002234

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| R4-2002265 | Running CR to 38.133 for Multi-RAT Dual-Connectivity and Carrier Aggregation enhancements  Ericsson: too many unsettle issues, postpone the CR.  [Moderator]: Postponed |
| R4-2002234 | Agreeable |

## Companies’ contributions summary (LTE NR Inter-RAT EMR (8.6.3.2.2))

Following contributions are submitted for LTE NR Inter-RAT EMR (8.6.3.2.2):

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8.6.3.2 | **R4-2002056** | Further discussion on early measurement reporting in MR-DC | Qualcomm Incorporated | discussion |
| 8.6.3.2.2 | **R4-2001341** | NR Inter-RAT measurements for early measurement reporting | Nokia, Nokia Shanghai Bell | discussion |
| 8.6.3.2.2 | **R4-2001628** | Discussion on LTE – NR inter-RAT EMR | Huawei, HiSilicon | discussion |
| 8.6.3.2.2 | **R4-2001796** | Discussion on NR SSB based measurement in LTE IDLE/INACTIVE mode | MediaTek inc. | discussion |

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2002056 | Qualcomm | **Proposal 1a: An overlapping carrier is defined as a carrier that UE is actively measuring for both mobility and EMR**  **Proposal 1b: A non-overlapping carrier is defined as a carrier that the UE is actively measuring for EMR only.**  **Proposal 2a: EMR requirements for NR carriers while camped on NR only apply if EMR carriers are in CA combination supported by UE**  **Proposal 2b: EMR requirements for NR carriers while camped on LTE only apply if UE supports EN-DC and NR EMR carriers are in the ENDC band combination supported by UE.**  **Proposal 3: The total number of carriers that the UE must measure, overlapping and non-overlapping, should not exceed UE’s idle mode measurement capability.**  **Proposal 4: RAN4 to not define any procedures for UE at cell change.**  **Proposal 5:** **New capability bit to be introduced to indicate if a UE support NR EMR in LTE idle.**  **Proposal 6a: The number of LTE carriers UE needs to measure for EMR in LTE idle should be the same as in euCA.**  **Proposal 6b: For a UE the supports measurement of NR carriers in LTE idle, the total number of carriers that the UE must measure, overlapping and non-overlapping, LTE and NR, should not exceed UE’s measurement capability.** |
| R4-2001341 | Nokia | 1. Define RAN4 requirements for an EN-DC capable UE supporting *ca-IdleModeMeasurements* and supporting early measurements and reporting of NR inter-RAT cells. 2. Define RAN4 requirements for an EN-DC capable UE not supporting *ca-IdleModeMeasurements* and supporting measurements of NR-inter-RAT for early reporting. 3. For a UE supporting EMR of NR inter-RAT carriers in addition to *ca-IdleModeMeasurements,* the existing number of LTE carriers as defined under *ca-IdleModeMeasurements* are kept unchanged. 4. For a UE supporting EMR of NR inter-RAT carriers in addition to *ca-IdleModeMeasurements* shall support NR inter-RAT measurements on one or more NR carriers in addition to the existing inter-frequency carriers as defined under *ca-IdleModeMeasurements*. 5. For a UE supporting EMR of NR inter-RAT carriers and not supporting ca-IdleModeMeasurements, shall support measurements on one or more NR carriers. 6. The UE supporting EMR of NR inter-RAT carriers and *ca-IdleModeMeasurements* shall support the LTE EMR requirements and NR EMR of at least 2 NR inter-RAT carriers of which zero or one NR inter-RAT carrier may be a non-overlapping carrier and at most 1 NR inter-RAT carrier can be overlapping. 7. The UE only supporting EMR of NR inter-RAT carriers shall support NR EMR of at least 2 NR inter-RAT carriers of which zero or one NR inter-RAT carrier may be a non-overlapping carrier and at most 1 NR inter-RAT carrier can be overlapping. 8. An NR inter-RAT cell which is a detected cell in Connected mode prior to connection release, shall remain detected after UE has entered Idle/Inactive mode. |
| R4-2001628 | Huawei | **Proposal 1:** **Define separate UE capabilities for LTE inter-frequency EMR (*ca-IdleModeMeasurements*) and LTE – NR inter-RAT EMR.**  **Proposal 2: RAN4 to define LTE – NR inter-RAT EMR requirements for type 3 and type 4 UEs.**   * **Type 3: UE supporting LTE – NR inter-RAT EMR but not LTE inter-frequency EMR** * **Type 4: UE supporting both LTE inter-frequency EMR and LTE – NR inter-RAT EMR**   **Proposal 3:** **Both type 3 and type 4 UE are required to measure [1] carrier for LTE – NR inter-RAT EMR, and the total number of carriers for EMR and mobility should not exceed the Rel-15 capability.**  **Proposal 4:** **For type 4 UE, the number of LTE inter-frequency EMR carriers is same as in euCA.**  **Proposal 5: UE performs periodic cell detection and measurement for LTE – NR inter-RAT EMR measurement.**  **Proposal 6:** **Re-use the same concept of detected cell status from LTE for LTE – NR inter-RAT EMR measurement.** |
| R4-2001796 | MediaTek | ***Proposal 1: RAN4 to avoid the parallel discussion for early measurement reporting capabilities and wait for the RAN2’s decision.***  ***Proposal 2:*** ***The number of reported carriers of CRS based and/or SSB based measurement in LTE IDLE/INACTIVE mode should not extend the measurement capability defined in Rel-15.***  ***Proposal 3: RAN4 to reuse the concept of known cell and unknown cell in Rel-15 re-selection requirement to specify the Rel-16 EMR measurement delay.***  ***Proposal 4: RAN4 to adopt the SSB based EMR requirement framework shown in following table as a baseline to further discuss the corresponding measurement delay and accuracy requirements***  Table 3: SSB based EMR requirement framework in LTE IDLE/INACTIVE mode   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Serving cell signal quality | Srxlev ≤ Threshold | | Srxlev > Threshold | | | Overlapping with carriers for  re-selection | Overlapping | Non-overlapping | Overlapping | Non-overlapping | | # of early measurement reporting carriers | At least [X] inter-freq. carriers | | At least [X+Y] inter-freq. carriers,  where Y>0 | | | SSB based Measurement delay | FFS | FFS | FFS | FFS | | SSB based Measurement accuracy | FFS | FFS | FFS | FFS | |

## Open issues summary

RAN4 discussed LTE NR Inter-RAT EMR in RAN4#93. Hence, the matter of introduction of NR inter-RAT measurement for EMR while camped in LTE. Based on the contributions, observations, proposals and WF following list of sub-topics for further discussion and agreement have been identified:

* Configuration scenarios
* Number of EMR carriers to measure
* Detected cell state during UE state transitions

Following sub-topics discuss each of these open issues.

### Sub-topic 2-7 Configuration Scenarios

To progress the requirements, work, RAN4 captured in the agreed WF to not focus on the UE capability discussion but define the necessary requirements irrespective of those. From WF

* *Different UE capabilities:*
  1. *Option 1: UE supporting ca-IdleModeMeasurements also support measurement of NR inter-RAT for early reporting.*
  2. *Option2: UE not supporting ca-IdleModeMeasurements support measurement of NR inter-RAT for early reporting.*
  3. *Other options are not precluded*
  4. *For all options: it is assumed that the UE under discussion is a UE capable of EN-DC, while a UE capable of existing ca-IdleModeMeasurements might not support EN-DC.*
* *Possible options: proceed the work in RAN4 defining requirements for all cases.*

**Issue 2-50: UE requirements scenarios:**

* Proposals
  + Option 1: New capability bit to be introduced to indicate if a UE support NR EMR in LTE idle
  + Option 2: Define RAN4 requirements for an EN-DC capable UE supporting ca-IdleModeMeasurements and supporting early measurements and reporting of NR inter-RAT cells. Define RAN4 requirements for an EN-DC capable UE not supporting ca-IdleModeMeasurements and supporting measurements of NR-inter-RAT for early reporting
  + Option 3: Define separate UE capabilities for LTE inter-frequency EMR (ca-IdleModeMeasurements) and LTE – NR inter-RAT EMR. RAN4 to define LTE – NR inter-RAT EMR requirements for type 3 and type 4 UEs.
    - Type 3: UE supporting LTE – NR inter-RAT EMR but not LTE inter-frequency EMR
    - Type 4: UE supporting both LTE inter-frequency EMR and LTE – NR inter-RAT EMR
  + Option 4: RAN4 to avoid the parallel discussion for early measurement reporting capabilities and wait for the RAN2’s decision
* Recommended WF
  + Postpone the capability discussion to later phase.
  + Define the RAN4 requirements such that legacy LTE EMR requirements are not impacted.
  + Define new RAN4 requirements for a UE supporting NR EMR measurements.
  + Define UE requirements for following 2 UE types:
    - Type 1 UE: A UE supporting ca-IdleModeMeasurements and supporting NR inter-RAT EMR
    - Type 2 UE: A UE supporting NR inter-RAT EMR and not supporting ca-IdleModeMeasurements.

### Sub-topic 2-8 Number of carriers to measure

RAN4 agreed to progress the requirements for number of EMR carriers to measure while in LTE SA (NR SA is discussed in section 2.2.2).

RAN4#93 agreed following baseline for the discussion:

* *Possible options:*
  + *For a UE supporting EMR of NR inter-RAT carriers in addition to ca-IdleModeMeasurements existing number of LTE carriers as defined under ca-IdleModeMeasurements are kept unchanged*
    1. *For a UE supporting EMR of NR inter-RAT carriers in addition to ca-IdleModeMeasurements shall support NR inter-RAT measurements on a number of NR carriers in addition to existing inter-frequency carriers as defined under ca-IdleModeMeasurements.*
  + *For a UE supporting EMR of NR inter-RAT carriers in addition to ca-IdleModeMeasurements the UE support a number of EMR carriers which may be LTE or NR (total number of euCA EMR carriers remain unchanged)*
  + *For a UE supporting EMR of NR inter-RAT carriers but not supporting ca-IdleModeMeasurements shall support measurements on a number of NR carriers.*
  + *Other options are not precluded*
* *Number of NR inter-RAT carriers:*
  + *FFS*

Hence, for each scenario in section 2.8.1 RAN4 need to define:

* number of LTE inter-frequency EMR carriers, and
* number of NR inter-RAT EMR carriers.

**Issue 2-51: Number of LTE inter-frequency carriers:**

* Proposals for Type 1 UE
  + Option 1: The total number of carriers that the UE must measure, overlapping and non-overlapping, LTE and NR, should not exceed UE’s measurement capability
  + Option 2: existing number of LTE carriers as defined under ca-IdleModeMeasurements are kept unchanged.
  + Option 3: For type 4 UE, the number of LTE inter-frequency EMR carriers is same as in euCA (Both type 3 and type 4 UE are required to measure [1] carrier for LTE – NR inter-RAT EMR, and the total number of carriers for EMR and mobility should not exceed the Rel-15 capability)
  + Option 4: The number of reported carriers of CRS based and/or SSB based measurement in LTE IDLE/INACTIVE mode should not extend the measurement capability defined in Rel-15
* Proposals for Type 2 UE
  + N/A.
* Recommended WF
  + A UE supporting ca-IdleModeMeasurements and supporting NR inter-RAT EMR (Type 1 UE) the number of LTE inter-frequency EMR carriers is the same as defined for ca-IdleModeMeasurements.

**Issue 2-52: Number of NR inter-RAT carriers:**

* Proposals for Type 1 UE
  + Option 1: the total number of carriers that the UE must measure, overlapping and non-overlapping, LTE and NR, should not exceed UE’s measurement capability
  + Option 2: UE shall support NR inter-RAT measurements on one or more NR carriers in addition to the existing inter-frequency carriers as defined under *ca-IdleModeMeasurements*. UE shall support NR EMR of at least 2 NR inter-RAT carriers of which zero or one NR inter-RAT carrier may be a non-overlapping carrier and at most 1 NR inter-RAT carrier can be overlapping.
  + Option 3: The UE is required to measure [1] carrier for LTE – NR inter-RAT EMR, and the total number of carriers for EMR and mobility should not exceed the Rel-15 capability
  + option 4: The number of reported carriers of CRS based and/or SSB based measurement in LTE IDLE/INACTIVE mode should not extend the measurement capability defined in Rel-15
* Proposals for Type 2 UE
  + Option 1: The number of LTE carriers UE needs to measure for EMR in LTE idle should be the same as in euCA
  + Option 2: The UE shall support measurements on one or more NR carriers. The UE shall support NR EMR of at least 2 NR inter-RAT carriers of which zero or one NR inter-RAT carrier may be a non-overlapping carrier and at most 1 NR inter-RAT carrier can be overlapping
  + Option 3: The UE is required to measure [1] carrier for LTE – NR inter-RAT EMR, and the total number of carriers for EMR and mobility should not exceed the Rel-15 capability
  + Option 4: The number of reported carriers of CRS based and/or SSB based measurement in LTE IDLE/INACTIVE mode should not extend the measurement capability defined in Rel-15
* Recommended WF
  + A UE supporting ca-IdleModeMeasurements and supporting NR inter-RAT EMR (Type 1 UE) shall support at least [1, 2] NR inter-RAT EMR carriers.
    - number of NR EMR carriers are in addition to LTE EMR carriers.
    - the total number of carriers for EMR and mobility should not exceed the Rel-15 capability.
    - Open: restrictions on overlapping/non-overlapping EMR carrier
  + A UE only supporting NR inter-RAT EMR (Type 2 UE) shall support at least [1, 2] NR inter-RAT EMR carriers.
    - the total number of carriers for EMR and mobility should not exceed the Rel-15 capability.
    - Open: restrictions on overlapping/non-overlapping EMR carrier

### Sub-topic 2-9 Detected cell state during UE state transitions

RAN4 agreed to progress on the detected cell status at transitioning from connected to either idle or inactive mode. Following was captured in the WF:

* *Detected cell state:*
  + *The existing requirements under ca-IdleModeMeasurements as baseline,*
  + *FFS whether to define requirements for the detected cell status for the idle mode CA measurement when UE transitions from RRC Connected mode to Idle mode and after UE has entered Idle mode in 36.133 section 4.9.2.1*
* *Possible options:*
  + *Option 1: Apply the same principles for NR inter-RAT cells.*
  + *Option 2: Do not apply the same principles for NR inter-RAT cells.*

**Issue 2-53: Cell detected status at transitioning from connected mode:**

* Proposals
  + Option 1: Re-use the same concept of detected cell status from LTE for LTE – NR inter-RAT EMR measurement
  + Option 2: An NR inter-RAT cell which is a detected cell in Connected mode prior to connection release, shall remain detected after UE has entered Idle/Inactive mode
* Recommended WF
  + Adopt the LTE concept:
    - An NR inter-RAT cell which is a detected cell in Connected mode prior to connection release, shall remain detected after UE has entered Idle/Inactive mode
  + Open: conditions when the detected cell status remain detected during transitioning from connected to idle or inactive mode.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| **Ericsson** | **Issue 2-50: UE requirements scenarios:** Option 3  **Issue 2-51: Number of LTE inter-frequency carriers:** Option 1  **Issue 2-52: Number of NR inter-RAT carriers:** Option 1  **Issue 2-53: Cell detected status at transitioning from connected mode:** Option 1 |
| **QC** | **Issue 2-50: UE requirements scenarios:**  **Need a new capability bit for an EN-DC capable UE to indicate support for inter-RAT NR EMR measurements when in LTE idle**  **Issue 2-51: Number of LTE inter-frequency carriers:**  **The number of LTE carriers can be kept the same as euCA . We will then need to ensure that the total number of carriers configured for measurement is not exceeding the measurement capability**  **Issue 2-52: Number of NR inter-RAT carriers:**  **We don’t need to limit the number of NR inter-RAT carriers. The limit should just come from UE’s idle mode measurement capability.**  **Issue 2-53: Cell detected status at transitioning from connected mode:**  **If the cell was detected in connected mode, it is assumed to remain detected in idle mode as long as the side conditions continue to be met.** |
| **Nokia** | **Issue 2-50: UE requirements scenarios:**  Recommended WF seems to be a feasible way to progress the work in RAN4 disregarding the capability discussion.  **Issue 2-51: Number of LTE inter-frequency carriers:**  Recommended WF is agreeable to us.  **Issue 2-52: Number of NR inter-RAT carriers:**  The recommended WF gives framework for the further discussion while also progressing the work. Numbers and open points would need further discussion.  **Issue 2-53: Cell detected status at transitioning from connected mode:**  Support recommended WF |
| **Huawei, HiSilicon** | **Issue 2-50: UE requirements scenarios:**  We are fine with the recommended WF except for the second bullet. At this stage we cannot agree to “Define the RAN4 requirements such that legacy LTE EMR requirements are not impacted”. We suggest first discuss the LTE-NR EMR requirements.  **Issue 2-51: Number of LTE inter-frequency carriers:**  We are fine the recommend WF conditioned on that the total number of carriers for EMR and mobility should not exceed the Rel-15 capability.  **Issue 2-52: Number of NR inter-RAT carriers:**  We support the recommended WF. We see no need to have specific restriction on number of overlapping or non-overlapping carriers.  **Issue 2-53: Cell detected status at transitioning from connected mode:**  Support the recommended WF in principle, but the detailed conditions need to be further discussed.  **Other:**  It seems Proposal 5 in our paper R4-2001628 was not captured in the open issue discussion. |
| MediaTek | **Issue 2-50: UE requirements scenarios:**   * Recommended WF   + Postpone the capability discussion to later phase.   [MTK]: Agree. RAN4 to avoid the parallel discussion for EMR capabilities.   * + Define the RAN4 requirements such that legacy LTE EMR requirements are not impacted.   [MTK]: Agree. The scenario we should focus on is “NR SSB based measurement in LTE IDLE/INACTIVE mode for DC purpose”   * + Define new RAN4 requirements for a UE supporting NR EMR measurements.   [MTK]: Agree.   * + Define UE requirements for following 2 UE types:     - Type 1 UE: A UE supporting ca-IdleModeMeasurements and supporting NR inter-RAT EMR     - Type 2 UE: A UE supporting NR inter-RAT EMR and not supporting ca-IdleModeMeasurements.   [MTK]: We prefer to prioritize Type 2 UE first. It is too complicated to discuss requirements of 2 scenarios at the same time.  **Issue 2-51: Number of LTE inter-frequency carriers:**   * Recommended WF   + A UE supporting ca-IdleModeMeasurements and supporting NR inter-RAT EMR (Type 1 UE) the number of LTE inter-frequency EMR carriers is the same as defined for ca-IdleModeMeasurements.   [MTK]: No matter Type 1 or Type 2 UE. We suggest to follow the similar principles agreed in NR, so we suggest that “**The number of reported carriers of CRS based and/or SSB based measurement in LTE IDLE/INACTIVE mode (for CA and/or DC purposes) should not extend the measurement capability defined in Rel-15.”**  **Issue 2-52: Number of NR inter-RAT carriers:**   * Recommended WF   + A UE supporting ca-IdleModeMeasurements and supporting NR inter-RAT EMR (Type 1 UE) shall support at least [1, 2] NR inter-RAT EMR carriers.     - number of NR EMR carriers are in addition to LTE EMR carriers.     - the total number of carriers for EMR and mobility should not exceed the Rel-15 capability.     - Open: restrictions on overlapping/non-overlapping EMR carrier   + A UE only supporting NR inter-RAT EMR (Type 2 UE) shall support at least [1, 2] NR inter-RAT EMR carriers.     - the total number of carriers for EMR and mobility should not exceed the Rel-15 capability.     - Open: restrictions on overlapping/non-overlapping EMR carrier   [MTK]: No matter Type 1 or Type 2 UE. We suggest to specify different overall reported EMR carriers when UE is at cell center (Ncell center = A+B) and cell edge (Ncell edge = A+B). Where   * + - Ncell center = A+B is the total number carriers the UE at least shall be able to measure for EMR when UE is at cell center.     - Ncell edge = A+B is the total number carriers the UE at least shall be able to measure for EMR when UE is at cell edge.     - A: The number of overlapping carriers.     - B: The number of non-overlapping carriers.     FFS the value of [Ncell center] and [Ncell edge].  Otherwise, it will be very difficult for companies to determine the overall reported number of EMR carriers. If only 1 single value N=A+B is applied.   * When UE is at cell center N=2 might be not enough, * When UE is at cell edge N=2 might be too large.   **Issue 2-53: Cell detected status at transitioning from connected mode:**   * Recommended WF   + Adopt the LTE concept:     - An NR inter-RAT cell which is a detected cell in Connected mode prior to connection release, shall remain detected after UE has entered Idle/Inactive mode   + Open: conditions when the detected cell status remain detected during transitioning from connected to idle or inactive mode.   [MTK]: We prefer to discuss the necessary conditions first. For example, inter-frequency  layer should also be configured as the EMR measurement object, otherwise UE might delete  the cell ID and corresponding measurement results from the RRC when UE enters the idle  mode. |

### CRs/TPs comments collection

CR is 2nd priority.

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2001928, Early measurement reporting requirements structure, Ericsson | Nokia: More discussion needed |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Issue 2-50: UE requirements scenarios:** | *Tentative agreements:*  RAN4 defines the LTE NR Inter-RAT measurements requirements for EMR agnostic to the capability. Additionally, the usual assumption applies when a new feature it introduced in a later release it shall not impact legacy features and legacy features stay unchanged for UEs not supporting the new features.  *Candidate options:*  Go along with the recommended WF and work along the assumptions:   * + Postpone the capability discussion to later phase.   + Define new RAN4 requirements for a UE supporting NR EMR measurements.   + Define UE requirements for following 2 UE types:     - Type 1 UE: A UE supporting ca-IdleModeMeasurements and supporting NR inter-RAT EMR     - Type 2 UE: A UE supporting NR inter-RAT EMR and not supporting ca-IdleModeMeasurements.   *Recommendations for 2nd round:*  RAN4 to continue the discussion related to UE requirements for supporting NR Inter-RAT measurements for EMR. Later RAN4 can, if needed, return to the capability discussion.  RAN4 defines the LTE NR Inter-RAT measurements requirements for EMR agnostic to the capability. Additionally, the usual assumption applies when a new feature it introduced in a later release it shall not impact legacy features and legacy features stay unchanged for UEs not supporting the new features. |
| **Issue 2-51: Number of LTE inter-frequency carriers:** | *Tentative agreements:*  No clear candidate preference as input from companies is not clear.  *Candidate options:*  Recommended WF:   * A UE supporting ca-IdleModeMeasurements and supporting NR inter-RAT EMR (Type 1 UE) the number of LTE inter-frequency EMR carriers is the same as defined for ca-IdleModeMeasurements.   For LTE EMR carriers it seems that some companies can agree to the recommended WF. It seems all companies can agree that UE measurement capability is the upper limit while it is not clear what are the different company preferences related to the number of LTE carriers:  At least 3 companies can agree to the recommended WF and the number of LTE carriers.  Companies seems to agree also that there is no need to limit the number of NR carrier (but this is handled in next issue 2-52)  *Recommendations for 2nd round:*  Company views on the on the number of **LTE EMR** carriers is needed to progress:   1. Same as for a UE supporting ca-IdleModeMeasurements? 2. Can be different than for a UE supporting ca-IdleModeMeasurements?   Companies are welcome to give their views on the UE Types and whether the generic expression (under Issue 2-52) for the number of LTE EMR carriers to measure is acceptable. |
| **Issue 2-52: Number of NR inter-RAT carriers:** | *Tentative agreements:*  It seems agreeable to all companies that the number of NR Inter-RAT carriers for EMR measurements need only to be limited by UE idle mode measurement capability.  *Candidate options:*  Originally the recommended WF included 2 options (option 1 and option 2 next) for number of NR Inter-RAT EMR carier to measure. These have been updated based on the tentative agreement:   1. A UE supporting ca-IdleModeMeasurements and supporting NR inter-RAT EMR (Type 1 UE) shall support at least [D] NR inter-RAT EMR carriers.    1. number of NR EMR carriers, D, are in addition to LTE EMR carriers, C.    2. the total number of carriers for EMR and mobility should not exceed the Rel-15 capability.    3. Open: restrictions on overlapping/non-overlapping EMR carrier 2. A UE only supporting NR inter-RAT EMR (Type 2 UE) shall support at least [D] NR inter-RAT EMR carriers.    1. the total number of carriers for EMR and mobility should not exceed the Rel-15 capability.    2. Open: restrictions on overlapping/non-overlapping EMR carrier   Based on the tentative agreement RAN4 also need to look at the total LTE and NR EMR carriers to measure. Based on the contributions and discussion from companies two options are available (option 3 and 4 below)   1. New option by Moderator: Modified version of option 1:    1. The number of LTE carriers, C, stay unchanged and aligned with ca-IdleModeMeasurements and the number of NR carriers, D, can be larger with the limitation that D cannot exceed the measurement capability for NR Inter-RAT carriers. Additional limitation is that C+D does not exceed UE measurement capability, N. 2. New Option by MediaTek:    1. The number of LTE carriers, C, and the number of NR carriers, D, are limited by the UE measurement capability for C and D, and with the limitation that C+D cannot exceed UE measurement capability, N.   To progress the work while discussing these numbers Moderator suggest using similar approach as in Issue 2-3. Assuming non-IncMon capable UE, the options considering how many LTE and NR EMR carriers the UE at least shall be able to measure can be expressed as:   1. The total number carriers the UE at least shall be able to measure for EMR, N ≤ 10;    * 1. N ≥ C + D;      2. C: The number of LTE carriers, C = [0;x];      3. D: The number of NR carriers, D = [0;y] 2. C, D, x and y are all FFS with the exception that they should not exceed current measurement capability.   *Recommendations for 2nd round:*  Confirm the tentative agreement.  Discuss if the generic expression for the number of LTE and NR EMR carriers to measure is acceptable. |
| **Issue 2-53: Cell detected status at transitioning from connected mode:** | *Tentative agreements:*  Agree to the principle in the recommended WF.  *Candidate options:*  In general, it seems most companies are fine agreeing to the principle in WF. To be discussed are the conditions when a detected cell in connected mode can be assumed to remain detected in Idle/Inactive mode.  Following approach is proposed:   * It is proposed to use the conditions agreed for LTE and use those as baseline for NR FR1 conditions. * RAN4 then additionally develop conditions for NR FR2.   *Recommendations for 2nd round:*  Confirm the tentative agreement.  Discuss the conditions when the detected cell status remain detected during transitioning from connected to idle or inactive mode |
| **Issue 2-54 Measurement requirements for NR Inter-RAT EMR carrier** | *Tentative agreements:*  Topic was by accident left out from 1st round  *Candidate options:*  RAN4 will need to discuss and define requirements for an NR Inter-RAT EMR carrier:   * UE performs periodic cell detection and measurement for LTE – NR inter-RAT EMR measurement * UE measurement requirements   *Recommendations for 2nd round:*  Companies are encouraged to state their view on above topic and add further. |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| R4-2002235 | WF on NR Inter-RAT EMR requirements | Nokia, Nokia Shanghai Bell |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| New | Running CR to 36.133 for Multi-RAT Dual-Connectivity and Carrier Aggregation enhancements |

## Discussion on 2nd round (if applicable)

Issue 2-11-50: UE requirements scenarios:

RAN4 to continue the discussion related to UE requirements for supporting NR Inter-RAT measurements for EMR. Later RAN4 can, if needed, return to the capability discussion.

RAN4 defines the LTE NR Inter-RAT measurements requirements for EMR agnostic to the capability.

Comments: [Chronological order]

[Company A:]

[Huawei, HiSilicon] we prefer to be more specific regarding the below statement. We understand here the new feature is LTE-NR inter-RAT EMR while the legacy feature is LTE inter-frequency EMR. For UE not supporting the LTE inter-frequency EMR, the requirement for LTE inter-frequency EMR is irrelevant. For UE supporting both, we are not sure if all the LTE inter-frequency EMR requirement can stay unchanged. In this meeting, the discussion is focused on number of LTE inter-frequency EMR carriers, and for this one we are fine to keep it unchanged.

“Additionally, the usual assumption applies when a new feature it introduced in a later release it shall not impact legacy features and legacy features stay unchanged for Ues not supporting the new features”

[Nokia] A UE supporting LTE inter-frequency EMR and not LTE-NR inter-RAT EMR, shall not be impacted by introduction of the LTE-NR inter-RAT EMR. For a UE only supporting LTE-NR inter-RAT EMR this UE would not need to be impacted by LTE inter-frequency EMR. However, for the UE supporting LTE inter-frequency EMR and LTE-NR inter-RAT EMR it may be adding complexity to specification, system and to network configuration and management if there will be separate LTE inter-frequency EMR measurement capability in terms of number of LTE inter-frequency EMR carriers that this UE can support compared to a legacy UE only supporting LTE inter-frequency EMR. However, we are open to discuss this further based on additional input from companies. We could see some benefits as well but it would depend on the detailed proposal.

[Ericsson]: the tentative agreement is probably Ok, without the last sentence. Perhaps “agnostic” could be replaced by “regardless of the capability, which is being discussed separately”.

Agreement:

Issue 2-11-51: Num Company views on the on the number of **LTE EMR** carriers is needed to progress:

1. Same as for a UE supporting ca-IdleModeMeasurements?
2. Can be different than for a UE supporting ca-IdleModeMeasurements?

Companies are welcome to give their views on the UE Types and whether the generic expression (under Issue 2-52) for the number of LTE EMR carriers to measure is acceptable.ber of LTE inter-frequency carriers:

Comments: [Chronological order]

[Nokia] As starting point we’re fine progressing with the proposed WF. If the discussion related to Issue 2-11-50 shows benefits in having new LTE inter-frequency EMR requirements – i.e. we see this as an increase in number of carriers – this can be discussed. But to progress the work we can accept current restrictions (which are in fact currently open).

Ericsson: the total number of carriers for EMR and mobility should not exceed the corresponding Rel-15 capability.

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002235

Issue 2-11-52: Number of NR inter-RAT carriers:

1. Confirm the tentative agreement.
2. Discuss if the generic expression for the number of LTE and NR EMR carriers to measure is acceptable.

Comments: [Chronological order]

[Company A:]

[Huawei, HiSilicon] the tentative agreement is copied below. Does it mean there will be no limit on LTE-NR inter-RAT EMR carriers as long as the total UE idle mode measurement capability is not exceeded? If so we cannot agree to it in this meeting as this is a different approach than in LTE euCA, and also it is conflicting with the generic framework in 2).

“It seems agreeable to all companies that the number of NR Inter-RAT carriers for EMR measurements need only to be limited by UE idle mode measurement capability”

[Moderator] It seems the company view collection is maybe then not reflecting the actual views from round 1. I suggest to postpone this discussion to next meeting and list this in the WF as open.

[Ericsson]: the total number of carriers for EMR and mobility should not exceed the corresponding Rel-15 capability.

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002235

Issue 2-11-53: Cell detected status at transitioning from connected mode:

1. Confirm the tentative agreement.
2. Discuss the conditions when the detected cell status remain detected during transitioning from connected to idle or inactive mode

Comments: [Chronological order]

[Ericsson]: tentative agreement is Ok

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002235

Issue 2-11-54 Measurement requirements for NR Inter-RAT EMR carrier

Companies are encouraged to state their view on above topic and add further.

Comments: [Chronological order]

[Ericsson]: tentative agreement is Ok

Agreement:

[Moderator]: Agreements and open aspects are captured in WF R4-2002235

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| R4-2002264 | Running CR to 36.133 for Multi-RAT Dual-Connectivity and Carrier Aggregation enhancements  Ericsson: too many unsettled issues, postpone the CR.  [Moderator]: Postponed |
| R4-2002235 | Agreeable |

# Topic #3: Efficient and low latency serving cell configuration, activation and setup

Efficient and low latency serving cell configuration, activation and setup is divided into two sub-topics:

1. Direct SCell activation (8.6.3.3.1). Sections 3.2 – 3.6
2. SCell dormancy (8.6.3.3.2). Sections 3.7 – 3.12

## Companies’ contributions summary (Direct SCell activation (8.6.3.3.1))

Following contributions are submitted for Direct SCell activation:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8.6.3.3.1 | **R4-2000059** | On delay requirements for direct SCell activation in resume | ZTE Corporation | discussion |
| 8.6.3.3.1 | R4-2000060 | [CR] Add delay requirements for direct SCell activation in resume | ZTE Corporation | CR |
| 8.6.3.3.1 | **R4-2000061** | [CR] Add delay requirements for direct SCell activation in resume | ZTE Corporation | CR |
| 8.6.3.3.1 | **R4-2000062** | [CR] Delay requirements for direct SCell activation | ZTE Corporation | CR |
| 8.6.3.3.1 | **R4-2001011** | Direct SCell activation interruption requirements | NEC | discussion |
| 8.6.3.3.1 | **R4-2001629** | Discussion on remaining issues for direct SCell activation | Huawei, HiSilicon | discussion |
| 8.6.3.3.1 | **R4-2001630** | CR on direct SCell activation delay | Huawei, HiSilicon | CR |
| 8.6.3.3.1 | **R4-2002084** | On direct SCell activation | Ericsson | discussion |
| 8.6.3.3.1 | **R4-2002085** | CR 38.133 (8.3.4-5) Corrections to Direct SCell activation | Ericsson | CR |

Companies have proposed following:

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2000059 | ZTE | Observation 1: Direct SCell addition and activation in RRC resume is similar to direct SCell addition and activation in RRC reconfiguration.  Proposal 1: Define requirements for direct SCell activation in RRC resume in a similar way as for direct SCell activation at SCell addition. |
| R4-2001011 | NEC | **Proposal 1:** **Direct SCell activation delay at SCell addition is: Ndirect = TRRC\_Process + T1 + Tactivation\_time - TMAC\_processing\_delay + TCSI\_Reporting; and Direct SCell Activation delay at handover is: Ndirect = TRRC\_process + Tinterrupt + T2 + T3 + Tactivation\_time - TMAC\_processing\_delay + TCSI\_Reporting.**  **Proposal 2:** **Interruption window for Direct SCell activation during SCell addition is from TRRC\_processing+T1 to TRRC\_processing+T1+ Tactivation\_time-5ms.**  **Proposal 3: Interruption window for Direct SCell activation during handover is from TRRC\_processing+ Tinterrupt + T2 + T3 to TRRC\_processing + Tinterrupt + T2 + T3 + Tactivation\_time- 5ms.** |
| R4-2001629 | Huawei | **Proposal 1: In direct SCell activation, the allowed interruption is located within Tactivation\_time.**  **Proposal 2: The requirements for direct SCell activation at SCell addition can be re-used for direct SCell activation at RRCResume.** |
| R4-2002084 | Ericsson | **Observation 1:** TFirstSSB and TFirstSSB\_MAX which are part of the definition of Tactivation\_time are not the same for *SCell activation of deactivated SCell* (8.3.2) and *Direct SCell activation at SCell addition* (8.3.4), since the former is based on reception and processing of a MAC command and the latter is based on processing of a RRC message.  **Proposal 1:** For *Direct SCell activation at SCell addition* in clause 8.3.4, dedicated definitions of TFirstSSB and TFirstSSB\_MAX are introduced that overrides the corresponding definitions in clause 8.3.2. The dedicated definitions take into account the unique timeline for direct SCell activation at SCell addition.  **Proposal 2:** For *Direct SCell activation at SCell addition*, the interruption window is defined from *TRRC\_Process* + *T1* and until *TRRC\_Process* + *T1 + TFirstSSB\_MAX + TSMTC\_duration* for SCell in FR1, and until *TRRC\_Process* + *T1 + TFirstSSB + TSMTC\_duration* for SCell in FR2.  For Direct SCell Activation at Handover, the following observation an proposals were made:  **Observation 2:** TFirstSSB and TFirstSSB\_MAX which are part of the definition of Tactivation\_time are not the same for *SCell activation of deactivated SCell* (8.3.2) and *Direct SCell activation at Handover* (8.3.5), since the former is based on reception and processing of a MAC command and the latter is based on processing of a RRC message followed by actions related to handover.  **Proposal 3:** For *Direct SCell Activation at Handover* in clause 8.3.5, dedicated definitions of TFirstSSB and TFirstSSB\_MAX are introduced that overrides the corresponding definitions in clause 8.3.2. The dedicated definitions take into account the unique timeline for *Direct SCell Activation at Handover*.  **Proposal 4:** For *Direct SCell Activation at Handover*, the interruption window is defined from *TRRC\_Process* + *Tinterrupt + T2 + T3* and until *TRRC\_Process* + *Tinterrupt + T2 + T3* *+ TFirstSSB\_MAX + TSMTC\_duration* for SCell in FR1, and until *TRRC\_Process* + *Tinterrupt + T2 + T3* *+ TFirstSSB + TSMTC\_duration* for SCell in FR2. |

## Open issues summary

Following topics have been identified for discussion:

* UE requirements for SCell activation in resume message
* Requirements for Direct SCell activation
* Requirements for interruption window

### Sub-topic 3-1 UE requirements for SCell activation in resume message

Discuss the UE requirements for SCell activation in resume message.

**Issue 3-1: UE requirements for SCell activation in resume message**

* Proposals
  + Option 1: Define requirements for direct SCell activation in RRC resume in a similar way as for direct SCell activation at SCell addition.
  + Option 2: The requirements for direct SCell activation at SCell addition can be re-used for direct SCell activation at RRCResume
* Recommended WF
  + Direct SCell activation delay when received in RRC Resume message can be defined based on the requirements for direct SCell activation at SCell addition.

### Sub-topic 3-2 Requirements for Direct SCell activation

Discuss the UE requirements for Direct SCell activation. 3 different scenarios need to be considered:

* Direct SCell activation delay at direct activation at HO
* Direct SCell activation delay at SCell addition
* Direct SCell activation delay at direct SCell activation in RRC Resume

**Issue 3-2: Requirements for Direct SCell activation delay**

* Proposals
  + Option 1: Direct SCell activation delay at SCell addition is: Ndirect = TRRC\_Process + T1 + Tactivation\_time - TMAC\_processing\_delay + TCSI\_Reporting;
  + Option 2: For Direct SCell activation at SCell addition in clause 8.3.4, dedicated definitions of TFirstSSB and TFirstSSB\_MAX are introduced that overrides the corresponding definitions in clause 8.3.2. The dedicated definitions take into account the unique timeline for direct SCell activation at SCell addition.
  + Option 4: Direct SCell Activation delay at handover is: Ndirect = TRRC\_process + Tinterrupt + T2 + T3 + Tactivation\_time - TMAC\_processing\_delay + TCSI\_Reporting
  + Option 3: For *Direct SCell Activation at Handover* in clause 8.3.5, dedicated definitions of TFirstSSB and TFirstSSB\_MAX are introduced that overrides the corresponding definitions in clause 8.3.2. The dedicated definitions take into account the unique timeline for *Direct SCell Activation at Handover*
* Recommended WF
  + Discuss definitions of TFirstSSB and TFirstSSB\_MAX used in direct SCell activation at direct SCell activation at SCell addition and direct SCell activation at Handover case.
  + Discuss the direct SCell activation delay requirements for direct SCell activation at SCell addition and direct SCell activation at handover.

### Sub-topic 3-3 Requirements for interruption window

Discuss the requirements for interruption window for direct SCell activation.

**Issue 3-3: Requirements for interruption window**

* Proposals
  + Option 1: For SCell addition: Interruption window is from TRRC\_processing+T1 to TRRC\_processing+T1+ Tactivation\_time-5ms
  + Option 2: For SCell addition: interruption window is defined from *TRRC\_Process* + *T1* and until *TRRC\_Process* + *T1 + TFirstSSB\_MAX + TSMTC\_duration* for SCell in FR1, and until *TRRC\_Process* + *T1 + TFirstSSB + TSMTC\_duration* for SCell in FR2.
  + Option 3: Direct SCell activation during HO: Interruption window is from TRRC\_processing+ Tinterrupt + T2 + T3 to TRRC\_processing + Tinterrupt + T2 + T3 + Tactivation\_time- 5ms
  + Option 4: Direct SCell activation during HO: the interruption window is defined from *TRRC\_Process* + *Tinterrupt + T2 + T3* and until *TRRC\_Process* + *Tinterrupt + T2 + T3* *+ TFirstSSB\_MAX + TSMTC\_duration* for SCell in FR1, and until *TRRC\_Process* + *Tinterrupt + T2 + T3* *+ TFirstSSB + TSMTC\_duration* for SCell in FR2.
  + Option 5: In direct SCell activation, the allowed interruption is located within Tactivation\_time.
* Recommended WF
  + Discuss further on the details of the interruption window.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 3-1: UE requirements for SCell activation in resume message:** Agree with the WF recommended by moderator.  **Issue 3-2: Requirements for Direct SCell activation delay:** Support Option 2 and Option 3. All options are addressing the same issue. However, our preference is Options 2 and 3 (redefine T\_FirstSSB and T\_FirstSSB\_MAX) as it would look a bit strange if we defined a timeline where something that is not part of the steps the UE is going through is subtracted (subtraction of T\_MAC\_processing\_delay).  **Issue 3-3: Requirements for interruption window:** Support Option 2 and Option 4. The interruption windows only have to span the time up until the UE has had a chance to get the first SSB burst. Options 1, 3 and 5 are defining an interruption window that is much larger than needed and much larger than the baseline (8.3.2).  **Others:** |
| QC | Issue 3-1: UE requirements for SCell activation in resume message:  Agree with proposed WF that direct scell activation can be used as baseline.  Issue 3-2: Requirements for Direct SCell activation delay:  Agree with E// proposal the definitions of TFirstSSB and TFirstSSB\_MAX need to be slightly modified since there is no longer a MAC command. The starting point should now be after the RRC complete message is sent.  Issue 3-3: Requirements for interruption window:  Interruption window should be from the time UE sends the RRC complete, i.e, TRRC\_Process + T1 ¬ to the end of the first SSB reception + SMTC\_duration.  Others: |
| Nokia | **Issue 3-1: UE requirements for SCell activation in resume message:**  Support recommended WF  **Issue 3-2: Requirements for Direct SCell activation delay:**  Identified issues would need further discussion among companies  **Issue 3-3: Requirements for interruption window:**  Our view is that the interruption window should define a window within based on when the UE activates/changes RF settings causing the pulling and interrupt. Hence, interrupt in our understanding would need to happen before UE receives on the activated SCell.  **Others:** |
| ZTE | Issue 3-1: UE requirements for SCell activation in resume message:  Agree with proposed WF that direct scell activation can be used as baseline. Suggest companies to check if R4-2000061 prepared by ZTE is agreeable. |
| NEC | **Issue 3-1**: Agree with the recommended WF  **Issue 3-2**: As Ericsson pointed, all the proposals try to address the same issue. However, we think combination of both the proposals may be needed. That is need to redefine T\_FirstSSB and remove MAC CE processing delay, as Tactivation\_time already includes T\_FirstSSB+3ms+2ms and redefining T\_FirstSSB alone may not be sufficient.  Example proposal may be:  Tactivation\_time is the SCell activation delay in millisecond.  If the SCell is known and belongs to FR1, Tactivation\_time is:  - TFirstSSB+ ~~5ms~~2ms, if the SCell measurement cycle is equal to or smaller than 160ms.  - TFirstSSB\_MAX + Trs + ~~5ms~~2ms, if the SCell measurement cycle is larger than 160ms.  ….  ….  Where TFirstSSB: the time to first SSB indicated by the SMTC after slot *n + TRRC\_Process + T1*  **Issue 3-3**: Agree with Option 2 and 4. |
| Huawei, HiSilicon | **Issue 3-1: UE requirements for SCell activation in resume message:**  Support the recommended WF  **Issue 3-2: Requirements for Direct SCell activation delay:**  We agree with the identified issue and are fine with either way of capturing it.  **Issue 3-3: Requirements for interruption window:**  We understand the views in all submitted papers are same. We are also fine with the way how it is captured in Ericsson CR R4-2002085. |
| MediaTek | **Issue 3-1: UE requirements for SCell activation in resume message**  Support the recommended WF |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| R4-2000061 | ZTE: propose to use this CR to add requirements for direct SCell activation in RRC resume. Views from companies are welcome. |
| Huawei, HiSilicon: The CR partially duplicates the requirements in section 8.3.2. It is not desirable for future maintenance. For example, T\_activation needs to be updated due to Issue 3-2. Also the interruption window is not specified. Our preference is to make a simple reference to existing section 8.3.4 since the only difference is the name of the message. |
| Company B |
|  |
| R4-2001630 | ZTE: needs some time to check. |
| Huawei, HiSilicon: Could ZTE please clarify what the technical concern is for the resume part? (issue 3-2 can be addressed by Ericsson CR R4-2002085). |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Issue 3-1: UE requirements for SCell activation in resume message** | *Tentative agreements:*  All companies support the recommended WF:  Direct SCell activation delay when received in RRC Resume message can be defined based on the requirements for direct SCell activation at SCell addition.  *Candidate options:*  *Recommendations for 2nd round:*  Confirm the tentative agreement. |
| **Issue 3-2: Requirements for Direct SCell activation delay** | *Tentative agreements:*  All companies agree that correction is beneficial.  *Candidate options:*  option 1: Use Ericsson solution  Option 2: use ZTE solution  Option 3: use Huawei solution  *Recommendations for 2nd round:*  Agree among companies on which CR or CRs to capture the correction and requirement. |
| **Issue 3-3: Requirements for interruption window** | *Tentative agreements:*  No clear candidate although all proposals quite similar.  *Candidate options:*  option 1: 0 supporters  option 2: 2 supporters  option 3: 0 supporters  option 4: 2 supporters  option 4: 0 supporters  Other comments from other companies needs to be considered as well.  *Recommendations for 2nd round:*  Discuss and agree on the detailed requirement to be captured in a CR. If options 2 and 4 are captured in the Ericsson CR it seems reasonable to use the Ericsson CR as baseline. |

*Suggestion on WF/LS assignment*

|  |  |  |
| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| #1 |  |  |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
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| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| R4-2002085 | Revised to R4-2002236 (from R4-2002085) |
| R4-2001630 | Revised to R4-2002237 (from R4-2001630). |

## Discussion on 2nd round (if applicable)

Issue 3-5-1: UE requirements for SCell activation in resume message

Confirm the tentative agreement

Comments: [Chronological order]

[QC:] ok with tentative agreement

[Huawei, HiSilicon] we are fine with the tentative agreement.[Nokia] fine with this agreement (work is ongoing)

[Ericsson] We are fine with the tentative agreement.

[ZTE] We agree that direct SCell activation delay in RRC Resume can be defined based on the requirements for direct SCell activation at SCell addition, but we believe a dedicated clause should be added with full content, like suggested by CR R4-2000061, instead of referring to other clauses.

Agreement:

Issue 3-5-2: Requirements for Direct SCell activation delay:

CR drafting based on the revised CR’s.

[ZTE] At least CR R4-2000062 should be agreeable during this meeting, it contains very straightforward corrections.

Issue 3-5-3: Requirements for interruption window:

Discuss and agree on the detailed requirement to be captured in a CR. If options 2 and 4 are captured in the Ericsson CR it seems reasonable to use the Ericsson CR as baseline

Comments: [Chronological order]

[QC:] E// approach seems reasonable. We can use that as baseline and work on CRs for wording

[Nokia] fine to use Ericsson CR as baseline (work is ongoing)

Agreement:

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
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| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| XXX | *Based on 2nd round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |
| R4-2002236 | Withdrawn |
| R4-2002085 | Postponed (there are unresolved issues so we come back next meeting) |
| R4-2002237 | Agreeable |

## Companies’ contributions summary (SCell dormancy (8.6.3.3.2))

Following contributions are submitted for Dormancy SCell:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 8.6.3.3.2 | **R4-2001342** | UE Requirements for Dormancy Scell | Nokia, Nokia Shanghai Bell | discussion |
| 8.6.3.2.2 | **R4-2001631** | Discussion on RRM requirements for SCell dormancy | Huawei, HiSilicon | discussion |
| 8.6.3.3.2 | **R4-2002059** | Discussion on Scell BWP dormancy | Qualcomm Incorporated | discussion |

|  |  |  |
| --- | --- | --- |
| **T-doc number** | **Company** | **Proposals / Observations** |
| R4-2001342 | Nokia | 1. RAN4 need to define UE delay requirements for changing dormancy SCell to non-dormancy SCell.   RAN4 need to define UE delay requirements for changing non-dormancy SCell to dormancy SCell.  RAN4 will need to agree on the naming for non-dormancy/fully activated SCell.   1. Use the naming activated SCell for an SCell in non-dormancy. 2. Use the naming dormancy SCell when the activated SCell is in dormancy. 3. RAN4 defines UE BWP switch requirement for entering SCell dormancy. 4. RAN4 defines UE BWP switch requirements for leaving SCell dormancy.   The dormancy SCell is activated.   1. UE requirements for dormancy SCell requirements follows activated SCell requirements.   UE time tracking of a dormancy SCell is expected to be as good as for activated SCell.  No additional time- and frequency tracking delay is needed when switching BWP from dormancy to non-dormancy.  No additional time- and frequency tracking delay is needed when switching BWP from non-dormancy to dormancy.   1. Re-use existing BWP switch delay requirements for SCell dormancy BWP switch delay. |
| R4-2001631 | Huawei | **Proposal 1: RAN4 to define the delay and interruption requirements for switching between dormancy and non-dormancy based on DCI/timer based BWP switching requirements.**  **Proposal 2: UE shall finish the transition between dormancy and non-dormancy on SCell within**   * **current DCI/timer based BWP switching delay with type-1 capability, if the configuration between a regular BWP and a dormant BWP only differs in PDCCH monitoring and CSI-RS reporting configuration,** * **current DCI/timer based BWP switching delay, otherwise**   **Proposal 3: When defining the exact requirements for switching between dormancy and non-dormancy RAN4 to should take into account the requirements for BWP switching on multiple cells.**  **Proposal 4:** **RAN4 to define interruption requirements for CSI and RRM measurement when UE is in SCell dormancy.** |
| R4-2002059 | Qualcomm | **Proposal 1**: RAN4 to define requirements for Scell dormancy when signaled via the following mechanisms .  Inside active time  Case 1a: Scheduling DCI indicates switch in/out of dormancy  Case 1b: Non-scheduling DCI . DCI only provides dormancy indication.  Outside active time  Case 2: Wake-up signal (WUS) indicates switch in/out of dormancy  **Proposal 2**: For all cases in proposal 1, RAN4 to start defining requirements for one Scell and then extend to multiple Scells. |

## Open issues summary

This is the initial discussion on UE requirements for dormancy SCell. The discussion documents has identified a number of open aspects for further discussion.

RAN1 is assuming that switching between dormancy and non-dormancy, non-dormancy and dormancy is based on switching between BWP and hence, BWP part switch delays may be used as baseline. SCell change between dormancy and non-dormancy is done by changing between related BWP (1 for dormancy and one or more for non-cormancy). RAN4 would initially start discussing following sub-topics:

* UE SCell dormancy switch delay requirements
* UE requirements for an SCell in dormancy
* Interruption requirements

### Sub-topic 3-10 UE Switch delay requirements

Based on the dormancy is based on UE switching between a dormant BWP and non-dormant BWP, re-using the BWP framework, RA4 would need to discuss if the current BWP switch delay requirements framework can be used for dormancy SCell switch delay requirement, or whether any changes would be necessary.

**Issue 3-10: UE SCell dormancy switch delay requirements**

* Proposals
  + Option 1: RAN4 defines UE BWP switch requirement for entering and leaving SCell dormancy.
    - Re-use existing BWP switch delay requirements for SCell dormancy BWP switch delay.
  + Option 2: RAN4 defines switching between dormancy and non-dormancy based on DCI/timer based BWP switching requirements.
    - Both DCI/timer based BWP switching delay with type-1 capability, if the configuration between a regular BWP and a dormant BWP only differs in PDCCH monitoring and CSI-RS reporting configuration.
    - Otherwise, current DCI/timer based BWP switching delay applies.
  + Option 3: RAN4 to define requirements for Scell dormancy when signaled via the following mechanisms:
    - In UE active time
      * Case 1a: Scheduling DCI indicates switch in/out of dormancy
      * Case 1b: Non-scheduling DCI. (DCI only provides dormancy indication.)
    - Outside UE active time
      * Case 2: Wake-up signal (WUS) indicates switch in/out of dormancy
* Recommended WF
  + RAN4 to define UE requirements for:
    - BWP switch delay from dormancy to non-dormancy
    - BWP switch delay from non-dormancy to dormancy
  + RAN4 to define UE dormancy switch delay requirements for:
    - DCI based switch
    - Timer based switch
  + RAN4 defines UE dormancy switch delay requirements for:
    - Scheduled DCI dormancy switch indication
    - Non-scheduled dormancy switch indication
    - WUS indicated dormancy switch indication
  + Dormancy BWP switch delay requirements to be discussed further:
    - Re-use existing Rel-15 BWP switch delay requirements
    - Type-1 Rel-15 BWP switch delay requirements apply with conditions,
      * otherwise Type-2 BWP switch delay requirements apply
      * RAN4 to discuss further the possible conditions for when Type-1 BWP switch delay applies.
  + RAN4 initially defines dormancy switch delay requirements for one SCell after which RAN4 will define dormancy switch delay requirements when multiple SCells change between dormancy and non-dormancy.

### Sub-topic 3-11 UE requirements for an SCell in dormancy

RAN4 will need to define the UE requirements for an SCell in dormancy e.g. concerning cell detection delay requirements and measurement requirements.

**Issue 3-11: UE requirements for an SCell in dormancy**

* Proposals
  + Option 1: UE requirements for dormancy SCell follows activated SCell requirements.
  + Option 2: Other
* Recommended WF
  + Further discuss the UE requirements for dormancy SCell.

### Sub-topic 3-12 Interruption requirements

Interruption requirements related to dormancy SCell would need to be discussed and agreed in RAN4.

**Issue 3-12: Interruption requirements**

* Proposals
  + Option 1: RAN4 to define interruption requirements for CSI and RRM measurement when UE is in SCell dormancy
  + Option 2: Other
* Recommended WF
  + Further discuss the UE interruption requirements for a dormancy SCell.

## Companies views’ collection for 1st round

### Open issues

|  |  |
| --- | --- |
| **Company** | **Comments** |
| Ericsson | **Issue 3-10: UE SCell dormancy switch delay requirements:** In general support the WF recommended by moderator. We may however need to settle on more details, e.g. on what synchronization level can be anticipated when the UE is going back to non-dormancy, before stating whether Rel-15 BWP switching delay requirements can be re-used (this connects to Issue 3-11).  **Issue 3-11: UE requirements for an SCell in dormancy:** Support the WF recommended by moderator  **Issue 3-12: Interruption requirements:** Support the WF recommended by moderator  Others: |
| QC | Mostly agree with the recommended WF. In addition to discussing the delay in each of the scenarios we would also like to study the interruptions in each of the dormancy switch scenarios. |
| Nokia | **Issue 3-10: UE SCell dormancy switch delay requirements**  Agree on the recommended WF for which requirements to define in RAN4. Additionally we agree to initially focus on requirements for 1 dormancy SCell.  **Issue 3-11: UE requirements for an SCell in dormancy**  RAN4 would need to define UE requirements for the dormancy SCell. As such SCell is activated our understanding is that a dormancy SCell naturally need to follow serving cell measurement requirement as defined for an activated SCell.  **Issue 3-12: Interruption requirements**  Interruptions would need to be discussed and decided. Our view though is that the number of interrupts would need to very limited in order not to cause negative system impact from using dormancy SCell.  Others: |
| NEC | **Issue 3-10, 3-11, 3-12:** Agree with the WF suggested by topic lead |
| Huawei, HiSilicon | **Issue 3-10: UE SCell dormancy switch delay requirements**  Support the recommended WF. On the third bullet, could QC please clarify if the switching delay is expected to be different for “Scheduled DCI”, “Non-scheduled DCI” or “WUS PDCCH”?  **Issue 3-11: UE requirements for an SCell in dormancy**  Support the recommended WF.  **Issue 3-12: Interruption requirements**  We are fine with the recommended WF. Can we further agree that interruption requirements need to be defined for   * Switching between SCell dormancy and non-dormancy, and * CSI and RRM measurement when UE is in SCell dormancy?   Then next meeting we can further discuss the exact requirements. |
| MediaTek | **Issue 3-10: UE SCell dormancy switch delay requirements**   * Recommended WF   + RAN4 to define UE requirements for:     - BWP switch delay from dormancy to non-dormancy     - BWP switch delay from non-dormancy to dormancy   [MTK]: Agree.   * + RAN4 to define UE dormancy switch delay requirements for:     - DCI based switch     - Timer based switch   [MTK]: Agree.   * + RAN4 defines UE dormancy switch delay requirements for:     - Scheduled DCI dormancy switch indication     - Non-scheduled dormancy switch indication     - WUS indicated dormancy switch indication   [MTK]: Unclear the definition of so-called  “WUS indicated dormancy switch indication”   * + Dormancy BWP switch delay requirements to be discussed further:     - Re-use existing Rel-15 BWP switch delay requirements     - Type-1 Rel-15 BWP switch delay requirements apply with conditions,       * otherwise Type-2 BWP switch delay requirements apply       * RAN4 to discuss further the possible conditions for when Type-1 BWP switch delay applies.   [MTK]: We support option 2. Type-1 Rel-15 BWP switch delay requirements   apply with conditions: only different configurations between dormancy BWP and  non-dormancy BWP is PDCCH monitoring and CSI-RS reporting configuration.   * + RAN4 initially defines dormancy switch delay requirements for one SCell after which RAN4 will define dormancy switch delay requirements when multiple SCells change between dormancy and non-dormancy.   [MTK]: Agree.  **Issue 3-11: UE requirements for an SCell in dormancy**   * Recommended WF   + Further discuss the UE requirements for dormancy SCell.   [MTK]: Recommended WF is not clear for us  **Issue 3-12: Interruption requirements**   * Recommended WF   + Further discuss the UE interruption requirements for a dormancy SCell.   [MTK]: Recommended WF is not clear for us |

### CRs/TPs comments collection

*Major close to finalize WIs and Rel-15 maintenance, comments collections can be arranged for TPs and CRs. For Rel-16 on-going WIs, suggest to focus on open issues discussion on 1st round.*

|  |  |
| --- | --- |
| **CR/TP number** | **Comments collection** |
| XXX | Company A |
| Company B |
|  |
| YYY | Company A |
| Company B |
|  |

## Summary for 1st round

### Open issues

*Moderator tries to summarize discussion status for 1st round, list all the identified open issues and tentative agreements or candidate options and suggestion for 2nd round i.e. WF assignment.*

|  |  |
| --- | --- |
|  | **Status summary** |
| **Issue 3-10: UE SCell dormancy switch delay requirements** | *Tentative agreements:*  All companies can support the recommended WF. It is proposed that RAN4 agree on using the WF as baseline to progress the work on UE requirements for SCell dormancy.  *Candidate options:*  A number of clarifications seems necessary:   * More details can be included in the future e.g. synchronization level assumption when returning from dormancy SCell to non-dormancy SCell.   These should be discussed and captured during the 2nd round. The WF is a starting point to get the work forward. It is expected that RAN4 will discover more detailed aspects to discuss during the work.  *Recommendations for 2nd round:*  Discuss the recommended WF and update according to discussion. Capture agreed WF in a new official WF. |
| **Issue 3-11: UE requirements for an SCell in dormancy** | *Tentative agreements:*  RAN4 continue to discuss the UE requirements for dormancy SCell  *Candidate options:*  This is the initial meeting with initial papers from the companies. More input, views and discussion is needed in RAN4.  *Recommendations for 2nd round:*  Possibly clarify ‘Further discuss the UE requirements for dormancy SCell’ |
| **Issue 3-12: Interruption requirements** | *Tentative agreements:*  RAN4 continue to discuss the UE requirements for dormancy SCell  *Candidate options:*  Discuss further the more detailed the interruption need including at least:   * Switching between SCell dormancy and non-dormancy, and * CSI and RRM measurement when UE is in SCell dormancy?   RAN4 should initially agree when the UE would cause potentially interrupts. Then if interrupts are caused, RAN4 need to discuss the actual expected interrupt length. Additionally, RAN4 would then need to agree on the final requirement.  *Recommendations for 2nd round:*  Discuss above further and see what could be captured in the WF. |

*Suggestion on WF/LS assignment*

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| --- | --- | --- |
|  | **WF/LS t-doc Title** | **Assigned Company,**  **WF or LS lead** |
| R4-2002238 | WF on UE RRM requirements for dormancy SCell | Nokia, Nokia Shanghai Bell |

### CRs/TPs

*Moderator tries to summarize discussion status for 1st round and provided recommendation on CRs/TPs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP number** | **CRs/TPs Status update recommendation** |
| XXX | *Based on 1st round of comments collection, moderator can recommend the next steps such as “agreeable”, “to be revised”* |

## Discussion on 2nd round (if applicable)

Issue 3-11-10: UE SCell dormancy switch delay requirements:

Use the recommended WF and update according to discussion. Capture agreed WF in a new official WF. Companies to add further in the WF to be circulated on the reflector.

[Moderator]: Open aspects are captured in WF R4-2002238

Issue 3-11-11: UE requirements for an SCell in dormancy.

Possibly clarify ‘Further discuss the UE requirements for dormancy SCell’ which can be done in the WF.

[Moderator]: Open aspects are captured in WF R4-2002238

Issue 3-11-12: Interruption requirements:

Discuss further in the WF to be circulated

[Moderator]: Open aspects are captured in WF R4-2002238

## Summary on 2nd round (if applicable)

*Moderator tries to summarize discussion status for 2nd round and provided recommendation on CRs/TPs/WFs/LSs Status update suggestion*

|  |  |
| --- | --- |
| **CR/TP/LS/WF number** | **T-doc Status update recommendation** |
| R4-2002238 | Agreeable |